Detailed Project Report

IURWTS
Integrated Urban Regeneration & Water Transport System

Integrated Urban Regeneration and Water Transport System (IURWTS) Project in Kochi

anteagroup

ACRONYMS

AAQMS	Ambient Air Quality Monitoring Stations
AHR	Abnormally High Rate
AMC	Annual Maintenance Contract
AMRUT	Atal Mission for Rejuvenation and Urban Transformation
AOI	Area of Interest
ASP	Activated Sludge Process
ASTER	Advanced Spaceborne Thermal Emission and Reflection Radiometer
ASTM	American Society for Testing and Materials
BGL	Below Ground Level
BIS	Bureau of Indian Standards
BOD	Biochemical Oxygen Demand
BOQ	Bill of Quantities
BOT	Build Operate and Transfer
BPCL	Bharat Petroleum Corporation Limited
BSNL	Bharat Sanchar Nigam Limited
CAI	Computer Aided Instruction
CAPEX	Capital Expenditures
CBA	Cost Benefit Analysis
CE	Construction Engineer
CFE	Consent for Establishment
CFO	Consent for Operation
CFP	Continuous Flow Process
CGWB	Central Ground Water Board
CI	Cast Iron
CM	Construction Manager
COD	Canal Oriented Development
COPT	Cochin Port Trust
CPCB	Central Pollution Control Board
CPCL	Chennai Petroleum Corporation Ltd
CPHEEO	Central Public Health and Environmental Engineering Organisation
CPPR	Centre for Public Policy Research
CoPT	Cochin Port Trust
CPWD	Central Public Works Department
CQAO	Contactors Quality Assurance Officer
CQAP	Construction Quality Assurance Plan
CRZ	Coastal Regulation Zone
CSIN	Coastal Shipping and Inland Navigation
CSML	Cochin Smart Mission Ltd
CSP	Corrugated Steel Plate
CTC	Corporate Training Centre
CTE	Consent to Establish
CWC	Central Water Commission
CZM	Coastal Zone Management
CZMP	Coastal Zone Management Plan

DBOO	Design Build Own Operate
DBOT	Design, Build, Operate & Transfer
DBT	Direct Benefit Transfer
DC	District Collector
DDMA	District Disaster Management Authority
DEIAA	District Environment Impact Assessment Authority
DEM	Digital Elevation Model
DFT	Dry Film Thickness
DG	Diesel Generator
DHS	Demographic And Health Surveys
DI	Ductile Iron
DLP	Defect Liability Period
DMA	District Management Agency
DBOT	Design, Build, Operate and Transfer
DPR	Detailed Project Report
DSR	Delhi Schedule Of Rates
DTM	Digital Terrain Model
EC	Encumbrance Certificate
EIA	Environmental Impact Assessment
EIRR	Economic Internal Rate of Return
EMP	Environment Management Plan
ENPV	Economic Internal Rate of Return
EPABX	Electronic Private Automatic Branch Exchange
EPC	Engineering, Procurement, Construction
ESMP	Environmental and Social Management Plan
ESZ	Ecologically Sensitive Zone
EV	Electric Vehicle
FER	Flood Estimation Report
FIDIC	International Federation Of Consulting Engineers
FIRR	Financial Internal Rate of Return
FMB	Field Measurement Book
FNPV	Financial Net Present Value
FOB	Foot Over Bridge
FRP	Fibre Reinforced Plastic
GAIL	Gas Authority of India Limited
GC	General Consultant, Antea Group
GCDA	Greater Cochin Development Authority
GFC	Good for Construction
GIS	Geographic Information Systems
GL	Ground Level
GOI	Government of India
GOK	Government of Kerala
GRP	Glass Reinforced Plastic
GTS	Great Trigonometrical Survey
GW	Groundwater
HDPE	High Density Polyethylene

HECRAS	Hydrologic Engineering Centers River Analysis System
HFL	High Flood Level
HSD	Health Services Department
HSE	Health and Safety Executive
HTL	High Tide Level
ICT	Information and Communication Technology
IMD	Indian Meteorological Department
IPT	Intermediate Public Transport
IRJET	International Research Journal Of Engineering And Technology
IRR	Internal Rate of Return
ISO	International Standards Organization
ISRO	Indian Space Research Organisation
IURWTS	Integrated Urban Regeneration and Water Transport Studies
IWAI	Inland Waterways Authority of India.
IWPS	Intermediate Wastewater Pumping Station
KCZMA	Kerala Coastal Zone Management Authority
KFRS	Kerala Fire And Rescue Services
KIIFB	Kerala Infrastructure Investment Fund Board
KINCO	Kerala Inland Navigation Corporation
KLD	Kilolitres Per Day
KMBR	Kerala Municipality Building Rules
KMC	Kochi Municipal Corporation
KMRL	Kochi Metro Rail Ltd.
KSC	Kerala Shipping Corporation
KSEB	Kerala State Electricity Board
KSINC	Kerala State Inland Navigation Corporation
KSLUB	Kerala State Land Use Board
KSPCB	Kerala State Pollution Control Board
KW	Kilo Watt
KWA	Kerala Water Authority
LAN	Local Area Network
LARR	Land Acquisition Rehabilitation and Resettlement
LCC	Life Cycle Costing
LHS	Left Hand Sides
LiDAR	Light Detection And Ranging
LPCD	Liters Per Capita Per Day
LTL	Low Tide Level
LWL	Length of The Waterline
MAW	Municipal Solid Waste
MBBR	Moving Bed Biofilm Reactor
MBR	Membrane Bioreactor
MLD	Million Litre Per Day
MoEF&CC	Ministry of Environment, Forest, and Climate Change
MORTH	Ministry of Road Transport and Highways
MS	Mild Steel
MSE	Materials Science and Engineering

MSL	Mean Sea Level
MSW	Municipal Solid Waste
NABET	National Accreditation Board for Education & Training
NATPAC	National Transportation Planning and Research Centre
NBWL	National Board of Wildlife
NCESS	National Centre for Earth Science Studies
NOC	No Objection Certificate
NOx, SOx	Nitrogen Oxides, Sulphur Oxides
NPV	Net Present Value
NRSC	National Remote Sensing Centre
O&M	Operations and Maintenance
OPEX	Operating Expenses
PAF	Project Affected Family
PAH's	Polycyclic Aromatic Hydrocarbons
PAP	Project Affected People
PAR	Plinth Area Rate
PCB's	Polychlorinated Biphenyls
PEA	Project Executing Agency
PEB	Pre-Engineered Building
PHPDT	Peak Hour Peak Direction Traffic
PIANC	Permanent International Association Of Navigation Congresses
PIS	Project Implementation Schedule
PLC	Programmable Logic Controller
PM	Particulate Matter
PMC	Project Management Consultant
PPE	Personnel Protective Equipment
PPP	Public Private Partnerships
PPSD	Project Procurement Strategy Development
PSC	Prestressed Concrete
PSU	Public Sector Undertakings
PT	Public Transport
PUB	Public Utility Board
PVC	Polyvinyl Chloride
PWD	Public Works Department
QAP	Quality Assurance Plan
QC/QA	Quality Assurance/Quality Control
QCBS	Quality and Cost Based Selection
QCM	Quality Control Manager
R&R	Relief and Rehabilitation
RAP	Remedial Action Plan
RC	Reinforced Concrete
RCC	Reinforced Cement Concrete
REMS	Risk Evaluation Mitigation Strategy
RFP	Request for Proposal
RFQ	Requests for Quotes
RHS	Right Hand Sides

RIBs	Rigid Inflatable Boat
RMP	Risk Mitigation Plan
RP	Resettlement Plan
RTNLMS	Real Time Noise Level Monitoring Stations
RWH	Rainwater Harvesting
SBR	Sequential Batch Reactor
SCADA	Supervisory Control and Data Acquisition
SCF	Standard Conversion Factor
SCM	Smart City Mission
SEIAA	State Environment Impact Assessment Authority
SFRC	Steel Fiber Reinforced Concrete
SGWB	State Ground Water Board
SIA	Social Impact Assessment
SPS	Standard Project Storm
SPV	Special Purpose Vehicle, KMRL
STAAD	Structural Analysis And Design
STP	Sewage Treatment Plant
STW	Secondary Treated Water
SUH	Synthetic Unit Hydrograph
SW	Sub Watersheds
SWM	Solid Waste Management
SWAK	State Wetlands Authority Kerala
SWTD	State Water Transport Department
TDS	Total Dissolved Solids
TOD	Transit Oriented Development
TOR	Terms of Reference
UASB	Up Flow Anaerobic Sludge Blanket
UH	Unit Hydrograph
ULB	Urban Local Body
UR	Urban Regeneration
VCF	Value Capture Financing
WAPCOS	Water And Power Consultancy Services
WBS	Work Breakdown Structure
WELLC	Wellness Centre
WPI	Wholesale Price Index
WSP	Waste Stabilization Pond
WTE	Waste to Energy
YPCU	Yamuna Pollution Control Unit

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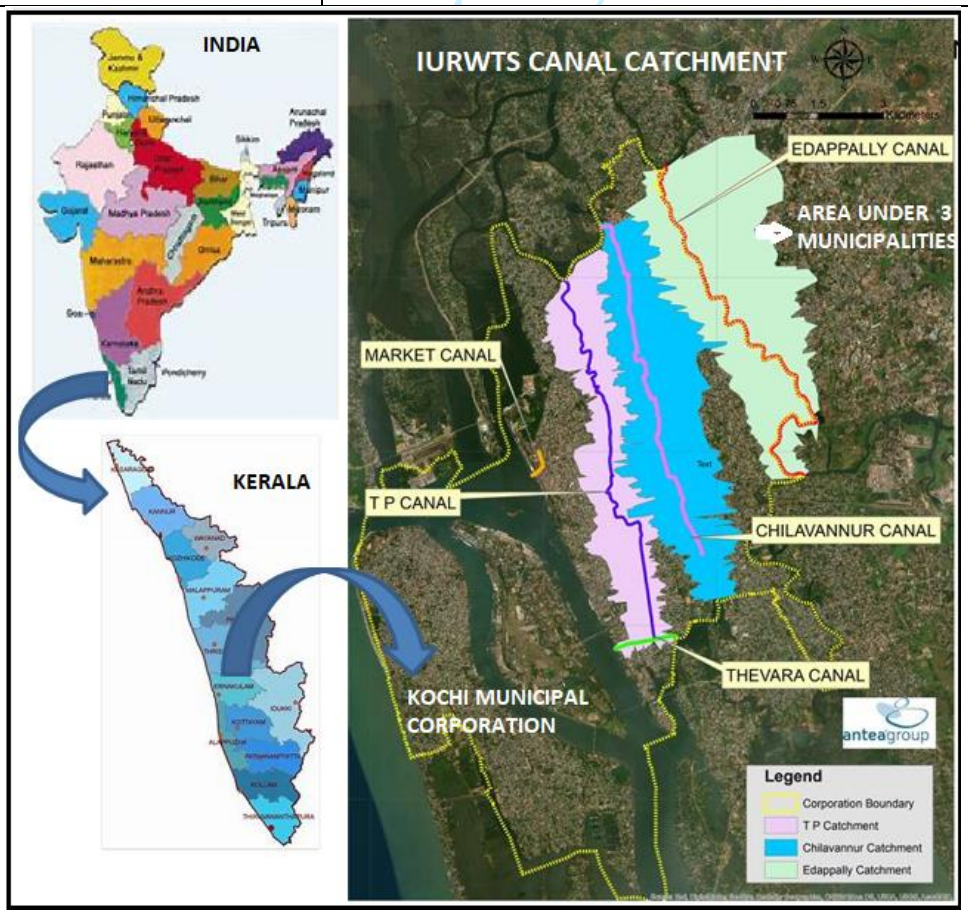
CHAPTER 1

SALIENT FEATURES / EXECUTIVE SUMMARY

1 SALIENT FEATURES / EXECUTIVE SUMMARY

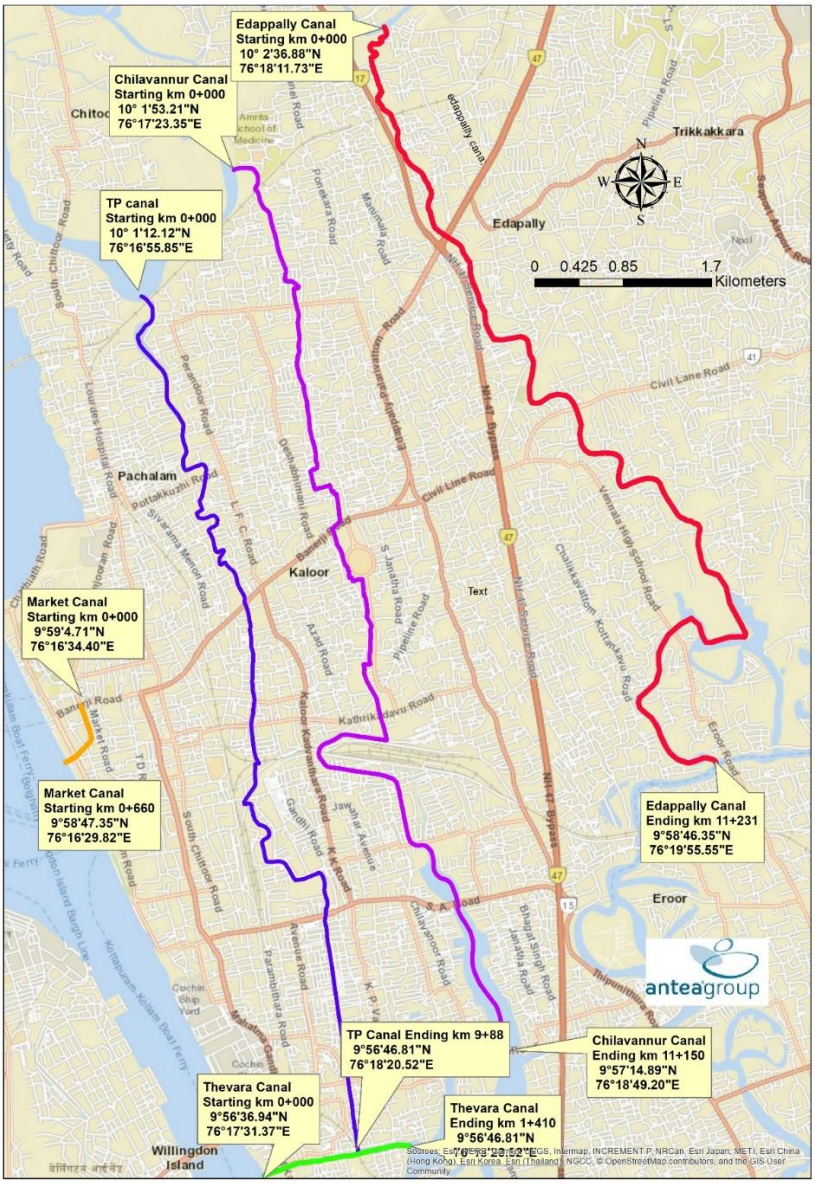
1.1 Salient Features

Sl. No	Item	Description
1.	Title of the project	**Integrated Urban Regeneration and Water Transport System (IURWTS) Project in Kochi.**
2.	Department	Coastal Shipping and Inland Navigation (CSIN), Govt. of Kerala
3.	Details of project location	
	i. District	Ernakulum
	ii. Taluk	Kanayannur , Aluva
	iii. Corporation/ Municipality/ Panchayath	Kochi Municipal Corporation, Thrikkakkara, Kalamassery and Thripunithura Municipalities
	iv. Assembly Constituency	Ernakulum and parts of Thrikkakkara, Thripunithura and Kalamassery Legislative Assemblies.
		

Sl. No	Item	Description
4.	Implementing agency/SPV	Kochi Metro Rail Ltd. (KMRL)
5.	DPR Prepared by	Antea Group (Antea Netherland and Antea India JV)
6.	Project Outlay	₹ 1528.27 Crores
7.	Budget speech reference	GO (Rt) No. 2010/2019/RD dated 23rd July 2019 Rs 566.52 Crores (Only for land acquisition and building compensation cost).
8.	Administrative sanction	GO (Rt) No. 2010/2019/RD dated 23rd July 2019. The present DPR is prepared based on above Govt order. (GO (Rt) No. 457/2017/CLAD dated 19/07/2017 for DPR by KSINC)
9.	Nature of the project	Canal restoration and navigation, flood mitigation, and urban regeneration
10.	Present status of existing canals/roads bridges/building/jetties	1. Inland canals running through the project command are in a dilapidated state due to dumping of waste, and rampant encroachments of canal banks. This has resulting in reduction in canal width thereby making the canals not suitable for navigation. 2. Poor sanitation facilities have resulted in direct sewage disposal into the canals by the inhabitants of canal catchments. This has resulted in poor water quality, creating foul smell in the surrounding areas, and affecting local environment and health of people. 3. Loss of life and property due to inundation/floods in the canal catchment during extreme rainfall events. 4. Reduction in canal width vent way and inadequate vertical clearance of existing road bridges/foot over bridges is hindering canal navigation and water flow. 5. Existing utilities (water pipelines, electric lines, transformers, culverts, etc.) hindering storm water drainage and canal navigation.

Sl. No	Item		Description				
	Need of the project		1. Improve intermodal connectivity with the Rail Metro and Water Metro by way of restoration of canals. 2. Providing necessary infrastructure for navigation facilities and vessels. 3. Flood mitigation and flood plain management. 4. Canal bank development which includes beautifications, walkways, recreation, and tourism. 5. Enhance sewerage network, establish sewage treatment plants, and provide sanitation facilities to the inhabitants of the project catchment and restrict dumping of waste, control encroachments, stop sewage mixing, etc. 6. Infrastructure / property development along the canals through Value Capture Financing & Transit Oriented Development for generating revenue.				
	The Canals						
	Existing canals to be taken up for canal navigation and canal bank development		Edappally	Thevara	Thevara-Perandoor	Chilavanoor	Market
	a) North Side	Latitude	10° 2'39.59"N	9° 56'46.93"N	10° 1'12.27"N	10° 1'53.12"N	9° 59'4.29"N
		Longitude	76° 18'2.85"E	76° 18'17.27"E	76° 16'56.54"E	76° 17'23.95"E	76° 16'34.42"E
	b) South Side	Latitude	9° 58'46.63"N	9° 56'36.98"N	9° 56'44.36"N	9° 57'14.56"N	9° 58'47.28"N
		Longitude	76° 19'55.33"E	76° 17'31.38"E	76° 18'1.70"E	76° 18'49.40"E	76° 16'29.82"E
	c) Hydraulic Particulars						

Sl. No	Item	Description				
	2. Max Width	181.52 m CH:8798	24.94 m CH:120	114.58 m CH:315	307.28 m CH:11025	32.09 m CH:345
	3. Minimum Width	5.16 m CH:300	13.04 m CH:765	1.98 m CH:5370	1.98 m CH:3660	1.83 m CH:664
	4. Maximum Depth	6.00m	8.00m	5.00m	6.00m	4.00m
	5. Minimum Depth	0.30m	3.0m	0.40m	0.20m	1.00m
	d) Canal length (km)	11.23	1.41	9.88	11.15	0.66
Major Components of the Project						
	a) Canal beautification	4 km (either sides)	Landscaping with walkways in balance portion as per site availability			
	b) Roads bridges to be reconstructed (nos.)	11	2	23	20	0
	c) Foot bridges to be reconstructed (nos.)	1	0	13	16	1
	d) Foot bridges (new) (nos.)	5	2	5	2	1
	e) Jetties, terminal buildings, etc. (nos.)	9	2	10	9	0
	f) Urban regeneration:					
	• Sewerage network (Sewer load to be treated) (in MLD)	11.71	10.59		13.15	Existing scheme
	• Sewerage Treatment Plant	Vennala + Muttar	Elamku-lam	Elamku-lam + Perand-oor	Elamku-lam + Puthukkal avattom	
	• Sanitation facilities	Based on the requirement				
	• Solid waste management	Kochi Municipal Corporation will handle the delivery and treatment as part of WTE proposal at Brahmapuram plant Ambalamugal in Vadavucode – Puthencruz Grama Panchayat in Kunnathanadu taluk, but provision to collect solid waste for 3 yrs. included as part of this project.				

Sl. No	Item	Description
	g) Rehabilitation, resettlement • Compensation for project affected people	280 units 94 buildings (Full) and 791 buildings partial
		
11.	Details of Investigation / surveys	Refer Chapter – 2 for details.
	a) Lidar and Topographical survey	Completed
	b) Bathymetry survey, Tidal, Rainfall data	Secondary Data Bathymetry: NATPAC 2018 validation survey in progress by GC Tidal data: Cochin port trust (CoPT) Rainfall data: IMD, CUSAT (RADAR Centre)

Sl. No	Item	Description
	c) Geotechnical investigation	Secondary Data: SPV, Primary data collection survey in progress
	d) Water quality parameters testing	Completed by GC in May 2020
	e) Social assessment surveys for resettlement & rehabilitation	Completed by GC in May 2020
	f) Land identification and its validation	Secondary Data: NATPAC 2018, Validation survey in progress by GC
12.	Whether Land acquisition involved	Yes
	Details of land acquisition:	
	a) Canal Oriented Development (COD)	Area: 37.50 ha; Land cost - **₹ 437.27 crores**
	b) Resettlement & Rehabilitation	Area: 3.13 ha (7.73 acres); Land cost - **₹ 29.61 crores**
	7. Total Land Acquisition Cost	**₹ 466.88 crores**
13.	Total estimated cost and item wise cost break up	(Refer details in Chapter - 6)
	a) Canal cleaning, deepening, widening, shore protection and regulatory works	₹ 204.31 crores
	b) Canal beautification (4Km) and land scaping works at selected stretches in other canals	₹ 55.0 crores
	c) Roads/foot bridges	₹ 131.03 crores
	d) Jetties, terminal buildings, control rooms, navigation aids, boats, etc.	₹ 42.31 crores
	e) Urban regeneration	
	a. Sewerage network, sanitation facilities & solid waste management	₹ 291.17 crores
	b. Sewerage treatment plants (5nos) 31MLD with O&M for 15 years	₹ 101.96 crores
	f) R&R - component - 7 blocks with total 280 units) including bottleneck removal	₹ 78.76 crores

Sl. No	Item	Description	
	g) Utilities and bottlenecks removal	₹ 30.00 crores	
	h) Building compensation to Project affected people	₹ 58.35 crores	
	i) Specific additional contracts, Environment monitoring Project management cost specialized work like LIDAR survey, Public campaign/social awareness management	₹ 34.50 crores	
	j) Development of Konthuruthy Canal (Additional work)	₹ 34.00 crores	
	Total cost – COD and Urban regeneration (excluding land acquisition)	₹ 1061.39 crores	
	Total -COD + Urban Regeneration (Capital cost+ Land acquisition)	₹ 1528.27 crores	
	Details of Schedule of rates	KPWD(PRICE) / CPWD (Delhi Schedule of Rates) /LMR (2019)	
14.	Whether detailed estimate attached?	Yes	
15.	Details of revenue streams (Refer Chapter-7 for details)	Proposal for Value Capture Financing & Transit Oriented Development to generate revenue	
16.	Details of Cost Benefit Analysis (CBR Value)	**EIRR (%)**	**FIRR (%)**
	a) Canal Oriented Development	26.41	5.24
17.	Details of project risks	(Refer Chapter - 9 for details)	
18.	Details of project management organization strategy	(Refer Chapter - 13 for details)	
19.	Details of Contract Management strategy	(Refer Chapter - 14 for details)	
20.	Details of Project Implementation Schedule (PIS) & work breakdown Schedule (WBS)	(Refer Chapter 12 for details)	

Sl. No	Item	Description
21.	Duration to complete the project proposed	36 months (starting from June 2020)
22.	Details of statutory clearances	(Refer Chapter -11 for details)
23.	Quality control Infrastructure and mechanism	(Refer Chapter -15 for details)
24.	Operation and Maintenance (O&M) arrangement of the project after completion	(Refer Chapter -16 for details)
25.	Details of attached drawings	Drawings attached for various project components as Annexures
26.	Other attachments	Appendix:1,2,3 & 4

1.2 Executive Summary

1.2.1 Background

Kochi being one of the prominent port cities and as part of Ernakulam district, enjoys a strategic location among all the ports in India. Being a historical port city, it has an elaborate network of navigable water channels. Water transport by means of traditional boats was a prime mode of movement from one island to another and surrounding the Ernakulam mainland. However, with improved road infrastructure, canal transport in Kochi experienced a decline and the inland canals got neglected and became waste dumping ground due to intense urbanization and industrialization over past few decades. In the recent years, the Government of Kerala (GoK) has emphasized the need to restore the inland water transport and started projects like the Water Metro. As per the GO (Rt) No. 2010/2019/RD dated 23rd July 2019, KMRL was entrusted the job of Special Purpose Vehicle (SPV) for implementation of the project. Antea Group was selected as the General Consultant for assisting SPV in preparation of the DPR. The formal agreement was signed on 19 November 2019.

This report prepared by Antea Group (General Consultant) for SPV(KMRL), is focussed on innovative solutions to address the challenges faced by the city in the areas of canal restoration for inland navigation, flood mitigation, and urban regeneration. The project aims to achieve better living conditions and tourism promotion in the canal catchments by focusing on canal-oriented transport development approach. The purpose of the preparation of this Detailed Project Report (DPR) is to have inclusive growth with the activities focused on climate change, improving life of people, promoting last mile connectivity. It has been ascertained that the activities proposed in the Integrated Urban Regeneration and Water Transport System (IURWTS) project are economically viable, environmentally sustainable, and socially acceptable.

This project is in line with the overall objective of improvement of transport system of Kochi city and for integration with the Rail Metro and Water Metro to enhance the last mile connectivity. This is proposed to be achieved by canal restoration and urban regeneration of the canal catchment. The Urban Regeneration and Canal Oriented Development (COD) is not considered as a simple form of renovation or rehabilitation of the obsolete and dilapidated canal infrastructure. The restoration of canals and urban regeneration is aimed at restructuring the urban fabric and renewal of the urban economy and thereby overall improvement of city's image.

This DPR has been prepared as per KIIFB guidelines to seek funding for the project, presenting details to meet the requirement.

1.2.2 Main Features of the DPR

Five canals are proposed to be taken up under the project: Edappally Canal (11.23 km), Thevara – Perandoor Canal (9.88 km), Chilavanoor Canal (11.15 km), Thevara Canal (1.41 km), and Market Canal (0.66 km). The project command of these canals falls in a rapidly urbanized coastal and estuarine region, which delimits within the Kochi corporation and three municipalities, viz., Kalamassery, Thrikkakkara, Thripunithura of Kochi city. Out of these, Edappally Canal, Thevara - Perandoor Canal and Chilavanoor Canal are three major canals in Kochi City aligned in the North - South direction, cutting across the heartland of Ernakulam mainland. Improving Edappally canal will facilitate to connect the Edappally Metro Station with the water metro route between Vyttila and Kakkanad. Chilavanoor canal and Thevara-Perandoor canal are also connected with Periyar river. The development of Thevara Canal will reduce the navigable distance between Kundannur and Venduruthy backwaters.

The development of these canals will facilitate passenger movement through canal waterways "Canal Metro" and between Rail Metro stations and Water Metro. In addition, the proposed development will augment tourism potential for Kochi city.

All the activities proposed under the project are grouped into two major components:

- Canal and canal bank development and Urban Regeneration.
- Infrastructure / property development by way of Value Capture Financing & Transit Oriented Development to generate revenue.

The concerns raised by various stakeholders (line departments, institutions, public representatives, etc.) during consultations are incorporated in the DPR to expand the benefits of the project. The canal and canal bank development are planned by adopting a canal-oriented development approach by (1) embracing the canal in its design and development, (2) intermingling the space with the greater urban form, and (3) connecting private and public spaces. The restoration process also focusses on enhancement of water storage capacity of canals, thus mitigating floods and improving canal navigation for enhancing last mile connectivity. In the urban regeneration front, a catchment approach is adopted to assess the sewer loads from the canal catchment rather than confining to the sewer loads to the main canal areas only.

Formation of a Special Purpose Vehicle (SPV) is of paramount importance to manage this project during implementation and post implementation stage, involving all related government departments. A separate building to house the activities of the SPV with a control room connected to the CCTV's installed all along the project canals is among the highlights of this project.

The demands and requirements of the project were assessed during the stakeholder consultations with line departments, key government officials, NGOs, senior citizens, and public representatives of the project command. Secondary data has been collected from various departments and institutions along with field surveys for further assessment and preparation of design and cost estimates. The field surveys and additional information collection included: LiDAR and topography surveys, geotechnical surveys, bathymetry surveys, survey of the sub canals, validation of land identification data, social assessment, and water quality assessment. Further studies are undertaken for hydrological assessments, and hydraulic and flood studies to support the detail design and cost estimates.

Innovative design concepts for many activities such as shore protection, single span road bridge, foot bridge, regulatory arrangement for maintaining water depth, have been considered. Both the functional and engineering designs of the canal development, and urban regeneration are presented in this DPR relying on relevant codes, byelaws and both national and international practices.

The flood plain study is undertaken in the project command for an extreme rainfall event and in the surrounding water bodies impacted by flood discharge from the upper catchment of 6 rivers. Central Water Commission (CWC) guidelines have been followed to decide on the return periods for the flood plain study. A flood zone map has been prepared to identify the low-lying areas in the catchment. Considering the tidal fluctuations in the water bodies surrounding the project catchment and to maintain a navigable depth inside the canals, automatic operating shutter, and pumping arrangements at both ends of the 3 major canals is proposed.

An optimum canal width is fixed to drain out the flood in the catchment and PIANC guidelines followed for fixing the water way width for 2-way traffic. It is also assured that the width of the canal as per village records is not compromised in deciding on the final width. Both conventional and modern machineries are proposed for canal cleaning, canal widening and deepening. The design basis for fixing the dredge level to avoid salinity intrusion is discussed.

Different options for shore protection have been discussed and the choice for each location will be finalized in the detailed design and estimation stage.

The vertical clearance for reconstructed cross-structures for seamless navigation is based on the guidelines of IWAI guidelines. To have an innovative design for reconstruction of road bridges, different options were studied, and a site-specific solution will be adopted during the detailed design and estimation stage. Steel structures will be used for foot bridges and the engineering basis along with relevant codes are presented.

The willingness of passengers to use "Canal Metro" was assessed using the secondary traffic survey data. Accordingly, the number of boats, fixing of locations of jetties and terminal buildings, navigation aids, control room facilities (including CCTV installation, etc.) were finalized. The design basis for fixing (turning circle, length, and type of the jetty) was by adhering to international and national practices. The speed for the "vessels or canal boats" being shallow waters has been fixed at a maximum of 10 km per hour. Accordingly, vessel characteristics and the number of boats estimated, along with their travel frequencies.

Sewer load for the entire canal catchment has been assessed and sewer networks to individual household connections proposed. Based on different modes of sewer load transport studied, and considering the site-specific condition, pressurized mode of sewage transport to the sewage treatment plant has been selected. The life cycle cost of different STP's options were studied and the sequential batch reactor (SBR) is selected for the sewage treatment. Operation and maintenance for 15 years for STP's including defect liability period is also included. Adequate provision for transitional sanitation facilities is needed for the inhabitants who are not connected to the main sewer system.

Sewer load has been assessed, using computer aided software. The design basis for connecting the sewer lines to individual households, for fixing the interceptors, pipe diameter, and pumping arrangements using relevant codes are discussed. The operating principles of SBR technology and the components are discussed. Transitional sanitation facilities including community toilets and bio-toilets are also suggested. Solid waste management for collection of waste in the catchment using innovative technologies is also brought out.

1.2.3 Project Cost

The cost estimates are worked out using Delhi Schedule of Rates (DSR 2019), the schedule of rates of the state government (PRICE) as per price index of 2019, relevant Indian and International codes, and market rates as applicable. The cost estimates are summarized under six categories:

A. Canal Oriented Development

The cost estimates are further divided into various activities which was worked out considering cost of each canal as shown in **Table 1.1**.

Table 1.1: Canal Oriented Development

Project Activities	Amount (INR crores)
Canal cleaning and water hyacinth removal: Water hyacinth and other floating materials including plastic waste deposited in the canal a need to be cleaned. Provision has been included for cleaning the canal during the start and completion phase of the project i.e. during the preconstruction phase, and on completion of the project	**2.10**
Canal widening and deepening: The width of five canals are restored to the original width of canal as per village record and ensuring that the requirement for flood mitigation and navigation of vessels are met. The dredge level has been fixed taking into consideration the hydro-geological aspects and the minimum navigation depth to be maintained during low tide water level in the canal. Proposal to desilt the sub canals at essential locations is also proposed	**33.73**
Shore protection: Different types of shore protection measure have been studied and the detailed design and estimate will be based on site-specific type requirement.	**138.48**
Reconstruction of roads along canal: The reconstruction of damaged roads along the canal affected due to the widening of canals has been considered.	**10.32**
Reconstruction of road bridges: Based on the parametric analysis for different types of road structures chosen, site specific road bridges having a uniform and aesthetically pleasing appearance and in line with the canal-oriented development activities will be finalized in the detailed design and estimation stage. The reconstruction included is for 56 nos. bridges.	**69.45**
Reconstruction of foot bridges: Steel structure which are environmentally acceptable, aesthetically pleasing, and easy to assemble are proposed for the reconstruction of footbridges. Total 31-foot bridges for reconstruction and 15 nos. new for crossover of the utilities are included.	**16.10**
Regulatory arrangements with automatic operations and pumping arrangements: Three major canals will have locks on both ends to maintain the required water levels in the system for movement of navigation vessels. This system will also prevent the reverse flow of monsoon flood waters from the surrounding bodies into the canal. Direct sediment inflow from the flood waters will also get reduced drastically. Regulatory shutters will be designed and fabricated with the help of specialized agency, and hence a lumpsum provision of has been made based on market analysis.	**30.00**

Project Activities	Amount (INR crores)
Construction of access road to road bridges: As the bridge heights are increased to provide a clearance height of 4 meters, gradient correction to the access roads, reconstruction of damaged portion and demolishing charges are required.	**35.16**
Canal bank beautification with landscaping & promenade: Considering the availability of free space, limited encroachment and the location advantage, beautification of 4 km on either side of Edappally canal is included. The canal bank beautification benefits to the well-being of people and encourages lifelong tranquility that is in harmony with nature. It also adds value to the tourist infrastructure of the city and to increase the open area and parks inside the catchment. As per site availability, it is also proposed to provide walkways, fencing, and landscaping in limited stretches along other canal banks where space is available after implementation of the development activities.	**55.00**
Construction of jetties and jetties terminal buildings: The choice of location of the jetties are determined by the intermodal connectivity with the rail metro, water Metro, and road modes, i.e. the first and last mile connectivity. The navigational width of 16.5 m was estimated for 2-way movements in the project canals. Jetties and jetty terminal are designed for an average plinth area of 70 sq.m considering minimum CAPEX and O&M cost. A total of 30 jetties is proposed to meet the navigation requirement	**10.00**
Construction of office building for Special Purpose Vehicle with testing laboratory: An institutional mechanism to monitor the post implementation stage activities is suggested. To house the SPV office a plinth area 1200 m^2 is added to a jetty terminal near Lulu mall along Edappally canal. The other facilities provided in this building are a water quality testing laboratory, a tidal fluctuation measurement unit, and a control office connected to all the CCTV units along the 5 canals. The building cost has been estimated, and lump sum provision added for the other facilities proposed.	**6.00**
Construction of access roads to jetties and jetty terminals: Access roads to the jetty terminals will be improved.	**8.84**
Purchase of vessels / boats for navigation of passengers and tourism: Based on the traffic survey results, number of boats with various characteristics have been estimated to cater to the demand of the public.	**10.00**
Navigational aids, Signages, Markers and Way finding signages: Based on design considerations, the required navigation aids and related accessories have been estimated.	**2.47**

Project Activities	Amount (INR crores)
Miscellaneous items such as solar installations, EV chargers, electrical systems, non-motorized transport like electric buses, etc. for last mile connectivity are included to support the project operations.	**5.00**
Total	**₹ 432.65**

B. Urban Regeneration

The urban regeneration works include the provision of sewer lines on both sides of the canals, sewage interceptors to collect the sewage load from the sub canals, and pumping systems to pump the sewer load from interceptors into the main sewer line. A total of 5 STPs is proposed to treat the sewer load generated in the project catchment. The catchment has been divided into 2 sectors along the NH 544 which cuts across the project catchment in the east-west direction. The southern side catchments of Thevara-Perandoor, Chilavanoor canals and Edappally are proposed to be treated by 2 STPs. The northern side catchments of the 3 canals are proposed to be individually treated by 3 STPS. Sanitation facilities for inhabitants who are not connected to the sewer lines are also proposed. As a transitional facility, bio-community toilets are proposed at every 500 m along the canals during the project implementation phase. These community toilets would prevent sewage being discharged into the canal. Solid waste management load has been assessed for the catchment and alternate management measures are suggested. (**Table 1.2**).

Table 1.2: Urban Regeneration

Project activities	Amount (INR crores)
A full sewer network for the entire catchment with individual household, sewer network connectivity including interceptors, manholes, inspection chamber, pumping stations, etc. is proposed	**₹ 260.69**
Establishment of five STPs: The sewer load of the entire project command to be treated over and above the existing and ongoing scheme has been estimated as 31MLD. The sewer load of the southern side catchment of Thevara-Perandoor and Chilavanoor will be treated by a STP of 10 MLD at Elamkulam and the Edappally served by a 10MLD STP at Vennala. For treatment of sewer load on the northern side catchment of Thevara-Perandoor, Chilavanoor and Edappally, 3 Individual STPs are	**₹ 101.96**

Project activities	Amount (INR crores)
proposed at Perandoor (5MLD), Puthukkalavattom (4MLD) and Muttar (2MLD). Provision for 15 years operation and maintenance are also included.	
Sanitation Facilities: The transitional sanitation facilities for population is not covered by the proposed sewage network has been included to prevent sewage being discharged into the canal.	**₹ 26.65**
Solid waste management: Kochi Municipal Corporation has already envisaged a proposal for converting the solid waste into energy at Brahmapuram, Kochi. The requirement of daily waste is 250 tons. IURWTS catchment falls within corporation municipality and occupies a major portion of Kochi municipal corporation area. Hence rather than having a separate plant, it is proposed to have a coordinated effort with KMC for solid waste management for the initial 3-year period. Provision for innovative collection methods are only proposed.	**₹ 3.83**
Total	**₹ 393.13**

C. Land Acquisition for Canal Oriented Development and Urban regeneration

The total area required for canal bank development is **37.50 ha** and the total cost estimated is **INR 437.27 crores**. Land acquisition rates have been estimated based on the latest fair value rates fixed by the government also anticipating a future fair value increase before the land acquisition process is complete.

Table 1.3: Land Acquisition for COD & Urban Regeneration

Land Acquisition	Amount (INR crores)
Land Acquisition along canal banks: The land required for canal widening for maintaining a fairway of 20.5 m along the banks of the 5 canals is estimated at 34.68 ha	₹404.99
Land required for access road for bridges and STP's: The road structures across the canals do not adhere to the navigation standard and hence the vertical clearance for these structures need to be increased to 4m. By way of this gradient a	₹25.41

correction to the roads on either side acquisition is required and the estimated area is 2.22 ha.	
Land required for access road for jetty terminals: Land acquisition required for developing road access to jetties and the area required is estimated as 0.60 ha.	₹6.87
Total	₹437.27

D. Other Specific Contracts

A lumpsum provision has been given for the study of other specific contracts (navigation sector) for INR 2.50 crores for canals to be taken up adjoining to the canals of this project catchment. The environment management plan approved by (MoEFCC) also needs to be monitored during the implementation stage for all activities and provision has been included for monitoring the quality parameters for 5 years and lump sum provision of 2.00 crores is proposed. Project management cost, Specialized work like LIDAR survey, public campaign/social awareness management has been estimated for Rs 30 crores. The total cost of **INR 34.50** crores is proposed for these activities.

E. Rehabilitation & Resettlement/Building Compensation including Land Acquisition

Based on initial survey (NATPAC 2018), 181 dwelling units with a total population of 559 distributed over 3 colonies (P and T Colony and Udaya colony located on Thevara-Perandoor canal and old Kudumbi colony located at Chilavanoor canal) were estimated to be resettled. The land measuring 7.73 acres with a cost of **INR 29.61 crores** located at Kakkanad was identified for resettlement of the 181 slum dwellers.

A Social assessment study was carried by Antea Group to re-validate the number of units for R&R. The study identified an additional 99 squatters thereby 280 (181+99) number of units is presently to be resettled. The concept design proposed in the land identified is for 7 blocks (10 floors, 40 units each). **T**he total estimated cost for the 7 blocks including land cost has been worked out at **INR 108.37 crores**. The DPR for R&R resettlement for 280 units has been prepared and included as an **Appendix Volume 1** to this report.

The structures falling in a 20.5 m fairway in all project canals was also studied under the social assessment study and the Project Affected People (PAP) affected by implementation of the project was re-validated. The study brought out that 94 structures are completely affected, and 791 structures will be partially affected in the 20.5 m development zone. Buildings Compensation cost for PAP & PAF categories have been assessed and is estimated at **INR 58.35 crores.**

The removal of utilities including bridges/culverts (to be handled by respective department) has been roughly assessed and a lumpsum amount of **INR 30 crores** has been included.

The summary of cost estimates for Canal Oriented Development (COD) & Urban regeneration (UR) is estimated including land acquisition cost is **INR 1528.27 crores** as given in **Table 1.4**.

Table 1.4: Summary Cost for COD and Urban Regeneration

Sl. No.	Project Components	Amount (INR Crores)
A.	Canal Oriented Development	₹ 432.65
B.	Urban Regeneration	₹ 393.13
C.	Land Acquisition cost for Canal oriented development & Urban regeneration	₹ 437.27
D.	Specific projects, Environmental monitoring, Project management cost, Specialized work like LIDAR survey, public campaign/social awareness management	₹ 34.50
E.	Rehabilitation & Resettlement including utilities shifting	₹ 196.72
F.	Development of Konthuruthy Canal (Additional work)	₹ 34.00
	Total	₹ 1528.27

F. Infrastructure / property development for generation of revenue.

The IUWRTS project aims to achieve better living conditions and tourism promotion in the canal catchments by focusing on canal-oriented transport development approach. Being a large infrastructure, it is a capital-intensive project with a long gestation period. The residents and businesses within 1000m distance on both sides of the project canal banks will be connected to the sewerage network, boat jetties and parks and canal metro connectivity into the urban fabric. This will help an intermodal connectivity with the rail metro, water metro and road transport. Therefore, other revenue generating models such as Value Capture Financing (VCF) and Transit Oriented Development (TOD) will be explored. VCF and TOD are methods of funding infrastructure improvements by recovering all or some of the increase in property value generated by the public infrastructure investment. The benefits accruing from the same may be transferred to the SPV undertaking this project.

The EIRR and FIRR for the canal development and urban regeneration has been worked out and is given in **Table 1.6**.

Table 1.5: Economic Internal Rate of Return (EIRR) and Financial Internal Rate of Return (FIRR)

Sl. No.	Project Components	EIRR%	FIRR%
1.	Canal Oriented development and Urban regeneration	26.41	5.24

Capitalizing the popularity gained among the people within Kochi and the Kerala state, this project will be a milestone project for canal transport and urban regeneration space in the country.

1.2.4 Implementation framework and Risks

An overview of baseline environment conditions conducts of environmental impact assessment (EIA) study, preparation of environment management plan (EMP), monitoring the environment parameters (air, water, noise, etc) is presented. The impact of the development activities on air, water, noise, land and environmental safety hazards and management aspects of monitoring to protect the environment and coastal zone and ensure sustainability is detailed. Considering the applicability of CRZ regulation under which this project command is located, environmentally sustainable and financially viable activities with other revenue generation infrastructure models along the canals have been proposed.

Various risks are identified which include financial/monetary, schedule, scope, safety, environmental, etc., which will be assessed during various stages of the project implementation. The risks are also identified for the planning and design, preconstruction, and construction phases. Accordingly, the qualitative risk rating matrix has been prepared along with the proposed mitigation measures to address these risks during project implementation.

A project implementation framework and the roles and responsibilities of the SPV has been discussed during design, construction and operation and maintenance. The SPV will act as a nodal agency for project implementation and require support of various line departments such as Irrigation Department, Public Works Department, Revenue Department, Environment Department, Tourism Department, Survey and Land Records, Kochi Corporation, GCDA, NGOs and other agencies who will play supporting role in implementation and development of this project. The role of various committees are suggested such as an apex committee to settle disputes, a state level monitoring agency to undertake surprise inspection of the works and a project monitoring committee at the SPV level to monitor the project progress periodically.

A contract management strategy has been discussed with various contracting options for civil works, PPP, goods & purchase, operation, and maintenance that are planned to be tendered out on appropriate modes of contracting are discussed. Pre-qualification and tendering processes for the identification of

various boat manufacturers is presented included in the proposed implementation period. The work breakdown structure and the implementation schedule of 32 months has worked out, considering implementation of works concurrently and prioritization. The implementation period for this project is assessed as three years, and the canal routes are expected to be fully operational by June 2023.

As per environmental and social safeguard policies of MoEF&CC, the compliance to the statutory framework is being followed and will be implemented during construction stage. The KMRL has applied to MoEF&CC and other statutory agencies seeking required environmental and CRZ clearances for the project including the consent to establish from KSPCB.

The quality assurance and quality control plan are important for the works to ensure the quality procedures, quality tests, periodicity with IS codes, details of personal and labs facilities, format of reporting during implementation. The environmental protection, health and safety measures must be in place to protect the interests of all the people who are directly and indirectly involved in the project implementation.

After reconstruction and restoration of the five canals, infrastructure created need to be maintained to keep them functional for navigation, water conveyance as well as keep the water quality at the desired level. Before commissioning of project assets, operation and maintenance plan for all infrastructural components will be finalized considering the provisions of various contracts and SPV's mandate.

1.2.5 Conclusion

The IURWTS project addresses the issues of the Kochi city by restoring inland navigation, promoting last mile connectivity, protection from flood inundation in canal areas, improvement in urban spaces, and sanitation facilities. It aims to achieve better living conditions and enhance livelihood opportunities for the people as well as tourism. The development of inland canal navigation will enhance greater connectivity between Rail Metro and Water Metro and augment the tourism activities in the city.

Major project components include canal-oriented development and urban regeneration. The total project cost for canal-oriented development excluding the capital cost for revenue generation stream is **₹ 1528.27 crores**, with good potential returns in next 25 years. The excess land available after the development process is suggested to be leased or sold out and the anticipated revenue is around **60 crores**. This project, once implemented in the next three years, will be a milestone project in the inland navigation and urban regeneration sector and pave way for other similar projects in Kerala state.

CHAPTER 2

REQUIREMENT / DEMAND ANALYSIS

2 REQUIREMENT / DEMAND ANALYSIS

2.1 Introduction

A network of canals that were used for navigation purposes earlier and were more vibrant crisscrosses Kochi city. Due to urban sprawl and other modes of transport finding more importance, Kochi city canals got neglected and have become space for encroachers, slum dwellers, unplanned infrastructure activities, point and non-point source sewage disposal and waste dumping. The water carrying capacity has been completely lost and consequently, flooding in the adjoining areas of canals have become a recurrent phenomenon in many parts of the project catchment.

Antea Group Netherlands (General Consultant) selected for assisting SPV signed the agreement on 19 November 2019.

Letter of Acceptance (24-10-2019)

Signing of agreement (19-11-2019)

The IURWTS Project envisages to restore the 5 canals in the command as given in **Figure 2.1** for navigation of vessels, flood mitigation in the catchment and to make the canals pollution free. The program named 'Room for the river' in Netherlands is one such initiative, wherein by creating more room for the river, the objective was to provide more space for nature, navigation, and recreation.

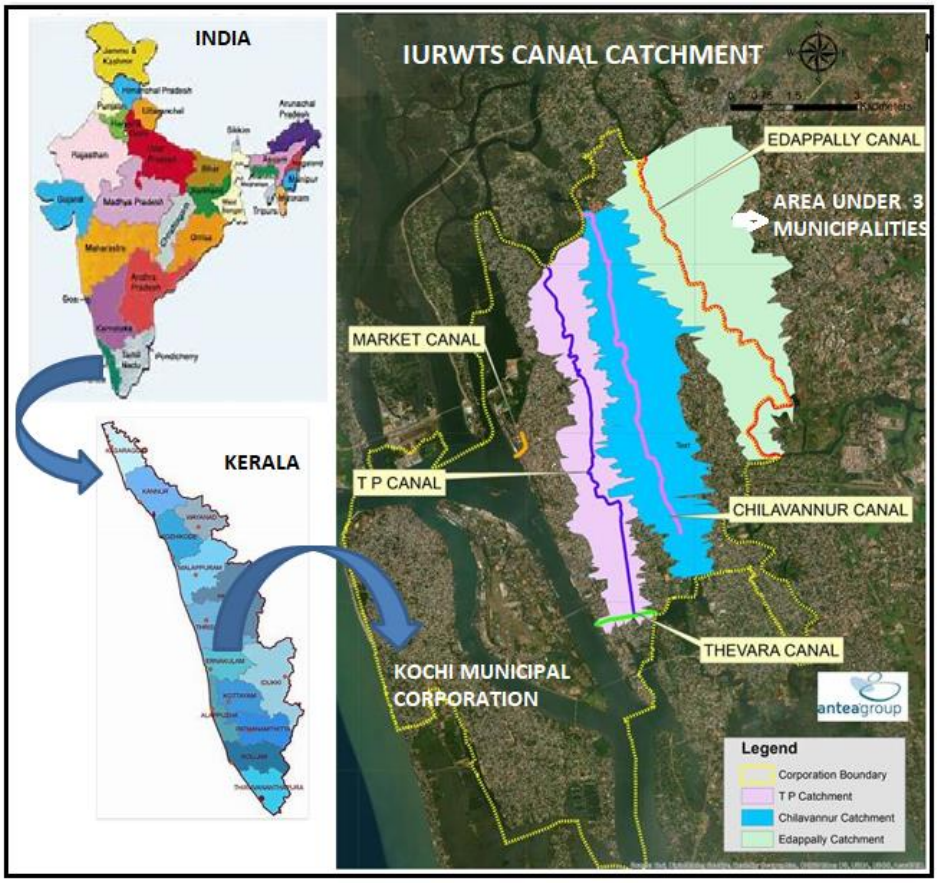
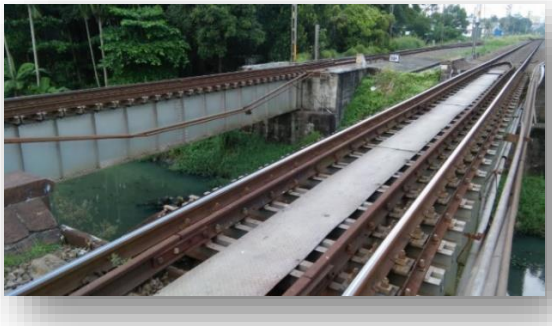


Figure 2.1: IURWTS project command

Pictures depicting the current dilapidated situation of the canals along a few stretches is given as **Figures 2.2, 2.3, 2.4 and 2.5**.

Ch 3800m Edappally canal (waste dumping)

Ch 4200m Edappally canal (Water pipeline crossing



Ch 1130m Edappally canal (Rail bridge crossing)

Ch 6200 Edappally canal (Private flat) encroachment in water way

Figure 2.2: Edappally canal stretches

Ch 4130m Chilavanoor canal, Kaloor JLN Metro NH crossing

Ch 3460m Chilavanoor canal vent way reduced and covered by slabs to increase road width

Ch 5880 Canal water way reduced for construction of Private road bridge

Ch 5750 IMA house Chilavanoor canal encroachment of vent way

Figure 2.3: Chilavanoor canal stretches

Ch 3800m Utility crossing Gail gas pipeline (T-P canal)

Ch 6470 P&T Colony slum encroachment (T-P canal)

Ch9850 old road bridge (T-P canal)

Ch 9200 KWA water pipeline crossing (T-P canal)

Figure 2.4: Thevara-Perandoor canal stretches

Ch 520m Waste accumulation -Market canal

Ch 650 Vegetative growth inside Market canal

Figure 2.5: Market canal stretches

The project activities described in this DPR are such that they are both environmentally acceptable and sustainable. This chapter deals with the requirement and demands of the inhabitants and stakeholders of the project command. Before arriving at conclusion on the activities that have been taken up under this project, detailed stakeholder consultation was carried out.

2.1.1 Stakeholder consultation

In order to have a clear understanding of the requirement of the stakeholders, the first step initiated by Antea Group was to identify the important stakeholders, NGOs, senior citizens, Government departments, and public representatives of the project, who can add value to the planning of the project. This helped SPV to initiate arrangements for interactions, meetings, and site visits with the stakeholders. The long-term issues faced by the inhabitants, risk involved in the implementation process, and the benefits that can be derived on implementation of the project were identified and discussed in detail.

The outcome of the interactions helped to:

1. Frame the concepts for the activities with the better understanding of the ground realities.
2. Improve public trust and confidence with a better understanding of the activities, which are taken up under this project.
3. Identify stakeholders, retired government officials who guided in obtaining secondary data and share important reports and legacy data in their possession.
4. Identify measures for Institutional strengthening.
5. Identify the causes and the actual locations in the project command prone to frequent flooding.

The identified stake holders were differentiated to prioritize, reconcile and balance the stake holders and to closely monitor to maximize the benefits accrued to the project .The stake holders were divided on the basis of whom to be monitored and managed closely, whom to be kept satisfied always and whom to be kept informed about the progress on a regular basis. The major stakeholders are given below in F**igure 2.6**.

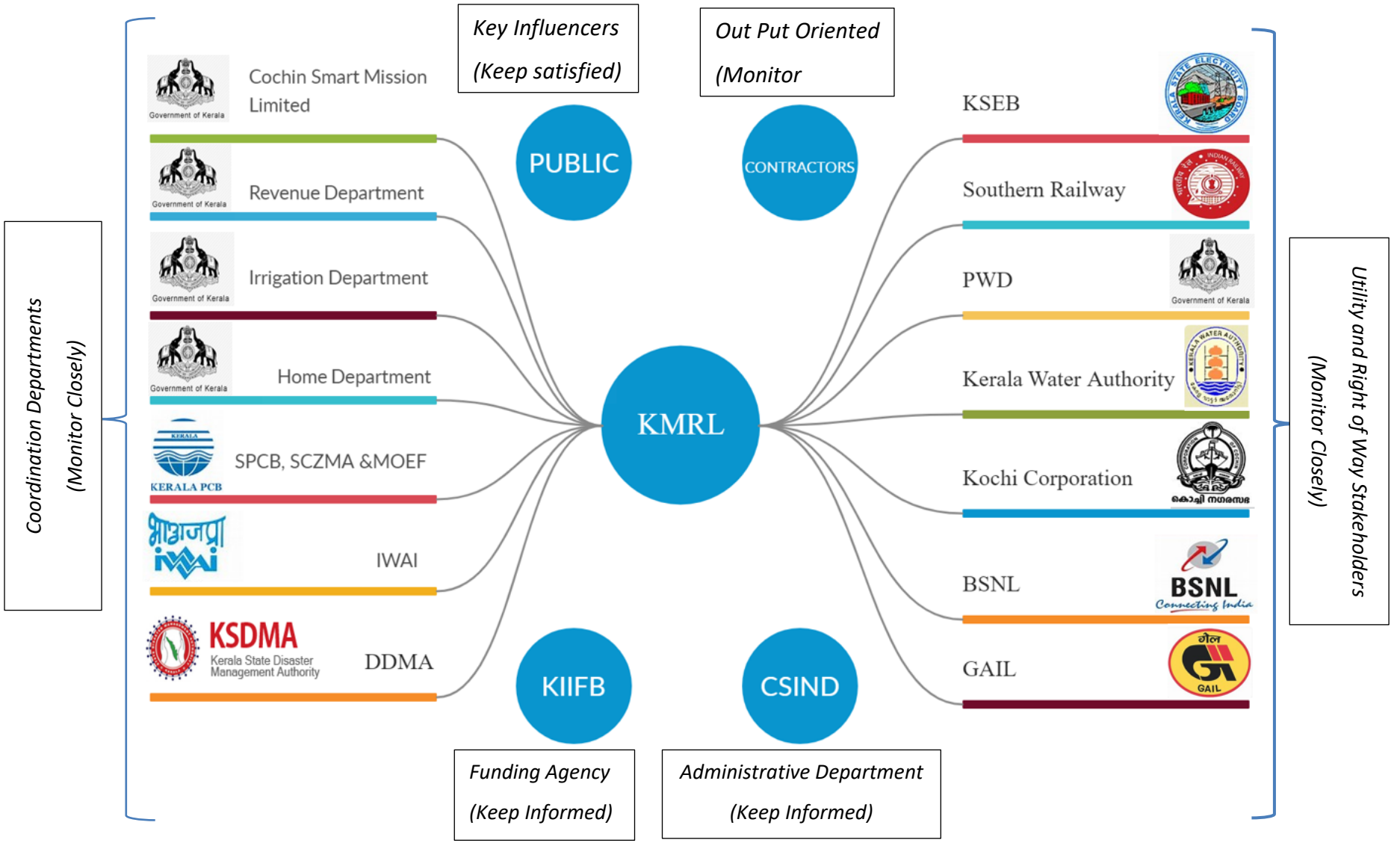


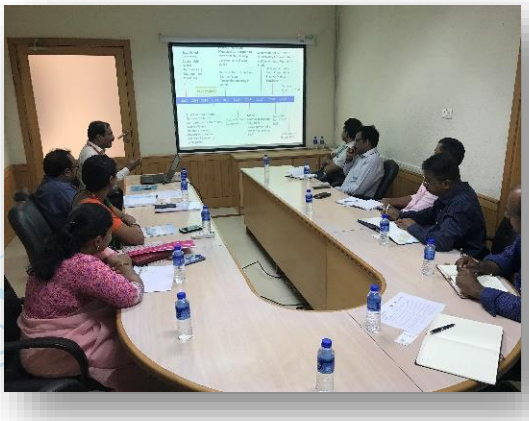
Figure 2.6: Major Stakeholders

KMRL and Antea Group initiated discussions with all the stakeholders to understand the legacy data and to understand the aspirations of each of the stakeholders.

Table 2.1: Stakeholder meetings conducted

Sl. No.	Meeting details	Departments	Photos
1	Stake Holder Meeting with concerned stake holder department officials. Venue: KMRL conference room. 23rd Nov 2019	PWD, Kochi Municipal Corporation, Major Irrigation Dept., Hydrographic Dept, IWAI, BSNL, Revenue, KSEB, IPE Global, CSML, AMRUT & SPV, Antea Group (33 members)	
2	Interactive meeting with Cochin Smart Mission Ltd. (CSML). Venue: CSML conference room. 28th November 2019	SPV, CSML and Antea Group. (9 participants)	

Sl. No.	Meeting details	Departments	Photos
3	Interactive meeting with Tehsildar Kanayannur Taluk Venue: Kanayannur taluk office. 7th December 2019	SPV, Kanayannur Tehsildar, office staff and Antea Group. (10 participants)	
4	Interactive meeting with Kerala State Electricity Board (KSEB) officials. Venue: KMRL conference room. 12th December 2019	SPV, Kanayannur Tehsildar and staff, Antea Group. (16 participants)	
5	Joint Site Visit, KSEB main station, Kaloor. Venue: near JLN Metro Station. 13th December 2019	SPV, KSEB officials, Antea Group. (15 participants)	

Sl. No.	Meeting details	Departments present	Photos
6	Interactive meeting with Kerala Water Authority (KWA) officials. Venue: KMRL conference room. 16th Dec 2019	SPV, KWA officials and Antea Group. (9 participants)	
7	Interaction with nearby education institute, Water Institute SCMS, Karukutty. Venue: SCMS, water institute conference room. 19th Dec 2019.	SPV, SCMS, Water Institute staff with Post graduate students, and Antea Group. (12 participants)	
8	Interactive with Kerala Voluntary Health Studies, Kottayam (KVHS) (Social impact assessment team). Venue: KMRL conference room. 16th December 2019.	SPV, KVHS team and Antea Group. (8 participants)	

Sl. No.	Meeting details	Departments present	Photos
9	Joint Site Visit, KWA STP plant. Venue: Elamkulam, Kochi. 23rd December 2019.	KWA officials and Antea Group. (7 participants)	
10	Stake holder meeting with NGO's, senior citizens, public representatives of the project command. Venue: Government Guest House, Kochi. 21st January 2020.	SPV, Stakeholders, Antea Group.	 

2.1.2 Requirements and Demands of stake holders addressed

The following are the activity-based requirements and demands of stakeholders that have been addressed in this project report.

1. **Canal rejuvenation:** Canal dimension estimated to mitigate flood and for restoring navigation. The upper limit of the canal width is fixed based on the village FMB records.
2. **Canal bank development:** Canal bank development is conceived with emphasis on reinventing the forgotten waterways and the search of places for entertainment, pleasure, and tourism at the waterfront.
3. **Navigation of vessels**: The quantification of boats and the type of vessels to be plied in the canal is based on traffic survey results and environmentally friendly mode of transport included.
4. **Sewer networks and sewage treatment facilities**: A catchment area approach (which includes the main canals and the sub canals) undertaken for calculation of sewer loads.
5. **Sanitation facilities**: Provision for sanitation facilities to the households that are not connected to the sewer systems. Transitional sanitation facilities also included during the implementation stage of the project.
6. **Solid waste management:** A coordinated approach with Kochi Municipal Corporation for solid waste management.
7. **Infrastructure property development revenue generation**: Value Capture Financing & Transit Oriented Development model proposed to be tried in IURWTS catchment after the development activities are completed.

2.1.3 History of Cochin canals

Cochin (alternatively called as Kochi or Ernakulum) finds its way into modern history with the arrival of Vasco Da Gama in 1498 and the advent of European colonialism. In the early 16th century, Mattancherry and Cochin regions had grown to important trading posts where merchants and traders of various nationalities jostled. Cochin thereby developed as a converging point of water transport (**Figure 2.7**). In the emergent phase of waterfront development, settlements were established around a port with safe harbour suitable for cargo and passenger ships. During this period, the waterfront had only a few trails converging at a jetty (**Figure 2.8**). After that, a street pattern was slowly installed, buildings began to develop on the street pattern. The settlement resulted in Kochi city and maritime trade stimulated urban development. The shoreline road turned into a busy street.

In 1905, Ernakulam got connected to the rest of the country by railroad, and thereby the process of urbanization picked momentum. The construction of highways largely changed the transportation pattern in Kochi city. The inter-woven canal network of Kochi and suburbs, which once brought fame for easy transportation at low cost became a sordid nightmare to the dwellers of the area. Several slums and encroachment resulted in wastes, including night soil from these slums, nearby houses and waste materials from shops, market, etc. being directly deposited in the canals.

Figure 2.7: Old Kochi harbor (1850-1897)

Figure 2.8: Old photo of Kochi canal

Considering the recurrent flooding in Panampally Nagar, near Thevara-Perandoor canal, Kochi, a PIL was filed by a resident in the Hon'ble High court of Kerala to intervene and praying urgent action from the administration. The Hon'ble court issued direction to Govt. of Kerala to impose ban and penal action against people who dump waste/Garbage and drain of sewage into the canal. Govt. of Kerala issued orders, vide G.O (Rt) 2466/2019/LSGD dated 06-11-2019 in this regard. Immediately SPV had initiated action at the government level to extend the ban to other IURWTS canals also. Govt orders have been issued vide G.O (Rt) no 823/2020/LSGD dated 04-05-2020 extending the ban to all the other 4 canals of the IURWTS project command also.

2.1.4 Need for the Project

The major deficiencies at present observed, in utilization of these canal systems include:

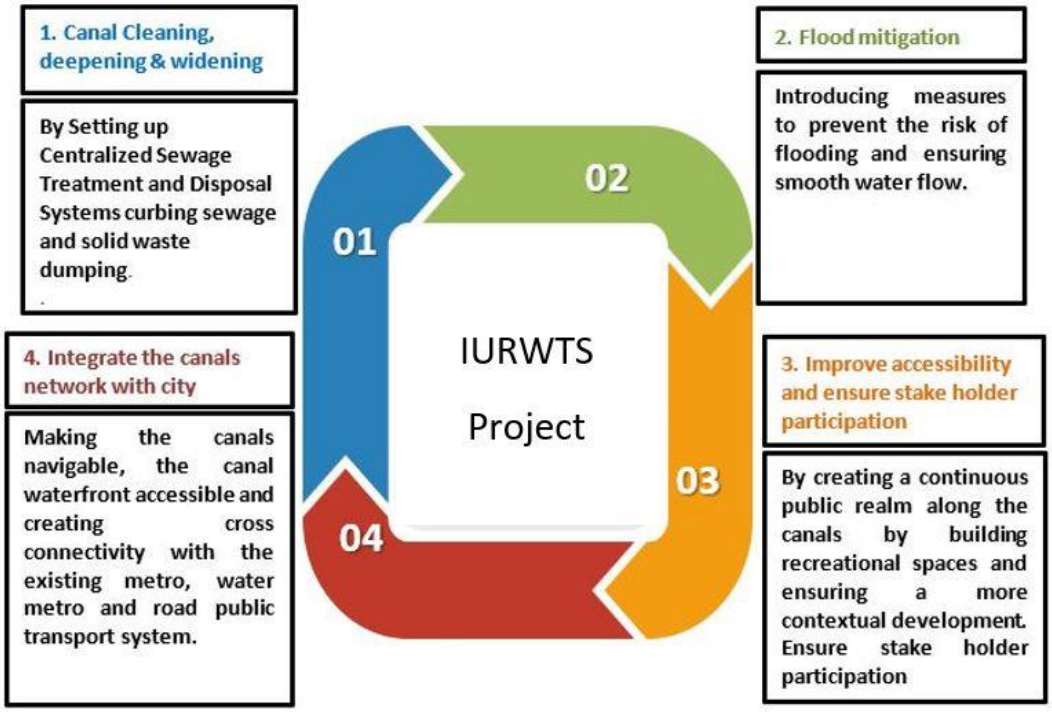
- Narrowing canal width due to continuous encroachment by users and squatters.
- Discharge of sewage, solid waste dumping into the canals.
- Unplanned infrastructure development.
- Frequent flood inundation in adjoining areas of canal catchments.
- Neglect of canals water transport by the administration and emphasis given more on other on alternative modes of transport.

- Haphazard surrounding development around canals without giving importance to the utility of canals thus creating hinderance to canal navigation.

Hence the need for Canal Oriented Development (COD) and Urban Regeneration is considered an urgent need to improve the deficiencies and meet the growing stake holders need for better connectivity. In this context the need for taking up this project was considered with following assumptions:

1. Revival of the canal network will develop the canals into a complementary mass rapid water transit system for the city. This in turn eases the road traffic density in the city.
2. Modern water transport facilities available will improve the riding quality, comfort, travel time through the canal system.
3. Cost of development of waterways is comparatively economical.
4. Rejuvenating the canal to its original conditions will improve the storm water drainage, mitigate floods in the canal commands.
5. Revitalizing and reinventing the forgotten waterways will enhance density along the canal.
6. Improve monitoring of the canal systems, which will reduce to zero waste disposal, mosquito menace, and carbon reduction

2.1.5 Goals and Objectives of the project



2.1.6 Action Plan for achieving the Goals and Objectives of the Project

The canals as it is now, is in a very dilapidated state due to the overuse. To bring back the canals to erstwhile glory, Antea Group proposes a three-pronged approach as given in **Figure 2.9**.

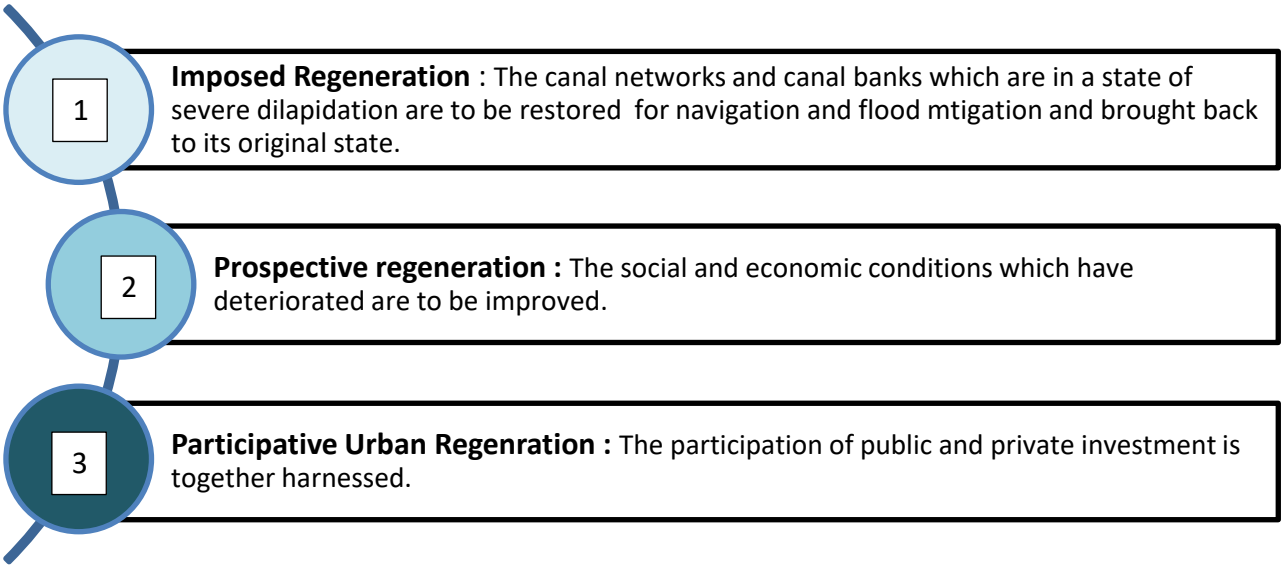


Figure 2.9: Three-pronged approach

2.2 Status of Feasibility studies

Data collection

Based on the discussions with the stakeholders, missing data were collected and used for this DPR preparation.

Secondary data collection

The details on the secondary data and the various stakeholder departments and individuals associated are shown in **Table 2.2**.

Table 2.2: Secondary data and reports collection

Sl. No.	Data type	Department
1	Field measurement book (FMB), Litho maps.	Revenue department, NATPAC/Directorate of survey and land records.
2	Population statistics, ward maps inside the project catchment.	Kochi Municipal Corporation.
3	Tidal data.	Cochin Port Trust.

Sl. No.	Data type	Department
4	Ground water level fluctuation in open wells and tube wells.	State Ground water department, Govt. of Kerala.
5	Tidal fluctuation in surrounding water bodies.	SPV/Cochin Port Trust.
6	Discharge data of rivers.	Irrigation department.
7	Survey of India Toposheets.	Survey of India.
8	Meteorological data (rainfall data).	Indian Meteorological Department, Govt. of India and CUSAT.
10	Bore log details.	SPV
11	Solid waste management reports.	Kochi Municipal Corporation.

Based on the situational analysis survey undertaken by Antea Group, one of the main issues raised by the public, NGO's and the elders of the society was that the minimum width of the canal for development should be based on the village cadastral maps. Hence after collection of the cadastral maps and after studying the requirement for flood mitigation and for navigation of vessels, the widths of 16.5m was estimated by Antea Group. In places were the cadastral maps showed a larger width, the width shown in the FMB records was used for estimation of the widening quantity by Antea Group. This was taking into consideration the concerns raised by the stake holders.

These FMB records were used for ascertaining the original width of the canals. The same were digitised on a GIS platform and along with the topographic survey AutoCAD drawing the comparison with the existing situation was brought out.

Primary data surveys

Primary data collection is being arranged through field surveys for 1) validating the preliminary design undertaken using the secondary data and 2) finalising the detailed design estimation and drawings before the tender process are initiated. The requirement of additional data, survey and geotechnical investigation was assessed, and the process of data collection has been initiated through various agencies. The list of surveys, required data, and initiators are given in **Table 2.3**.

Table 2.3: Requirement for Primary data collection

Sl. No.	Survey	Description of requirement	Arranged by
1	LiDAR and Topography survey	• Computer simulated hydraulic modelling and flood plain studies and validation with results estimated by rational methods. • SIA study validation of affected houses • Ground control points for Bathymetry survey and cross section verification.	Third party LiDAR survey agency by SPV (completed)
2	SIA survey	• Validation of results of secondary data • Identification of additional squatters and projected affected people, if any.	Antea Group (completed)
3	Bathymetry survey	• Validation of secondary data for final estimation of the deepening and widening quantity	Antea Group (in progress)
4	Geo-technical investigation (bore logs)	• Design drawings of cross structures, shore protection structure, STP and infrastructure property development works	Antea Group (in progress)
5	Survey of Catchment Sub canals/ drains	• Detailed estimate of sewer load and flood mitigation	Antea Group Completed
6	Water quality	• Revalidation of water quality sampling test results for STP design	Antea Group Completed
7	Land identification survey and land acquisition proposal	• Validation of the land acquisition area estimates of secondary data • Land identification and acquisition proposal as per the changes necessitated	Antea Group (in progress) (70% work completed, completion in June 2020)

Land acquisition

To move forward with the development activities, the encroachment by squatters and slum dwellers along the canal need to be urgently removed. The Government of Kerala anticipating the need had earmarked INR 566.52 crores in the KIIFB budget vide G.O(Rt)No 2010/2019/RD dated 23rd July 2019, of the Revenue Department. During the land identification process, all the field measurement book records were collected

from secondary sources; those that were not readily available were purchased from the Office of the Commissioner, Survey and Land Records. On completion of the land acquisition proceedings the canal is proposed to be widened after the resettlement of the slum dwellers and rehabilitation of project affected people from the canal banks.

For validation of the land survey estimates, a separate land survey agency (Agilitus Infrastructure Pvt. Ltd.) was engaged by Antea Group to start survey in January 2020.

The terms of Reference for the survey agency is as follows:

1. **Stretches of the canal where the width of the existing canal is greater than 16.5 meters:** land acquisition is for a width of 2 meters along both banks for the laying of sewer lines.
2. **Stretches of the canal where the width of the existing canal is less than 16.5 meter:** land acquisition needed for a width of 8.25 meters on either side of the centre line of the canal. In addition, 2 meters will be acquired for laying the sewer lines.
3. **Stretches of the canal where the existing width is less than 16.5 meters but where the land width as per village records is greater than 16.5 meters:** land acquisition needed for the entire width of the canal as per village record.
4. **The 4 km stretch along Edappally canal where canal beautification is considered**: land acquisition needed for a land width of 15 meters on either side of the canal.
5. **Land identified along the canals for developing revenue generation models:** Survey of locations identified.
6. **Land identified for the 30 jetties and jetty terminal facilities:** Survey of locations identified.
7. **Land acquisition needed for the road bridge reconstruction:** land area required for the gradient adjustment on either side of the road.
8. **Land acquisition required for roads reconstruction along the canal stretches:** Survey of locations identified.
9. **Land acquisition required for 5 STP's along the canal stretches:** Survey of locations identified.

Antea Group initiated the land identification validation process after discussion with KMRL Revenue Division on 14-01-2020 as given in **Figure 2.9**.

The land acquisition proposal for Thevara canal and Edappally canal is complete and the survey agency submitted the report. The survey agency has agreed to submit the land acquisition report for the remaining 3 canals by 30th June 2020.

Figure 2.10: Kick off meeting with KMRL Revenue Division officials

The fair value of the land proposed for acquisition along the 5 canals were estimated in by NATPAC by adhering to Gazette Notification SRO No. 698/2014 dated 14/11/2014. Govt. of Kerala (GoK). After the submission of land acquisition proposal by NATPAC, the fair value of land was increased twice by GoK. The first enhancement of fair value of 10 percent was by gazette notification SRO No.186/2018 dated 31/03/2018 and the second enhancement of 10 percent was by gazette notification SRO No.311/2019 dated 30/04/2019. The estimated provision in the this DPR has accounted for anticipated future increase also before the land acquisition process is finalised.

2.2.1 Social assessment survey

In the social assessment survey undertaken by NATPAC (2018), the project affected people (units) affected by the canal development proposal were identified as 181 units in 3 slum colonies of the project site. For confirming the current situation, a survey was undertaken by the General consultant in Jan 2020 through Kerala Voluntary Health Services (KVHS) Kottayam, a reputed NGO. In the 20.5 m corridor width were development of canal are proposed, the draft validation survey report submitted by KVHS provided the following details as given in **Tables 2.4, Table 2.5,** and **Table 2.6.** The squatters which was earlier estimated as 181 units has increased to 280 units. The Social assessment report undertaken by Antea Group is included as **Appendix Volume 2** of this report.

Table 2.4: Area details as verified from individual households

Canals	Houses surveyed (Nos.)	Area surveyed (ha)	Possession of land (ha)		
			Government land	Government land in private possession	Private land
Edappally	555	9	3.9	2.3	2.8
Thevara	239	1	0.9	0.1	-
Thevara-Perandoor	582	12.5	4.2	3.4	4.9
Chilavanoor	14	17.5	4.1	3.8	9.6
Market	118	1	0.58	0.05	0.07
Total	1508	41	13.68	9.65	17.37

Table 2.5: Details of category of house units (Nos.)

Canals	Houses surveyed (Nos.)	Squatters	Overlap in Slum dwellers of 3 colonies	Additional to be resettled	Encroachers	Owners
Edappally	555	29	0	29	13	10
Thevara	239	2	0	2	4	2
Thevara-Perandoor	582	145	101	44	17	20
Chilavanoor	14	31	7	24	16	22
Market	118	0	0	0	0	0
Total	1508	207	108	99**	50***	54

** Additional resettlement required: 99 Nos.
*** Encroachers who can be owners and decision after completion of land acquisition proceeding, total eligible for full building compensation: 104 Nos.

The loss of structures (such as compound walls, partial portion of houses, etc.) is given in **Table 2.6**. The compensation measures will be finalized after revalidation with the LiDAR survey data. The land acquisition process will be taken up by KMRL after approval of land acquisition details.

Building compensation

The existing buildings within the 20.5 meters buffer zone were classified into single floor RCC, double floor RCC, more than two floors RCC, sheet roofed, tiled roof, and other types. The revalidated survey report with details of PAP submitted by KVHS is given as **Appendix Volume 2**. to this DPR. The number of PAP assessed for a 20.5 m fairway, include a total of 104 units whose buildings will be completely lost, 791 units who are

partially affected and for which compensation measures have been proposed. The financial estimates and costing for rehabilitation and resettlement are provided in detail in **Chapter 6** (Financial Estimates & Cost Projections) of this report.

Table 2.6: Loss of structures in 20.5m corridor width surveyed (Nos.)

Canals	Type of Structures					
	Residential	Commercial	Common property resources	Cultural property	Government property	Total
Edappally	246	36	2	4	4	292
Thevara	11	0	1	0	1	13
Thevara-Perandoor	210	28	2	2	3	245
Chilavanoor	0	32	0	0	1	33
Market	186	18	0	2	2	208
Total	**653**	**114**	**5**	**8**	**11**	**791**

Passenger demand survey

For validating the demand analysis in this DPR, the survey data of the NATPAC DPR (2018) was used. These included: 1) the total tourist demand, 2) a road network inventory, 3) traffic counts, 4) origin and destination, 5) stated preference survey of bus passengers 6) passenger boarding alighting survey, and 7) tourist interview surveys.

The probable users to move over to the canal mode has been categorised into 3 categories is given in **Table 2.7**.

Table 2.7: Potential users and their requirement

Sl. No.	Kinds of users	Requirement
1	Locals, domestic and foreigners visiting Kochi	Only those who walk to the nearest bus stops or those using IPT modes
2	Residents who reside by the side of the canals	Who can use the navigation facility for their first mile/ last mile connectivity and for their various uses are considered for regular boat services.

Sl. No.	Kinds of users	Requirement
3	Regular floating Population other than tourists	Visitors who are attracted by the beautification and facilities developed along the canals
4	Local and floating population including tourist	Who are attracted to the proposed infrastructure revenue stream models along the canal

As per the Kerala tourism statistics (2014), the growth rate of tourists in Kochi city is estimated at seven percent every year. Hence, applying this growth rate the daily expected tourist in peak month of January 2019 is projected at 7,921 as given in **Table 2.8**.

Table 2.8: Tourist arrivals in Kochi city

Tourists arrivals and projected tourists (Nos.) to Kochi city		
Type of Tourists	2017*	2019 (projected)
Foreign	1,65,000	188,908
Domestic	17,85,000	20,43,646
Total	19,50,000	22,32,554
Projected total during peak month (January) (with 11% YoY growth)	-	2,45,580
Per day projected, peak month	-	7,921

**Estimated @ 7% growth per year (Source: Kerala Govt. Tourism Statistics, 2014)*

Road Network around the canals

The frequency of public transport along the roads running parallel to the canals in the immediate influence zone of 0-1km is found to be very low or nil in certain canal stretches as per the secondary data used for this study. The existing road network map is shown in **Figure 2.11**.

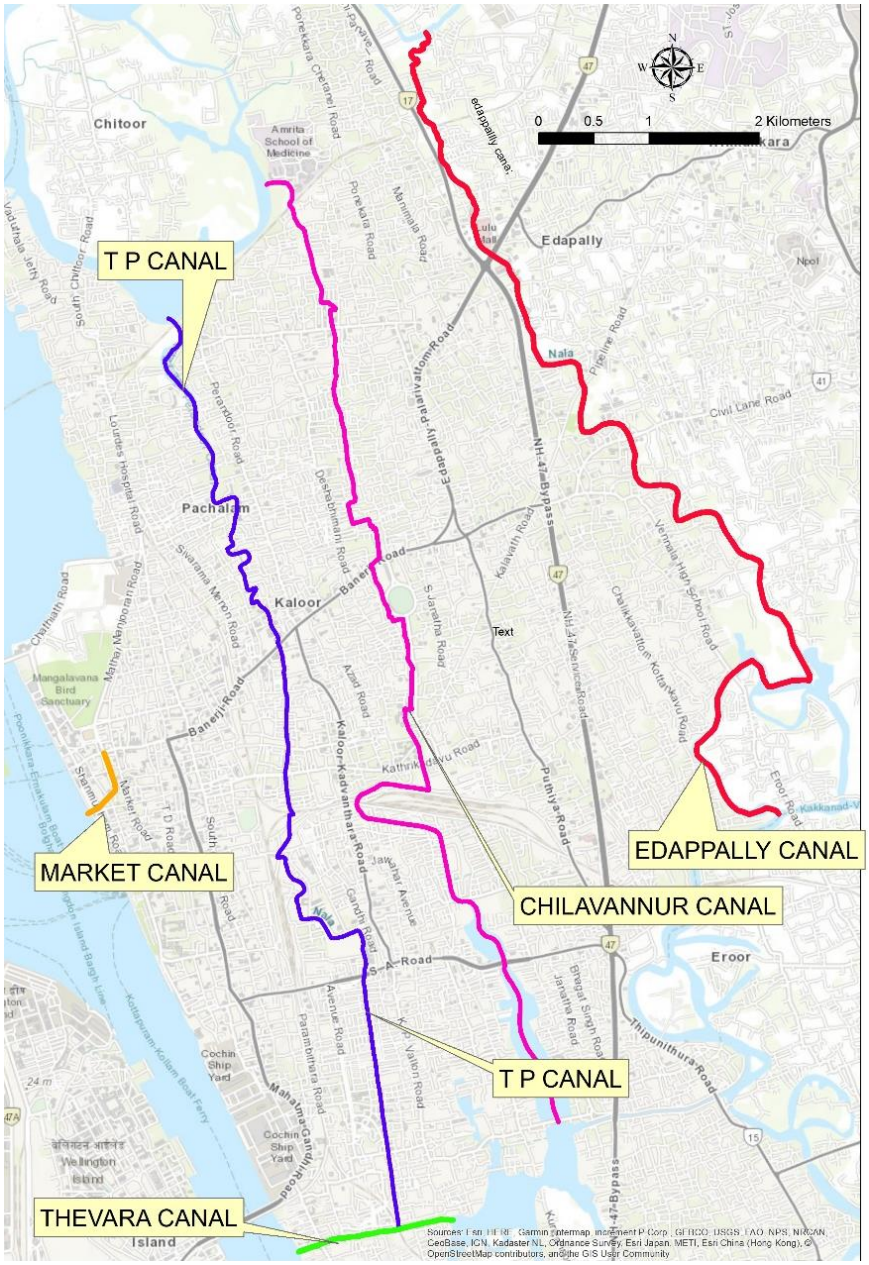


Figure 2.11: Road network parallel to the canals

Demand from resident/ floating population

Passenger demand for boat services in the Kochi canals has been estimated by taking two components of road users. One is the bus passengers having their first mile/ last mile connectivity close to the canals. Second is the IPT users who ply on the roads parallel to the canals. As per boarding / alighting surveys and stated preference surveys carried out at bus stops, the number of passengers using the bus stops on the bus routes close to the canal and those likely to use the canals have been estimated and given in **Table 2.9**.

Table 2.9: Likely users shifting from bus/IPT passengers

Sl. No.	Canal	Bus passengers		IPT passengers		Total (likely to shift)
		Total	Likely to shift	Total	Likely to shift	
1	Edappally canal	7157	296	19130	792	1088
2	Chilavanoor canal	6668	462	34190	2380	2842
3	Thevara-Perandoor canal	12775	1516	31830	3777	5293

Mid-Block Traffic Counts

A mid-Block traffic counts survey data was used to capture the incidence of Intermediate Passenger Traffic (IPT) modes. People travelling by IPT modes are considered to be the potential passengers for diversion to canal boat services. The maximum and minimum percentage of IPT mode along the existing roads surrounding these three canals have been inferred from the survey results as given in **Table 2.10**.

Table 2.10: Maximum and Minimum % IPT mode in 3 canals

Parameters	Vennala road	Edappally to Kunnumpuram	Deshabhimani road	Stadium link road	GCDA to Salim raja road	KP Vallon road
	Edappally		Chilavanoor		T-P canal	
IPT mode (Nos)	1490	9142	6442	1417	2936	3381
No. of Vehicle	16977	42318	19574	14414	27663	16174
Peak hour volume (PU)	1362	2962	1370	1009	1936	1151
Peak hr capacity (PCU	900	1500	900	1200	900	900
V/C ratio	1.51	1.97	1.52	0.84	2.15	1.28
% of IPT Mode	8.78	21.60	32.91	9.83	10.61	20.90

On all the roads, the proportion of autorickshaws (IPT) range from 8% to 20%. Hence, it is necessary to consider another mode of feasible transport facility that can be developed to reduce the traffic. **Table 2.10** also shows that the requirement of other feasible modes of transport facility such as the use of the canals will reduce road traffic.

Canal wise travel pattern

Travel pattern of bus passengers at the bus stops close to Edappally, Chilavanoor and Thevara Perandoor canal were analysed from the secondary data. It was analysed that within 1 km zone, the passenger usage by bus in Thevara -Perandoor canal was 39% and near Edappally only 11% of total passengers. However, in the zone length of 1 to 3 km, passenger usage by bus in Edappally canal was 34% and in Thevara-Perandoor only 12% of total passengers (**Table 2.11**).

Table 2.11: Canal wise travel pattern of bus passengers (% distribution) at the bus stops close to IURWTS canals

Type of Trip Pattern	Edappally canal (%)	Chilavanoor canal (%)	Thevara-Perandoor canal (%)
Internal within the canal length (0-1 Km)	11	21	39
Internal-External and external -Internal (1-3 Km)	34	28	12
Through Traffic	55	51	49

Source: NATPAC DPR (2018)

Findings of the above data indicate that once the canal rejuvenation, canal bank development and beautification in Edappally canal is completed, there will be a shift of passengers using bus to move to the canal mode travel. The outcome will be a demand shift for passengers to use the canal mode travel within the zone of 1 km. In addition, there will be a shift of bus passenger usage to canal mode travel from zone 1 km to 3 Km.

Stated Preference Survey of bus passengers

From the stated preference survey data of bus passengers, the trip pattern at gathering points was analysed at bus stops and metro stations near the canals. The mode of travel, time taken, and cost spent were studied from first origin to origin for the boarding passengers and from destination to final destination for the alighting passengers. It revealed that out of the 2647 passengers surveyed along Edappally canal, Chilavanoor canal and T-P canal 57 percent passengers indicated preference to use the canal mode of transport.

The Stated Preference Survey (SPS) of bus passengers is given in **Table 2.12**.

Table 2.12: Stated Preference Survey (SPS) of bus passengers

Sl. No.	Details	Edappally canal	Chilavanoor canal	Thevara-Perandoor canal	Total
1	No. of passengers interviewed	870	968	809	2647
2	No. passengers of origin & destination near canal	89	200	312	601
3	No of passengers using walk out	50	141	183	374
4	Aware of the canal development	635	294	460	1389
5	Likely to use canal	629	462	427	1518
6	% of usage (Row 5/Row 1)	72.3	47.73	52.78	57.35
7	No. of passengers likely to shift	36	67	96	199
8	% of Passengers likely to Shift	4.14	6.92	11.87	7.57

Tourists interview survey

The tourist interview survey undertaken to find out the awareness of canal usage for transportation among tourists. A wide range of sample was collected covering local, national, and international tourists (**Table 2.13**).

Table 2.13: Tourists interview survey

Sl. No.	Details/Canals	Number	Points
1	No. of tourists interviewed	457	100
2	No. of tourists interested in backwaters	88	19.26
3	No. of tourists aware about		
	Edappally	41	8.97
	Chilavanoor	4	0.88
	Thevara-Perandoor	22	4.81
4	No. of tourists willing to use		
	Edappally	264	57.77
	Chilavanoor	245	53,61
	Thevara-Perandoor	254	55.58
5	No. of tourists interested in backwaters and willing to use		
	Edappally	37	8.10
	Chilavanoor	36	7.88
	Thevara-Perandoor	36	7.88

Considering the limited availability of public transport in the 0-1 km zone of the canal as inferred from the survey statistic of NATPAC (2018) the probability of shift of passengers from the bus mode to canal mode is

very promising. In Edappally canal the users of bus mode is already less due to the non-availability of bus mode as mentioned in **Table 2.12**. Based on the tourist demand survey results as given in **Table 2.13** and on the stated preference survey as given in **Table 2.12**, it is expected that after the implementation of the canal oriented development the shift of passengers to canal mode from bus mode will be more than 70 percent in case all three canals.

Swot Analysis

Based on the data collected, completion of stakeholder meetings arranged by SPV, conclusions from site visits and surveys involving various components at the project sites, the Strength, Weakness, Opportunities and Threats (SWOT) analysis have been prepared for quick understanding as given in **Table 2.14**.

Table 2.14: SWOT Analysis

Activities	Strength	Weakness	Opportunities	Threats
Canal Restoration		Regulatory authority if not formed will bring back the canal to a dilapidated stage.		
1)Cleaning the canal from Water hyacinth, and Permanent removal of waste.	Helps in bringing back the canal to the original state.		Helps to generate revenue from water transport.	Obtaining CRZ/EIA clearance for deepening and widening.
2)Desilting and widening and soil removal				
3)Shore/Bank protection	Shore protection to canal to the design width and depth section will contain the flood flows.			Realtors and encroachers political influence to get going with the work smoothly.
4)Canal waterfront development at specific location	Environment sustainable waterfront structures.		Flood mitigation and losses incurred due to water logging. - Revenue generation through tourism promotion. - Intermodal transport.	Protest from public for reducing the existing road width by the sides of canal.
5) Sanitation	Separate Sewer lines to tap the sewer flows into canals with treatment facility from houses by side of canal.	Regulatory modes to treat the sewer flow from houses by the side of incoming side drains into canal.	Regulatory authority if not formed will bring back the canal to a dilapidated stage.	Protest from public on the location selected for Sewage treatment plant.

Activities	Strength	Weakness	Opportunities	Threats
				Obtaining CRZ/EIA clearance.
6) Roads and land Scaping	Road network and landscape improvement will help in intermodal connectivity.	Space constraints in developing the road after increasing the width of the canals will be a major constraint.	Revenue generation and an opportunity to redesign the storm drains and roads to mitigate floods.	Protests from public in increasing the width of canal by reducing the side road width.
				Obtaining CRZ/EIA clearance.
7) Reconstruction of cross structures	Road bridges and foot bridges to be reconstructed with required vent way from vessel movement.	Action to realign the utilities (Pipelines, cables etc.) crossing the canal.	Regulatory authority to check the unauthorized construction of cross structures.	Obtaining CRZ/EIA clearance.
				Protest in Reducing the existing road width by sides of canal.
8) Routes and jetties	Helps in Intermodal connectivity to nearest etc.	Developing the canals for the entire stretch due to major bottlenecks is a remote possibility.	To have better connectivity to other inland modes (Metro stations, bus station etc.) transport and reducing the distance of travel.	interference from private inland bus operators.
9) R&R Activities	Alternate housing for slum dwellers and better standard of living.	Plinth area acceptance for R&R by slum dwellers.	Opportunity to clear encroachment.	Reluctance of slum dwellers to move to urban sites.
Infrastructure/ Property development by landowners/builders	Modernization of infrastructure in addition to strengthening of existing ones and landscape will help in increasing tourism potential.	Difficulty in going in for concrete structures due to CRZ regulations.	Opportunity to go in for new revenue generation models like Value Capture Financing & Transit Oriented Development	CRZ/EIA clearance for concrete structures.
Navigation through canal-based mode	Cost of transport less compared to other modes.	No door to door service possible.	Intermodal connectivity can improve opportunity.	Adverse climate conditions like winds and thunderstorms can disrupt navigation.

2.3 Major components of the project

The IURWTS Project has 3 components as given in flow chart given as **Figure 2.12**.

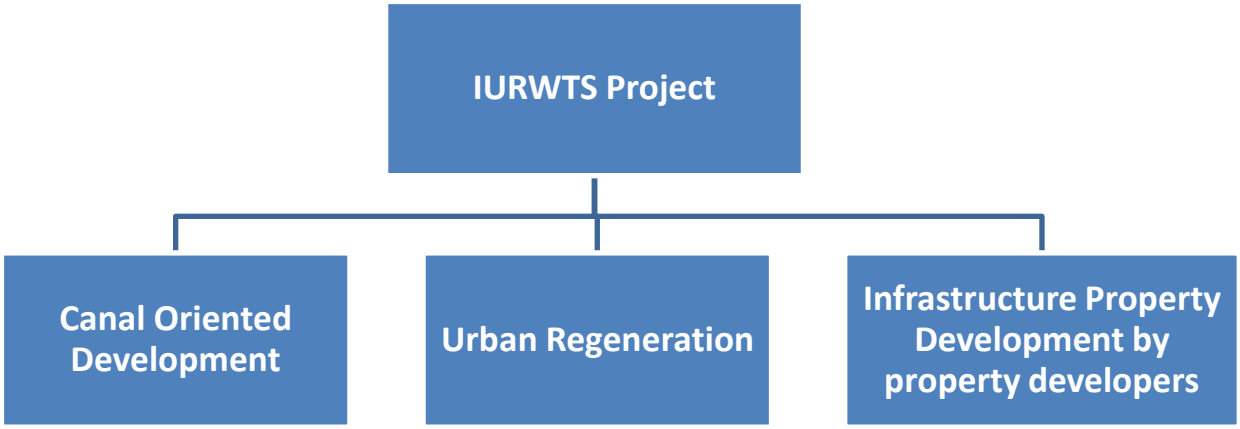


Figure 2.12: Major components of the IURWTS project

2.3.1 Canal Oriented Development

The canal-oriented development will meet the requirements and demands of various stakeholders as well as it will add value to the overall canal improvement and development.

2.3.1.1 Canal cleaning

Canal cleaning is a recurring phenomenon rather than a one-time activity. The growth of water hyacinth is seasonal; it cannot be quantified exactly and hence lumpsum cost provision to periodic cleaning the canal during the start, implementation and post implementation stage has been included in this DPR.

2.3.1.2 Desilting and widening of canals

The major demand from the stakeholders was that, during the widening process of the canals the original width as shown in the village Field Measurement Book (FMB), records should be maintained. In places where encroachments had taken place, and the cadastral maps showed a larger width (> than design width of 16.5m), the width shown in the maps was used for estimation of the widening quantity by Antea Group. In places where the existing canal width was greater than the fairway width of 24.5m, deepening quantity was limited to 24.5m. This was taking into consideration the concerns raised by the stake holders.

The Field Measurement Book (FMB) records obtained from Survey and land records office at Thiruvananthapuram were used for ascertaining the original width of the canals. The same is digitised on a

GIS platform and along with the topographic survey AutoCAD drawing the comparison with the existing situation is brought out.

As per the navigation standards of IWAI, for a canal influenced by tidal level fluctuations a minimum navigation requirement depth is to be maintained all throughout the year. To fulfil the depth requirement, the criteria as per standard guidelines for small canals was followed. A depth of 1.2 m below the low water level (LWL) of +0.3m MSL is estimated by Antea Group and the deepening quantity estimated accordingly.

By considering the above criteria the quantity of deepening and widening of canals were reassessed, at closer intervals of 15m along the canal reach. Twenty percent of the earth obtained from deepening and widening is proposed to be reutilised for developing the following:

1) Low lying areas along the canal banks,
2) Low lying areas of the land used for beautification and land scaping in Edappally canal
3) Bio -engineering works for embankment formation

Bank protection

The requirement for shore protection in the low-lying areas of the canal is to prevent flood waters entering into the catchment when the water level in the canals are high during the South-West monsoon (June to Sept) and North-East monsoon periods (Oct-Nov) of the year. Parametric analysis of different types of shore protection was undertaken and the pros and cons of each evaluated. Even though sheet piles are favoured based on site conditions and execution easiness, on account of the limited geotechnical data, site specific design on the type to be followed will be segregated during the detailed design and estimate phase. Hence site-specific proposals will be finalised during the detailed design and estimation stage. The shore protection stretches have been decided based on flood zone map generated and is given in **Table 2.15**. The detailed analysis on shore protection is also addressed in **Chapter 3** (Functional Design) of this report.

Table 2.15: Details of the existing width of the canals

Sl. No.	Canal	Total Length (Km)	Proposed width of canal (mt.) for development	Existing length of canal>16.5m (Km) / (%)	Length <16.5m (Km)	Protection works Proposed (Km)
1	Edappally	11.23	16.5	7.11 (63.3%)	4.12Km	2.1Km
2	Chilavanoor	11.15	16.5	3.2/ (33.18%)	6.68 Km	4.2Km
3	Thevara-Perandoor	9.88	16.5	3.7/ (28.7%)	7.45 Km	4.3Km
4	Thevara	1.41	16.5	1.09/ (77.8%)	0.315 Km	nil
5	Market	0.66	16.5	0.510 (76.8%)	0.154 Km	nil

2.3.1.3 Regulatory shutter arrangement

A concept design for a regulatory mechanism has been formulated by Antea Group at the canal ends. The shutters will regulate the change in water level during the high and low tide time and will prevent water entering the canals when the water level in the surrounding water bodies are high. During this period, when the water level in the canal rises, pumping arrangements are also proposed to pump out the flood waters from the canal. Total 6 shutters are proposed for the 3 major canals.

2.3.1.4 Canal bank development and beautification

The increasing pace of urbanization and industrialization has left Kochi city with minimum avenues for recreation and open green spaces. The stakeholders demand for canal developments that will provide residents access to new recreation opportunities and an expanded awareness of the natural aspects of river life has been addressed. The developed canal banks will attract a growing legion of morning walkers and runner. Added to this, beautification works in Edappally canal banks will attract public sites connected by linear greenways and the developments together will animate the waterfront with the light and life of the city. As canal beautification is a value addition to the entire project it has been dealt separately under **Chapter 5** Value Engineering**.**

2.3.1.5 Restoring navigation in canals

Estimation of passenger demand is one of the important steps to determine the usage of a new transport facility. The estimated future use of a new facility is a critical consideration in deciding whether to go ahead with the project or not. An exhaustive traffic survey was undertaken by NATPAC (2018) to assess the

passenger demand to shift over to the canal mode of transport in the 3 major canals (Edappally, Chilavanoor and Thevara-Perandoor canals). The base data used for the NATPAC survey was from the Kerala State Tourism Department (2014).

2.3.1.6 Navigation Facilities

The major city canal navigation related requirements from stakeholders are:

1. Adequate interchange facilities between different modes of transport.
2. Adequate number of jetties and fleet strength.
3. Modern facilities in jetty terminals.

2.3.1.7 Jetties

The PHPDT secondary survey data[1] was used to decide on the hourly passenger density for the jetties proposed under the project canals. The demands of stakeholders have also been addressed while fixing the location of the jetties. The passenger traffic demand survey results (NATPAC 2018) was used to finalize the choice of the jetty locations. Location of jetties and their numbers were revisited and aligned to the changes to accommodate the requirement in this DPR.

The criteria adopted for fixing the location is detailed in **Chapter 3** (Functional Design) of this report. Thirty jetties have been proposed along the canals. These locations of jetties will provide better connectivity to the proposed canal developments. The detail design, drawings, and estimations as detailed in **Chapter 4** (Engineering Design) of this report.

2.3.1.8 Boats and navigational aids

The number of boats plying the inland water network has been assessed based on the passenger density/hr taken from the secondary data. For a start to the project, one boat each is proposed to be operated and on gaining popularity it is planned to be increased. Based on the guidelines for deciding on the boat speed it was fixed as 6 knots (appr. 10 km/hr). Provision for navigational aids in places where the navigational width is more has been included in the DPR. This is dealt in detail in **Chapter 3** (Functional Design) and **Chapter 4** (Engineering Design) of this report.

[1] CPPR "A study on inland transportation in Kochi city region", Working paper series (2012)

2.3.1.9 Reconstruction of cross-structures with inadequate clearance and width

In the reconnaissance survey undertaken during the months of January and February of 2020 by Antea Group, the existing cross-structures that do not adhere to the designed width of 16.5 m and that do not have a vertical clearance of 4m for the movement of vessels were identified. These cross-structures were constructed in an unplanned manner by the Govt. departments (PWD), Municipal corporation, Central Govt., and private parties.

On widening of the canals, the existing cross-structures such as road bridges and foot bridges across the 5 canals which do not adhere to the design requirement will be reconstructed. A total of 56 road bridges constructed by the Govt departments (PWD), Municipal corporation and Central govt. Bodies and 31-foot bridges has been identified to be reconstructed. For sewer line crossings and other utility crossing of other stake holder departments, provision has been included for 15 new foot bridges. Based on the parametric analysis of different types of bridges, Innovative single span bridges using corrugated steel plate arch type bridges was found to be an aesthetically pleasing option. At present based on site specific conditions different options are proposed to be tried. The final decision will be taken during the detailed design and estimation stage. The functional details of the reconstruction proposed are presented in **Chapter 3** (Functional Design) of this report.

2.3.1.10 Improvement of approach roads

As a result of the reconstruction of the bridges and an increase in the vertical clearance, there is a need for improvement of the roads to adjust the gradient on either sides and to provide easy road access. The roads connecting the jetty terminals, which are in a dilapidated state, are also proposed to be reconstructed.

2.3.1.11 Realigning of utilities obstructing flow in canals

During the reconnaissance survey undertaken by Antea Group during January and February of 2020, a number of utilities were found criss-crossing the canals due to the unplanned development that had taken place. The obstructions are found to obstruct the flow of the canal. The identified obstructions include water pipelines (KWA), gas pipeline (GAIL/BPCL), railway crossings culverts (S. Railway), Telephone lines (BSNL) and HT cable lines (KSEB). The related stake holders, as given in **Figure 2.13**, have been asked to submit estimate proposals for realigning the utilities. As per the revised guidelines of KIIFB, the works of utility shifting will be undertaken by SPV separately.

As per the latest guideline issued by KIIFB vide G.O Ms. No:69/2018/FIN dated 24-02-2018 the estimated cost for removal of the bottlenecks will be estimated by the concerned stake holders and the consolidated DPR

for the same will have to be submitted by SPV for funding. Th tenders for the same will be floated by SPV for easy and timely implementation.

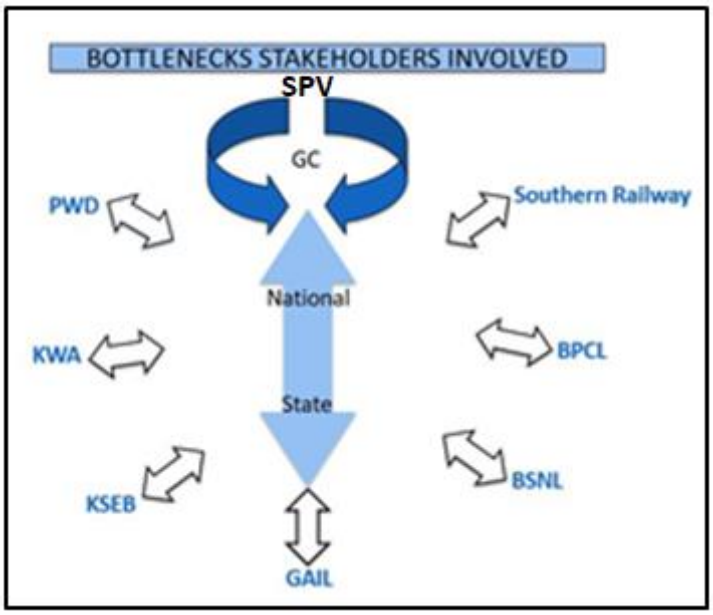


Figure 2.13: Bottleneck Stakeholders

2.3.2 Sewer and Sewage Treatment Facilities

Existing sewerage and treatment facilities in city are very limited. Consequently, sewerage is a major source of pollution and causing damage to the city's environment. Inhabitants to unauthorizedly let the household sewage flow in the main canal through sub drains are using the project canals in many parts. The Kochi Municipal Corporation (KMC) has a total area of 94.88 km^2 (including the project command falling inside Kochi corporation limits), yet only five percent area is covered under the sewer network. Thus, it is necessary to cover the project area under the proposed sewerage network to further protect the canals from pollution.

Sewage disposal from individual houses in the catchment area is discharged into the sub-canals and subsequently flows into the main city canals. During monsoon periods, the sub-canals are also the source for releasing the storm drainage into the main canals. Both these concerns were raised by the stakeholders and assessed in detail in this DPR. A total quantity was estimated considering the project catchment of individual canals as well as the flow from their sub drains and is used for designing the sewerage network and sewage treatment plant. Individual household sewer network connection is proposed. (see **Chapter 3B** of this report).

2.3.2.1 Sewage treatment facilities

This project command has mainly 2 types of waste disposal methods as shown in **Figure 2.14**.

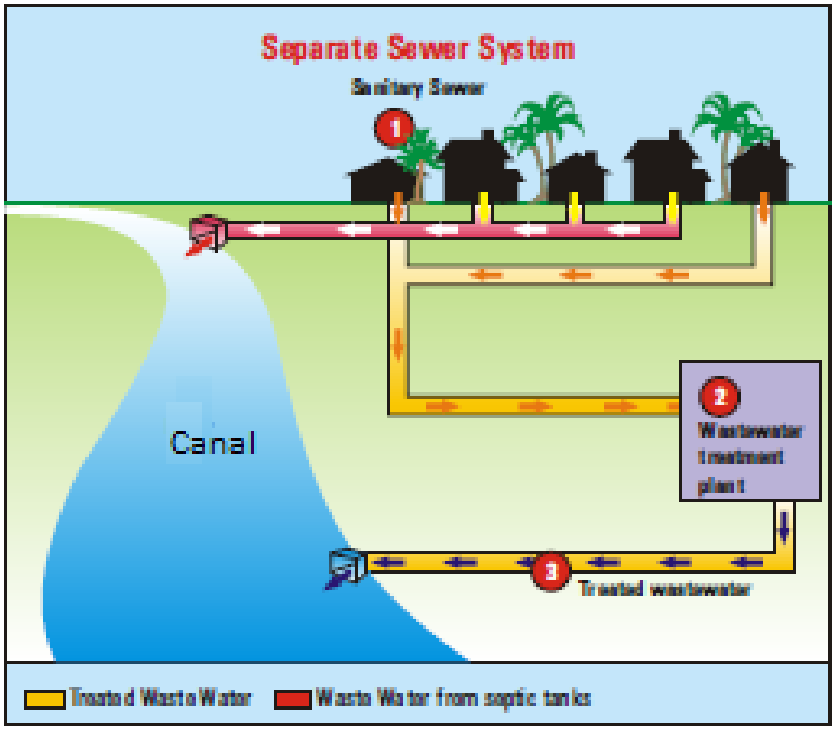


Figure 2.14: Schematic sketch of the sewage disposal modes

1) Offsite sanitation (through sewerage systems)
2) On site sanitation systems (through septic tanks and soak pits).

Most of the septic tanks and soak pits of the project command are defunct and the sewage is directly discharged into the (sub) canals in each canal catchment. During monsoon periods, the storm waters bring the remains of the waste which lie in the sub canals into the main canals. Here, individual canals and its catchments are considered as separately for design estimation and the entire households are proposed to be connected to the sewer systems.

Many proposals for STP works that Kochi Municipal Corporation (KMC) had taken up earlier failed due to protest from the public of the locality. This was mainly because the locations proposed for construction of STP's in the vicinity of highly urbanised colonies.

During stakeholder and NGO meetings held in December 2019 and January 2020 (**Table 2.1**) the following demands were raised:

1. Identify STP site location that are not in the middle of an urbanised colony area.
2. Improve the sewage treatment facility for the entire project catchment rather than limiting the area of interest in and around the main canals only.
3. Provide sanitation facilities for the those not connected with sewer networks.

For this project 5 STPs sites have been identified at Elamkulam, Vennala on the southern side and Perandoor, Puthukkalavattom and Muttar on the northern side all at the tail end of the canal systems.

The sewer load generated in the catchment of 4 canals namely Edappally canal, Chilavanoor canal and combined catchment of Thevara- Perandoor and Thevara canal is proposed to be diverted into 2 directions depending on the topography of the project command. On analysis of the LiDAR data it was seen that the ridge of the catchment was along the NH-544. Hence the sewer loads generated south of the NH 544 side catchment for Thevara-Perandoor and Chilavanoor is proposed to be treated at Elamkulam STP and Vennala site. Sewer load generated on the northern side will be treated at Perandoor, Puthukkalavattom and Muttar STPs. The summary of distribution of sewer load for the proposed STPs estimated based on Lidar Survey data is as given in **Table 2.16**. The sewer load flow direction is as given in **Figure 2.15.**

Table 2.16: Summary of Sewerage Flow/Sewage- New Plan

Sl. No.	STPs	Sewerage Flow				
		Sewage (2021) in MLD	Sewage (2031) In MLD	Sewage (2041) in MLD	Sewage (2051) in MLD	Proposed sewer load at STP sites
1	Elamkulam STP - Chilavanoor & TP south	13.48	13.84	13.86	13.68	10.00 MLD
2	Vennala STP - Edappally south	9.13	9.38	9.33	9.27	10.00 MLD
3	Muttar STP-Edappally north	2.40	2.46	2.45	2.44	2.00 MLD
4	Puthukkalavattom STP - Chilavanoor north	5.56	5.70	5.76	5.64	5.00 MLD
5	Perandoor STP - TP north	4.35	4.46	4.51	4.41	4.00 MLD
	Total	**34.92**	**35.86**	**35.90**	**35.45**	**31.00 MLD**

The Elamkulam STP, which was constructed in the year 1971, is currently treating only 3 MLD sewage due to decrease in efficiency of the plant (Source: KWA). There is already a proposal for establishing a 5 MLD plant at Elamkulam through AMRUT scheme. As per land records available with KWA officials, there is land is available nearby the site of the existing STP. The feasibility of upgrading the existing STP to 10 MLD was also explored with the KWA officials during the site visit on 23-12-2019 as shown in **Table 2.1**, and it was finally decided to go-ahead with this proposal for upgradation. The current area served with sewer systems, including both a lay out of the existing and the proposed STP's (Upgrading and new) for Elamkulam site is given in **Figure 2.16**.

The technology adopted for the proposed STP is a sequential batch reactor (SBR) mode of treatment. The sewer load is proposed to be conveyed by the sewer main through a combination of gravity and pumping to

the STP sites. Avoiding construction of STP's in urbanised areas will address the concerns of the stakeholders and avoid the future public protests.

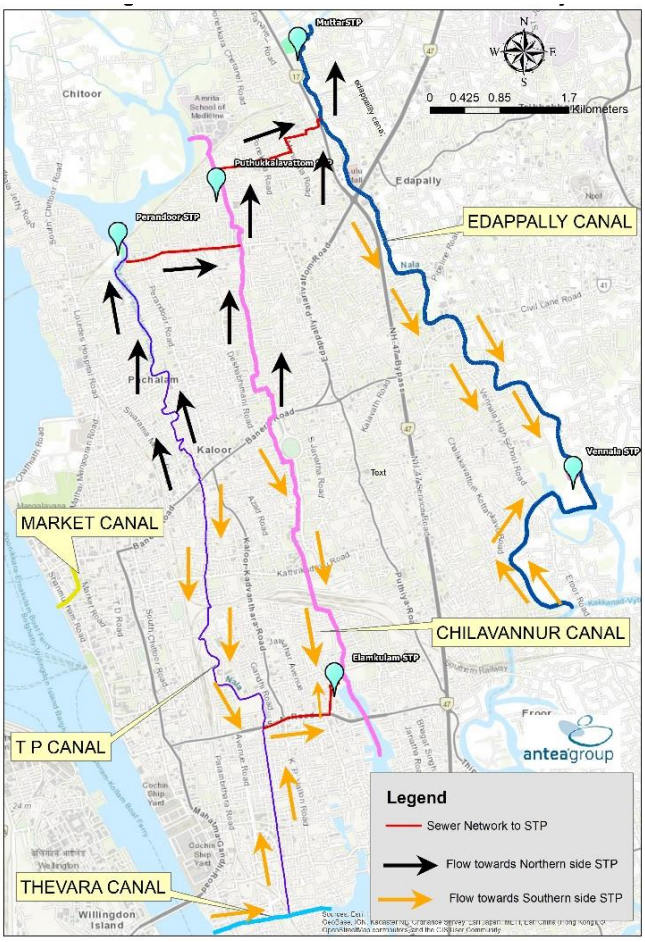


Figure 2.15: Sewer load flow direction

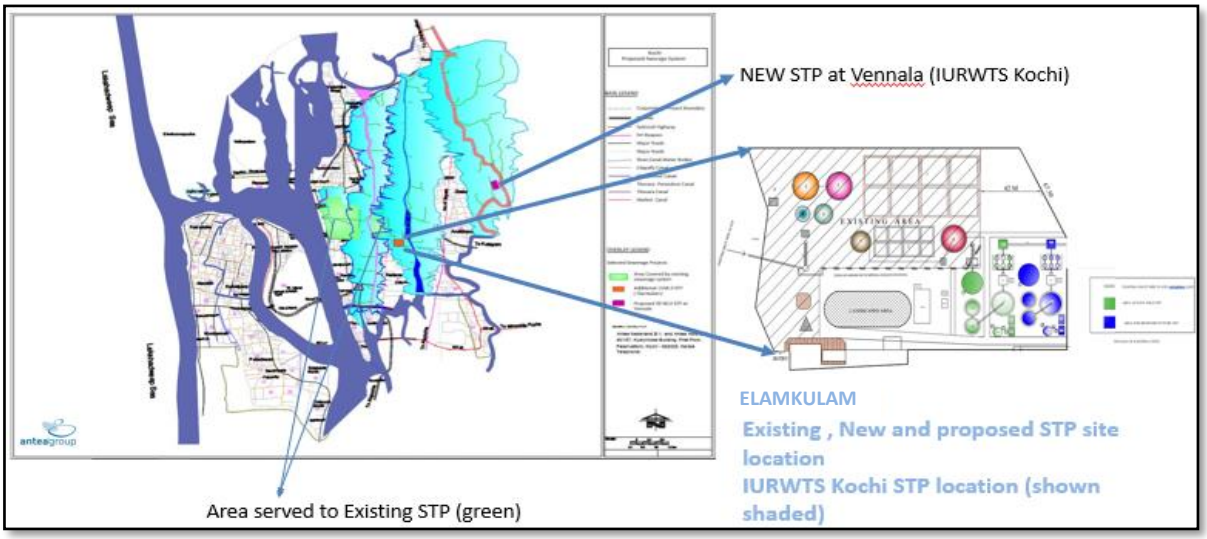


Figure 2.16: Location details of existing sewer networks and STP's proposed

A random water sample test of the areas was arranged by Antea Group in March 2020. The water sample results will be an important feedback for the final design of the sewage treatment plants proposed. The water sampling locations undertaken by Antea Group are given in **Figure 2.17**. The copy of the water sampling report included as **Appendix Volume 3**.

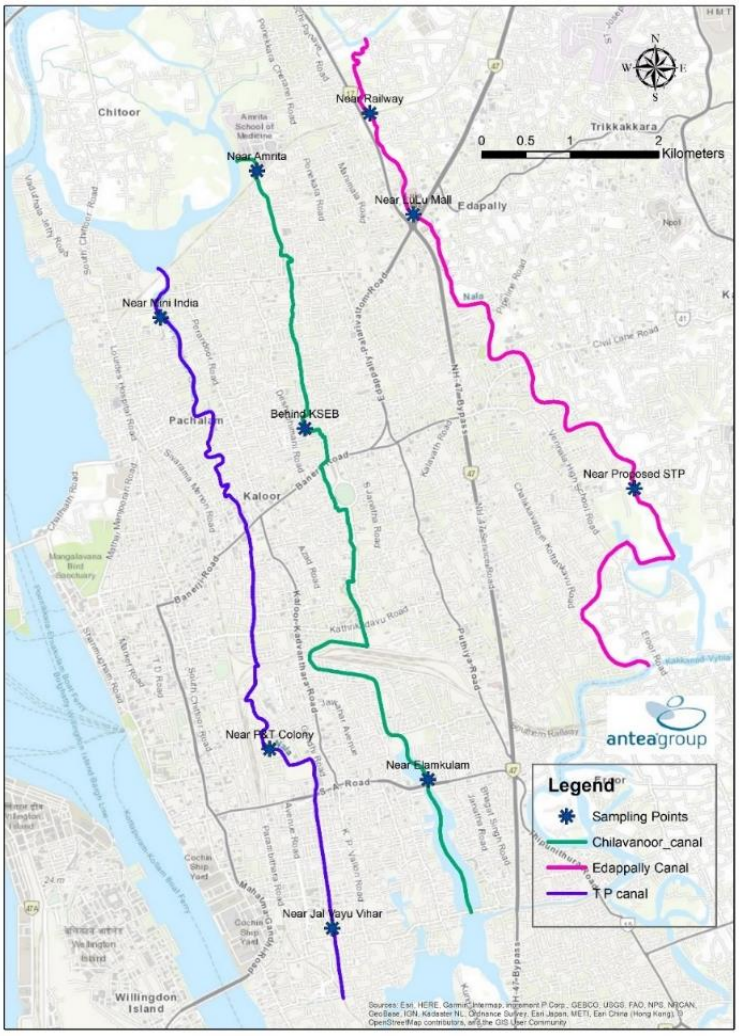


Figure 2.17: Water Sampling locations (by Antea Group, March 2020)

The functional and engineering aspects of the sewer networks, and STP's are discussed in detail in **Chapter 3** and **Chapter 4** of this report.

2.3.2.2 Sanitation facilities

There are pockets inside the project command wherein the household cannot be connected to the sewerage system. The following are the sanitation facilities that have been proposed.

1. Construct community toilets with latest technologies as required on both sides of the canal.
2. Provide drainage and sewerage facilities to the settlers.

3. Conduct public awareness programmes to the local community.
4. Organize involvement of NGO's in collaboration with GCDA or any other government agency to guard the canal from polluting by residents.

As per the demand from the stake holders, sanitation facilities like septic tank and soak pits are proposed for the needy in the current DPR. Transitional sanitation facilities in the entire catchment has been included when the sewer network lines are being laid in the project command as a part of this project.

2.3.2.3 Solid waste management plan

Solid waste management activities in the project area has already been initiated through the ongoing project of Kochi Municipal Corporation (KMC). This has been discussed in detail based on realistic assessment of ground situation.

The KMC has in possession 15.4 ha of land at Brahmapuram, 20 km from Kochi city for the treatment of solid waste in the corporation area. Currently, KMC has conceived a plant to convert Waste To Energy (WTE) at Brahmapuram which has a capacity to treat 300 TPD and generate energy to an extend of 10 MW. The location map is given in **Figure 2.18**.

Figure 2.18: Brahmapuram plant location

The significant feature of the plant will be that it produces green energy and thereby reducing the amount of methane and CO2 emission from the existing compost and landfill plant. This project will place Kochi in

the world map for adopting proven scientific initiative for carbon reduction through sustainable and green solid waste management practices. This project has obtained all necessary statutory approvals and it is in the final phase of implementation.

The total estimated quantity of solid waste generated daily from the project area is 152 MT. While conceiving the WTE plant at Brahmapuram, the quantity of solid waste generated from this project command was also included. As Kochi Municipal corporation has already initiated measures for collection and delivery to the WTE site, finding a parallel solution for conveying and treatment of solid waste of project command is not included in this report. Hence proposal in this report is only for collection of solid waste by Innovative measure and cost has been arrived accordingly.

2.3.3 Revenue Streams

The IUWRTS project is a capital-intensive project with a long gestation period. The residents and businesses within 1000-meter distance on both sides of the COD of IURWTS will be connected to the sewerage network, boat jetties and parks. Revenue generating models such as Value Capture Financing (VCF) and Transit Oriented Development (TOD) will be explored. VCF and TOD are methods of funding infrastructure improvements by recovering all or some of the increase in property value generated by the public infrastructure investment. VCF framework is proposed for implementation in the IUWRTS covering an area of 1000 meters on both sides of the Canal. The benefits accruing from the same is proposed to be transferred to the SPV, undertaking the IURWTS Project in terms of Land value tax, Vacant Land Tax (VLT), Luxury tax (Property tax), Additional property tax as Special Canal Tax, Betterment levy (Additional permit fee) etc..

2.4 Institutional Setting (SPV)

During the implementation period of this project various activities such as land acquisition, resettlement & rehabilitation, compensation for project affected people, cleaning of canal, deepening and widening of the canals, reconstruction/dismantling of cross structures, removal of bottlenecks across and along the canals, construction of Jetties and jetty terminals, sanitation facilities, sewer line, sewerage treatment plants, beautification of canal for tourism & recreation will be undertaken.

The project involves various activities coming under various line departments such as PWD, Water resources (KWA, Irrigation, GWD), LSGD, Revenue, Pollution Control Board) at the state level, Municipal corporation, Greater Cochin Development Authority, panchayats, district administration, at the district level in the decision making process, administration, funding and delivery of the services.

Some of these stakeholders are directly involved in planning, execution, operation & maintenance and monitoring of the canals and the catchment, while others influence either positively or adversely in efficient functioning of the activities. Before completion of the project, SPV or KMRL will set up a dialogue to ensure the smooth execution and sustainability of the project and with the financial commitment for this project.

For easy implementation of the activities for 3 years period and to maintain continuous interaction with all stakeholders, a separate institutional mechanism has been suggested in the NATPAC DPR. Antea Group suggest the need to establish the same for easy implementation of the project. The Special Purpose Vehicle (SPV) with all regulatory powers at the project level, headed by SPV is been suggested. The key stakeholder departments will be identified who can be the members of the project execution committee is given in the flow diagram in **Figure 2.19**.

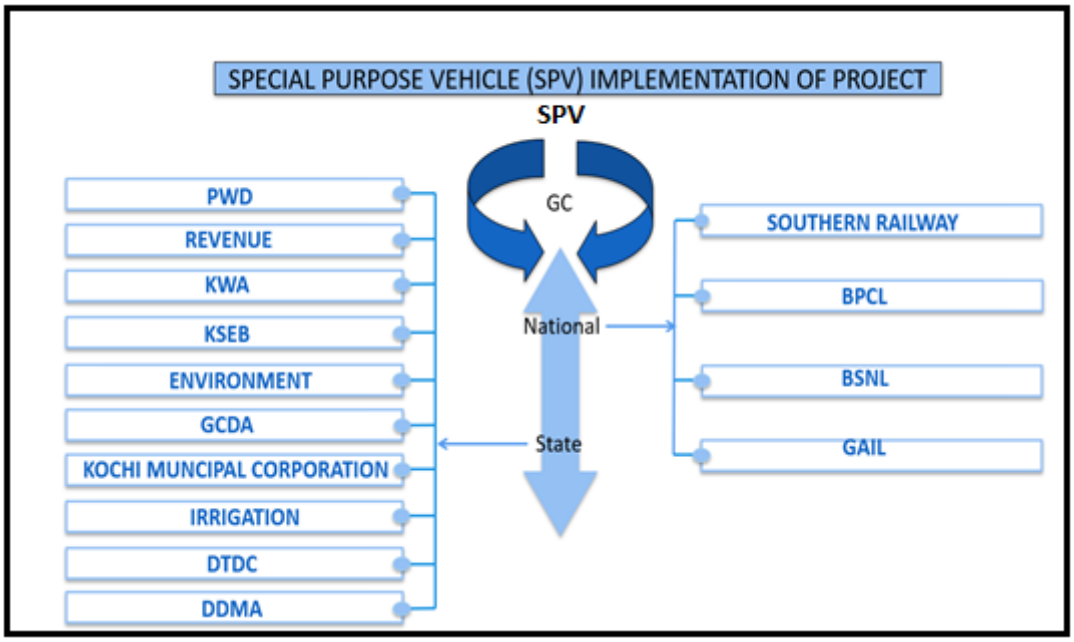


Figure 2.19: Authorities involved in the Institutional mechanism (SPV)

2.5 Environmental Statutory Clearances

Chapter 10 on Environment and sustainability aspects and **Chapter 11** on Statutory clearances deals exhaustively with the environmental aspects and statutory clearances of this project. The project command comes under various Coastal Regulation Zone (CRZ) categories and hence the development activities proposed are such that that the regulations imposed for each CRZ zone will be adhered ensuring minimum environmental disturbances. Mandatory Environment Clearance (EC) and (CRZ) clearance from Ministry of Environment and Forest & Climate Change (MoEF&CC) are required to initiate the proposed construction activities. The necessary action in this regard has been initiated in Feb 2020 through a NABET accredited

agency (WAPCOS) and project proponent has submitted the application to MoEF&CC to process the environment clearance and Consent To Establish (CTE) to KSPCB. The TOR has been approved by MOEFF&CC in May 2020. The submission of final EIA for clearance is expected within a period of next 6 to 9 months.

2.6 Project Benefits

This DPR for this project has been attempted with an intent to bring in economic viability of the project considering the long-term sustainability adding vision to the city's eco-development. Envisioned holistic Canal Oriented Development (COD), urban regeneration and alternative revenue streams that will bring the following expected outcome and create mixed use development.

1. Canal development will create beautifully landscaped canal spaces for leisure and tourism, cute shops, and eateries for creating an illusion of urban vitality along the canal banks and enhanced livelihood opportunities. This would further improve the city's image.
2. Enhanced utility of the canal waterfront as a natural attraction for social and economic activity for locals and tourists.
3. A hassle-free inland water navigation system along the canals to enhance urban mobility and tourism with environmentally friendly ferry vessels, comfort, and innovative jetty terminal facilities.
4. Sanitation facilities and sewage disposal system integrated to serve the inhabitants of the project command.
5. Climate change, carbon credits, flood mitigation, boosting of regional economy by tourism, etc.

2.7 Estimated Costs and Economic Rate of Return

Based on the revision in various project components and addition of new project components, the estimated cost is prepared and summarized in **Table 2.17**.

Table 2.17: Estimated costs and EIRR

Sl. No.	Project Components	Estimated cost (Rs. in Crores)	EIRR/FIRR (in %)
1.	A. Canal Oriented Development	₹ 432.65	26.41/5.24
	B. Urban Regeneration	₹ 393.13	
	C. Land Acquisition for Canals	₹ 437.27	
	D. Specific projects, Environmental monitoring, Project management cost,	₹ 34.50	

Sl. No.	Project Components	Estimated cost (Rs. in Crores)	EIRR/FIRR (in %)
	Specialized work like LIDAR survey, public campaign/social awareness management		
	E. Resettlement & Rehabilitation including building compensation & land cost	₹196.72	
	Total - (1)	**₹ 1494.27**	
2	Konthuruthy Canal (Additional Work)	**₹ 34**	
	Grand Total	**₹ 1528.27**	

2.8 Source of Funds

The funding for this project is envisaged from KIIFB for Canal oriented development, Urban regeneration, Land acquisition for COD, Urban regeneration, R&R and Land acquisition for Infrastructure property development components. The KMRL is in advance stage of discussion to seek funding from KIIFB for these components as KIIFB has already approved partial funding for this project as per orders from Govt. of Kerala. The details are given in **Table 2.18**.

Table 2.18: Source of Funds

Sl. No.	Project Components / Funding Source	Amount (INR in Crores)
1	Canal oriented development, urban regeneration, R&R, Land acquisition (COD, Urban Regeneration, R&R, and infrastructure) from KIIFB	**₹ 1528.27**

CHAPTER 3 FUNCTIONAL DESIGN

3A. CANAL ORIENTED DEVELOPMENT

3A. CANAL ORIENTED DEVELOPMENT

Introduction

This detailed project report proposes to restore the 5 dilapidated canals of the IURWTS Project command to its original state. The activities include cleaning the existing canals, removal of encroachers, widening and deepening the canal to its original state by ensuring that adequate width and depth are available in the canals to mitigate floods and restore navigation of vessels. Any canal-oriented development approach should be undertaken in a holistic manner considering every development aspect of the project command (like flood mitigation, restoring navigation, and place making development aspects of canal banks).

To ensure that the floods in the project catchment is mitigated, the primary consideration is to have a holistic idea of the hydrological characteristics of the catchment under study and the surrounding hydrological features. Urban flooding due to extreme climatic events in the project catchment is attributed to the combination of three causes.

i. Five rivers namely Achenkovil, Pamba, Manimala, Meenachal and Muvattupuzha rivers drain their flood discharge into Kochi lagoon on the southern side of the catchment. A portion of Periyar river also reaches the lagoon on the northern side of the catchment. The excess storage water braces through the catchment on the southern and northern side and flows through the estuary mouth to the sea. None of the rivers has a direct entry into the project canals but the rise and fall of the water level in the Kochi lagoon water body has an impact on the canal system. The geographical setting of the project catchment with respect to the surrounding Kochi lagoon is given in F**igure 3A.1**.

ii. The extreme precipitation event from its own catchment, causes flash flooding of streets and property in low-lying areas, is exacerbated by the dilapidated and clogged conditions of the leading canals. Because of the restriction in free movement of the flood waters through the canals to Kochi lagoon water body, the flood waters get accumulated in the project command

iii. The high tidal levels in the coast due to extreme coastal climatic conditions stops the flood waters movement to and from Kochi lagoon to the Arabian sea through the estuary mouth.

The net effect is the rise in water level in the surrounding water body and accumulation of flood water in the low-lying areas of the project catchment. Hence the hydrologic analysis with flood plain studies is undertaken in two parts 1) The impact of an extreme flood event for a suitable return period on the Kochi

lagoon from the rivers reaching Kochi lagoon from the upstream catchment and 2) the impact of extreme rainfall event in the urbanized project catchment.

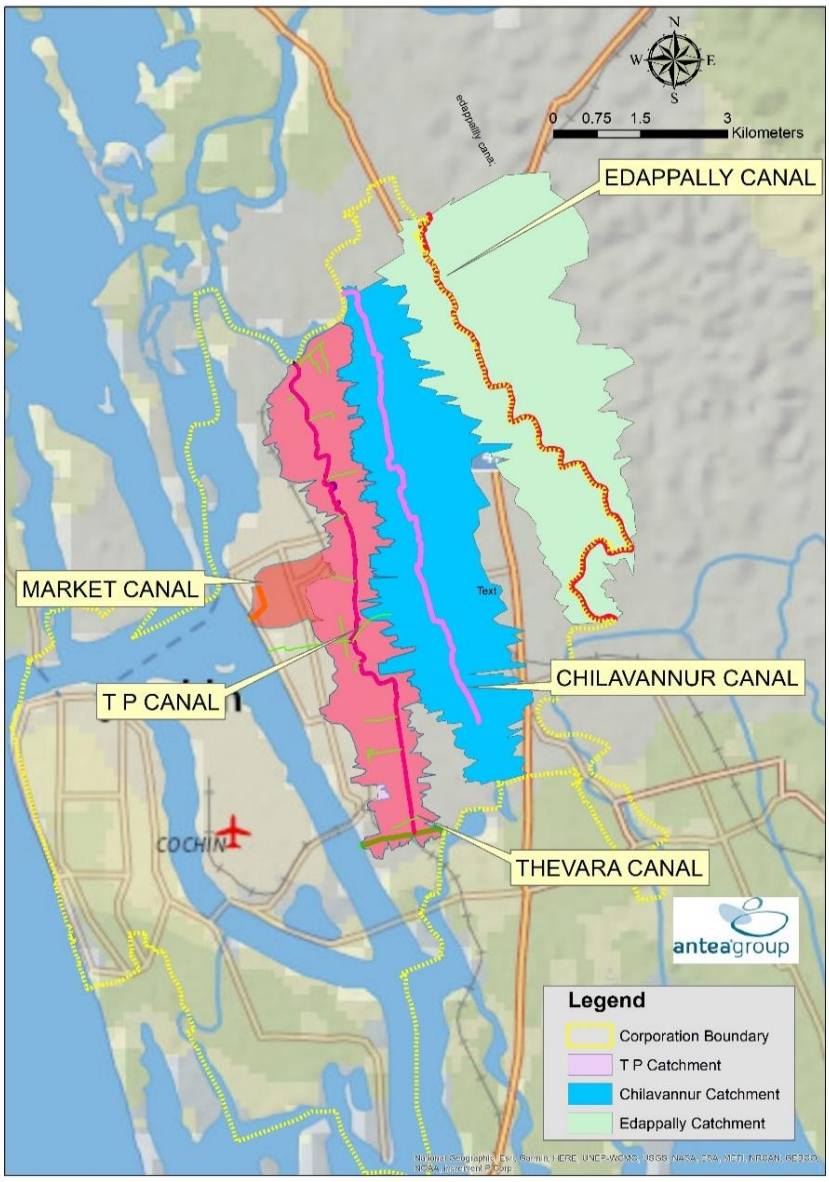


Figure 3A.1: Geographical setting of IURWTS catchment with Kochi lagoon water body

3A.1 Canal width and depth determination

The optimal canal width and depth has been finalized considering the following aspects:

1) Canal width and depth with respect to the flood containment
2) Canal width and depth by vessel dimension and navigation draft requirement.

For deciding on the canal width and depth for flood containment the Hydrologic, Hydraulic and flood plain studies is undertaken for the project catchment and the surrounding water bodies of Kochi lagoon.

3A.1.1 Flood plain studies for project catchment

The Flood plain management takes many forms including construction of various flood defence systems, engineering for navigation, farmland irrigation, drainage, and wetland management. Additionally, indirect management results from engineering works on the flood plain which affects flood water paths. Hence the type of flood plain selected for the study has great significance in deciding on the return period of extreme event to be chosen.

Flood plain is an area inundated by flood for a return period say 1 in 10yrs.,25yrs., 50yrs. and 100yrs. The return period chosen for flood plain study of Kochi lagoon water body is 1 in 25 yrs., and the project catchment being an urbanised area a 1 in 100yrs. return period is used as per the recommended guidelines of Central Water Commission (CWC), Govt of India (2012,2018) which is extracted below.

[1]*"3.2.3.1 Embankment for predominantly agricultural areas: The design flood for this type of embankment is kept 25 years for fixation of crest level.*

[2]*3.2.3.2 Embankments for township or areas having industrial installations: The design flood for this type of embankment is kept 100 years for fixation of crest level".*

Morphometric analysis

The morphometric analysis is performed with the help of Digital Elevation Model (DEM) and survey of India toposheets nos. 58 B8, 58 C1/5, 58 C6 and 58 C7 on 1:50,000 scale. The DEM used is of Indian Remote Sensing Satellite Cartosat-1 (1 arc sec (~ 30 m) available on Bhuvan portal of NRSC/ISRO.

The Digital Elevation Model (DEM) was processed in ArcGIS 10.5 to compute flow direction and flow accumulation raster. Using the flow accumulation map, the sub-watersheds (SW) were delineated. SWs were further processed using Spatial Analyst Tool of ArcGIS to demarcate the drainage pattern. Based on the drainage pattern, the morphometric analysis of delineated basins was carried out. The parameters such as area, perimeter, length of the basin, centroid, and stream length were computed using GIS software. The water holding area was identified and using the average depth of water column, the volume was calculated.

[1] Handbook for Anti-erosion, Flood protection & River training works, Central water commission (CWC), Govt of India, (June 2012)

[2] Guidelines for preparation of DPR for flood management projects Central water commission (CWC), Govt of India April 2018).

The delineated area polygon was converted to a presentable KML form for Google earth. The flow diagram of the process involved is as given in **Figure 3A.2**.

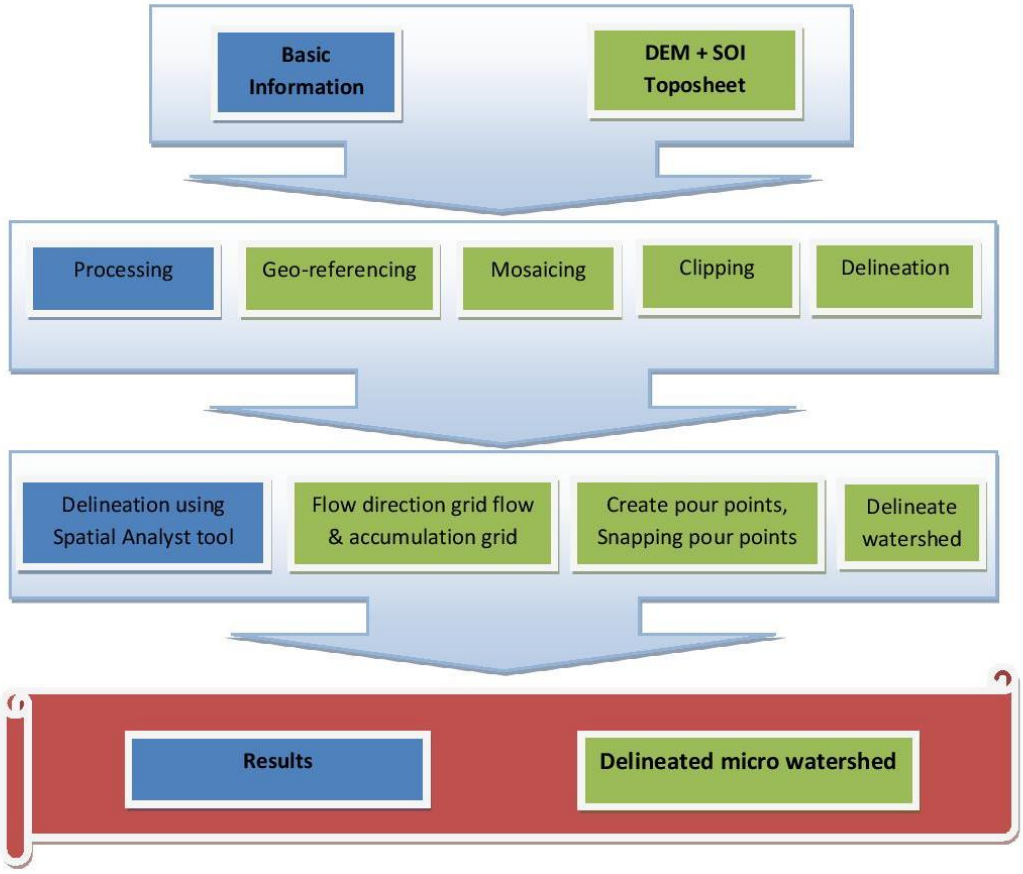


Figure 3A.2: Process involved in delineation storage area and watershed of canals

The network of rivers reaching Kochi lagoon from southern side and bordering the project catchment is given in **Figure 3A.3.**

The design flood from a 1 in 25 years flood reaching Kochi lagoon surrounding the project catchment and flowing through estuary mouth to the sea is from secondary sources of various central and state government agencies. The total discharge reaching Kochi estuary mouth during a 1 in 25 years flood is as given in **Table 3A.1**.

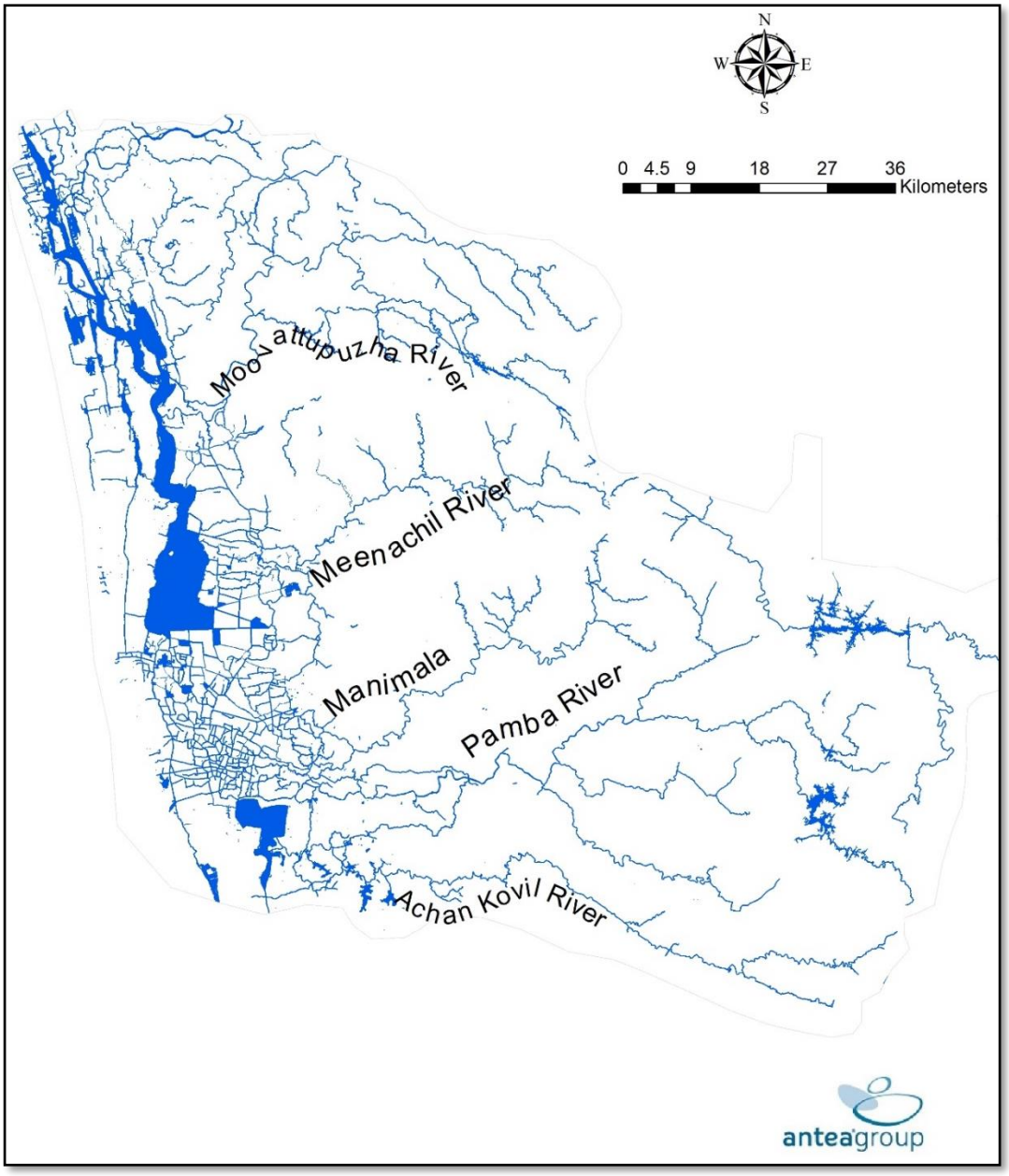


Figure 3A.3: Rivers draining from the southern side of the IURWTS catchment

Table 3A.1: Design flood (1 in 25 years) from river flows reaching Kochi lagoon

Sl. No.	Rivers draining into Kochi lagoon	Design flood 1 in 25 year (Cumecs)	Remarks
1	Pamba	1929**	**630 Cumecs** gets discharged through Thottappally spillway at the southern end of Vembanad lake**.** (Source: Planning Commission report, Govt of India (GoI), 2008)

Sl. No.	Rivers draining into Kochi lagoon	Design flood 1 in 25 year (Cumecs)	Remarks
	Pamba river contributing to Vembanad lake **(a)**	1299**	Balance flowing to Vembanad lake (1306 cumecs)
2	Achenkovil **(b)**	839**	**Source: Gopakumar et.al. (2009). CWRDM, IAHS Publ. 328
3	Manimala (**c**)	834**	
4	Meenachal **(d)**	957**	
	Total (a) +(b)+(c)+(d)	**3927**	
	Discharge capacity of Thaneermukkam barrage **(e)**	1706	Source: CWC, GOI (2018) report
5	Muvattupuzha **(f)**	400	Source: CWC, GOI (2018) report
6	Portion of Periyar **(g)**	238	Source: Tejas Keluskar et.al. (IRJET) (2019)
	Total discharge reaching Kochi lagoon (e) +(f) +(g)	**2344**	

Rise in water level in the lagoon water bodies

As per the morphometric analysis undertaken and explained in flow diagram given in **Figure 3A.2**, the surrounding water bodies of the project catchment is delimited based on the areas where flood water coming from the rivers starts storing water in the Kochi lagoon surrounding the project catchment. The water spread area contributing to the storage in Kochi backwaters is estimated on a GIS platform as 102 km^2 (**Figure 3A.4**).

During floods, due to the high tidal impact along the coast, the discharge through the estuary mouth is restricted. The discharge of 2,344 Cumecs reaching Kochi lagoon causes a rise in water level in the Kochi backwaters. The rise in water level in the backwaters surrounding the project catchment is as given below:

- Volume of flood water reaching the water body = 2344 X 24 X 60 X 60 = 202,521,600 m^3
- Area of water body surrounding the project area= 102x1000x1000 m^2

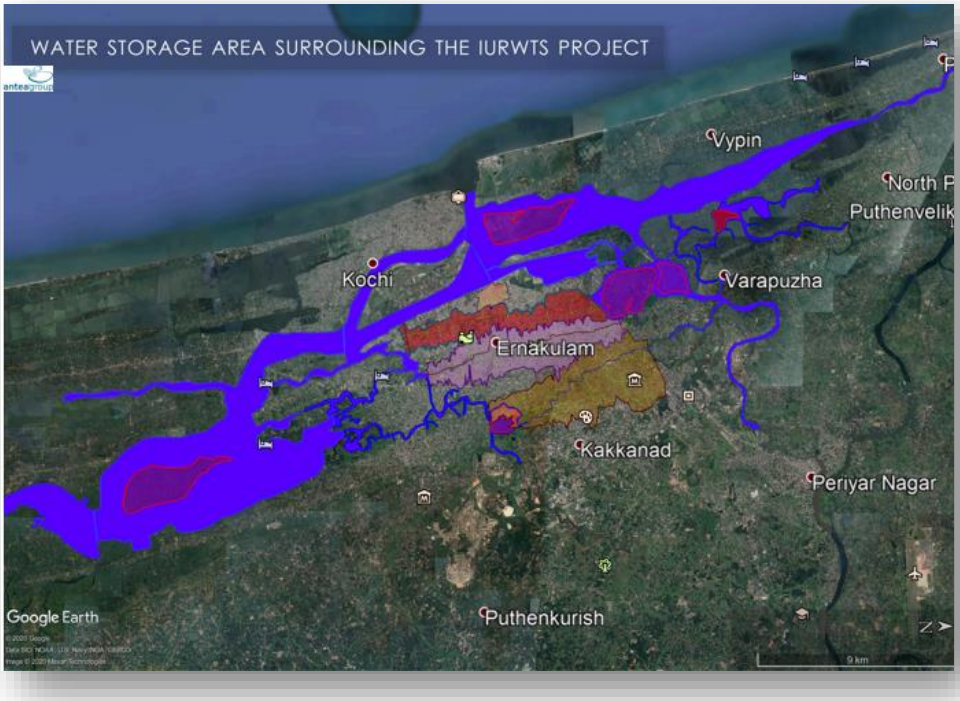


Figure 3A.4: Water storage area surrounding the IURWTS project command

The rise in water depth estimated is 1.98 from a flood of return period of 1 in 25 years. The rise in water level is also validated with the site condition near Muttar at the starting point of Edappally canal. A flood statue has been constructed by the locals marking the height of 6 feet which the water level rise during the August 2018 flood (**Figure 3A.5**).

Figure 3A.5: August 2018 floods statue (visit by Antea team, 2020)

High flood level (HFL) estimation

The depth of flooding is converted to elevation with respect to mean sea level as follows.

The draft required for vessel movement operated by Water Metro in the surrounding water body is taken 1.5m. The average Low tide level in the water body as per COPT records is +0.3 m. Hence the bed level of the surrounding water body is taken as (-) 1.2m MSL. With a flood depth of 1.98m the High Flood Level (HFL) for a 1 in 25 yrs. return flood with reference to the MSL is +0.8m.

3A.1.1.1 Design flood estimation for project catchment due to extreme rainfall event

The project command is an ungauged and rainfed catchment. The latitude and longitude values on the southern and northern ends are as given in **Table 3A.2**. The total catchment area for the project site is 42.85 Km^2. As per CWC guidelines (2012 & 2018), the project catchment being an urban area, a 100-year return period flood for the catchment is estimated using a hydro-meteorological approach.

Table 3A.2: Latitude and longitudes of the canals in the project command

Location	Southern end		Northern end	
	Latitude	Longitude	Latitude	Longitude
Edappally canal	9°58'46.63" N	76°19'55.33" E	10° 2'39.59"N	76°18'2.85"E
Chilavanoor canal	9°57'14.56" N	76°18'49.40" E	10° 1'53.12"N	76°17'23.95"E
Thevara Perandoor canal	9°56'44.36" N	76°18'1.70" E	10° 1'12.27"N	76°16'56.54"E
Market canal	9°58'47.28"N	76°16'29.94"E	9°59'4.29"N	76°16'34.42"E
	East end		West end	
Thevara canal	9°56'46.93"N	76°18'17.27"E	9°56'36.98"N	76°17'31.38"E

Physiographic parameters

The physiographic parameters of the individual canal catchments were estimated by GIS processing of ASTER DEM. Based on the process explained in the flow diagram given as **Figure 3A.2**, the delineated catchment area map of the canal catchments under study is given in **Figure 3A.6**. The canal catchments for Edappally canal and Chilavanoor is estimated separately. Thevara-Perandoor and Thevara are treated as a combined unit, since Thevara canal has only a length of 1.41Km and runs perpendicular to Thevara - Perandoor it forms part of Thevara-Perandoor catchment. Market canal has a length of 0.66km and has no catchment of its own since it is a manually cut canal for entry of vessels into the mainland from the Kochi lagoon on the northern side. The catchment area of the 3 major canal catchments, longest flow path (L), centroidal longest flow path (Lc), slope of the catchment (S) is as given in **Table 3A.3**.

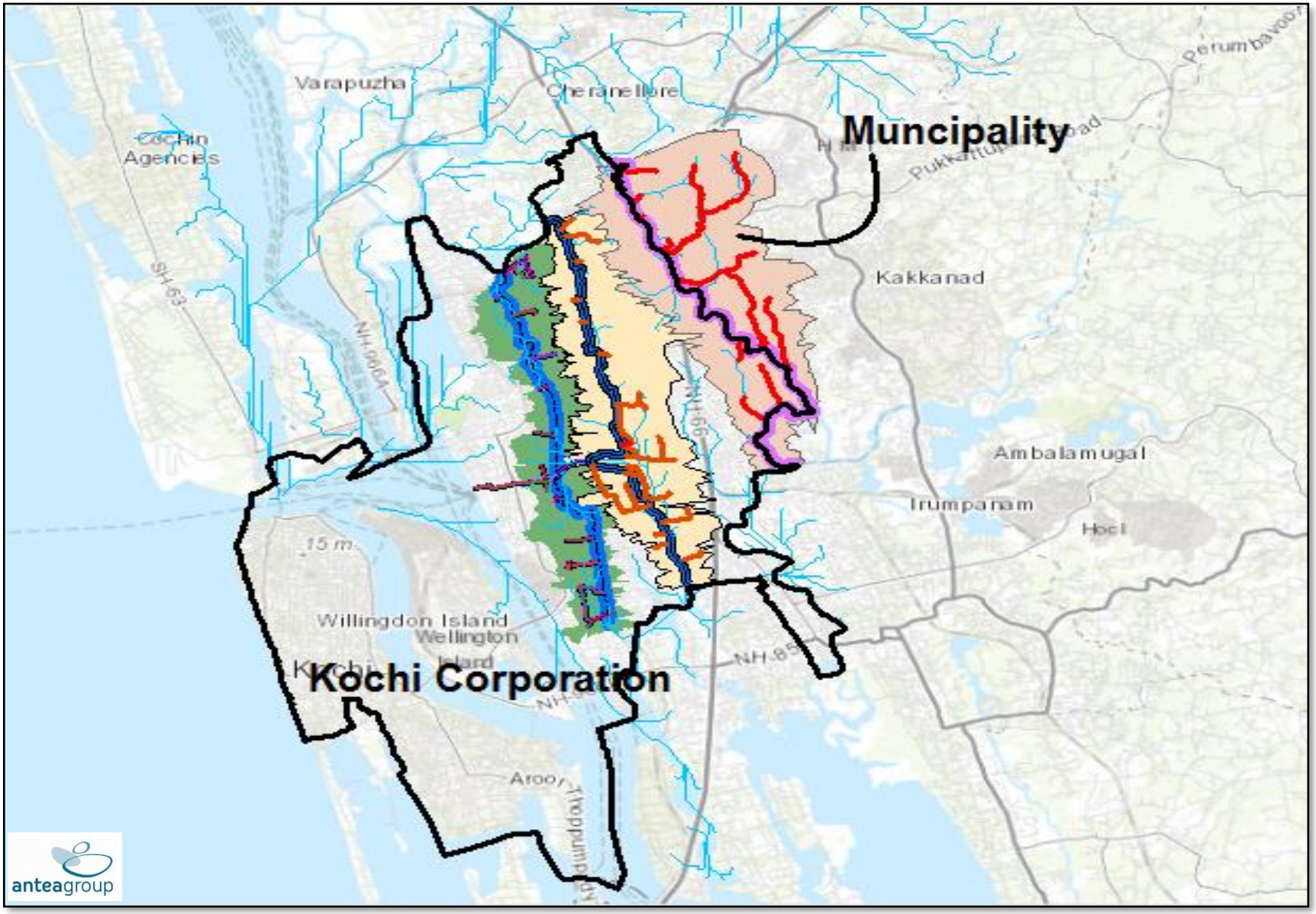


Figure 3A.6: Delineated catchments of IURWTS project

The catchment parameters given in **Table 3A.3** is utilized into the physiographic parameters' equations of CWC (2001) report for working out the synthetic unit hydrograph. Since, representative concurrent rainfall and discharge data at short interval is not available, the synthetic unit hydrograph (SUH) for drainage area has been worked out using Flood Estimation Report FER-5(b) of west coast region of CWC (2001). The basin characteristic of the project catchment given in **Table 3A.3** have been used for the study.

Table 3A.3: Basin characteristics of the three canal catchments

Name of Catchment	Area (Km^2)	Length (Km)	L_C (Km)	Slope (m/Km)	Point rainfall Zone 5 (b) for Catchment 1 in 100 yrs from Iso-pluvial maps (IMD)
Thevara-Perandoor & Thevara canal	10.35	9.88	4.484	0.779	320mm
Chilavanoor Canal	14.5	11.15	4.692	0.676	320mm
Edappally canal	18	11.23	7.663	1.32	320mm

The 1-hour unit hydrograph was derived, by estimating the unit hydrograph parameters as given in by CWC guidelines (2001) and is as given in **Table 3A.4** & **Table 3A.5**

Table 3A.4: Parametric equation for derivation of Synthetic unit hydrograph (CWC 2001)

Sl. No	Description	Parametric equation
1	Peak discharge of unit hydrograph in cubic metres per second	q_p = 0.9178 [L/S] ^(-0.4313)
2	Time from the center of unit rainfall duration to the peak of unit hydrograph in hrs.	t_p = 1.5067 [q_p] ^(-1.0814)
3	Width of unit hydrograph measured at 50% peak discharge ordinate (QP) in hrs.	W_{50}= 1.9251 [q_p]^ (-1.0896)
4	Width of unit hydrograph measured at 75% peak discharge ordinate (QP) in hrs.	W_{75}= 1.0189 [q_p] ^(-1.0443)
5	Width of the rising side of unit hydrograph measured at 50% of peak discharge (QP) in hrs.	W_{R50}= 0.5788 [q_p] ^(1.1072)
6	Width of the rising side of unit hydrograph measured at 75% of peak discharge (QP) in hrs.	W_{R75}= 0.3469 [q_p]^ (1.0538)
7	Base width of unit hydrograph in hrs.	T_B = 7.3801[t_p]^ (0.7343)
8	Time from the start of rise to the peak of unit hydrograph in hrs.	T_m = t_p + (tr/2)

Sl. No	Description	Parametric equation
9	Peak discharge of unit hydrograph in cubic metres per second	$Q_p = q_p * A$

Table 3A.5: Estimated physiographic parameters

Canal	q_p (m^3/s)	t_p (hr)	Rounded top (hr)	W_{50} (hr)	W_{R50} (hr)	W_{R75} (hr)	T_B (hr)	T_m (hr)	P (m^3/s)	T_D (hrs) ($1.1*t_{ap}$)
Thevara Perandoor	0.31	5.59	2.50	6.96	2.14	1.20	26.11	3.00	3.18	6.15
Chilavanoor	0.28	6.30	4.50	7.85	2.41	1.35	28.50	5.00	3.99	6.93
Edappally	0.37	4.63	2.50	5.76	1.76	1.00	22.75	3.00	6.58	5.10

The estimated parameters of the unit hydrograph as given in **Table 3A.4** was plotted, and the points joined to draw a unit hydrograph. From the drawn hydrograph, the discharge ordinates Qi of the unit hydrograph at $i_t = t_r$ = 1-hour interval were estimated.

The discharge ordinates of synthetic unit hydrograph calculated at 1-hour interval for the 3 canals are given in **Table 3A.6**.

Table 3A.6: Discharge ordinates of synthetic unit hydrograph

Edappally canal		Chilavanoor canal		Thevara-Perandoor canal	
Time in hrs.	**SUH ordinates in Cumecs**	**Time in hrs.**	**SUH ordinates in Cumecs**	**Time in hrs.**	**SUH ordinates in Cumecs**
0	0	0	0	0	0
1	1	1	0.32	1	0.9
2	2.71	2	0.75	2	1.59
3	4.34	3	1.32	3	2.2
4	5.83	4	2.1	4	2.38
5	6.57	5	3.03	5	3
6	6.03	6	3.89	5.5	3.18
7	5.24	6.3	4	6	3.08
8	4.72	7	3.45	7	2.51
9	4.25	8	2.68	8	2.04
10	3.59	9	2.42	9	1.59

Edappally canal		Chilavanoor canal		Thevara-Perandoor canal	
Time in hrs.	SUH ordinates in Cumecs	Time in hrs.	SUH ordinates in Cumecs	Time in hrs.	SUH ordinates in Cumecs
11	2.45	10	2.24	10	1.28
12	1.29	11	2.05	11	1.04
13	0.5	12	1.94	12	0.81
14	0.31	13	1.71	13	0.49
15	0.23	14	1.48	14	0.33
16	0.21	15	1.24	15	0.297
18	0.15	16	1	16	0.19
19	0.12	17	0.85	17	0.16
20	0.11	18	0.71	18	0.14
21	0.1	19	0.66	19	0.13
22	0.08	20	0.6	20	0.11
23	0	21	0.533	21	0.09
		22	0.44	22	0.08
		23	0.36	23	0.07
		24	0.29	24	0.066
		25	0.19	25	0.064
		26	0.09	26	0
		27	0.04		
		28	0.01		
		28.5	0		

Estimation of design storm

As per CWC procedure, the point rainfall is converted to areal rainfall for the storm duration calculated. For the 3 canal catchments under study, the point rainfall for different return periods were taken from the iso-pluvial maps generated by the Indian Meteorological Department (IMD) and is given in **Table 3A.7**.

Table 3A.7: Point rainfall for different return periods

Sl. No.	Return period point rainfall	Point rainfall in mm
1	100 years -24 hours	320
2	50 years - 24 hours	280
3	25 years - 24 hours	240

The 100 years - 24 hours rainfall adopted for this study is 320 mm.

The design flood calculation (CWC 2001) estimated for 3 canals for a 1 in 100yrs. flood is given in **Annexure 3A.1**.

Depth of flooding in each catchment

From the design flood hydrograph and the area of the catchment, the depth of flooding in the project canal catchment was estimated and is given in **Table 3A.8**.

The average depth of flooding for a 1 in 100-year flood when distributed uniformly in the total catchment area under study, works out to 0.484 m. The depth of flooding will vary depending on the topography of the catchment.

Table 3A.8: Depth of flooding in 3 catchments

Sl. No	Canal	Reference design flood (Cumecs)	Volume (m^3)	Area (Km^2)	Depth (m)
1	Chilavanoor	68.71	5936544	14.85	0.41
2	Edappally	115.62	9989568	18.0	0.55
3	T-P Canal	55.74	4815936	10.35	0.47
	Total	240.07	20742048	42.85	0.484

The field validation was undertaken from local enquiry in T-P canal by Antea Group's field team as given in **Figure 3A.7** during reconnaissance survey. For a point rainfall of 200mm in the project catchment on 20th Oct 2019, the average height observed in one of the low-lying areas was 0.50 m.

Figure 3A.7: Field validation of flood depth in T-P canal

The flood zone maps using ArcGIS was developed for a 1 in100yrs. rainfall event, to identify the area that are prone to flooding in the project catchment and is as given in **Figure 3A.8.**

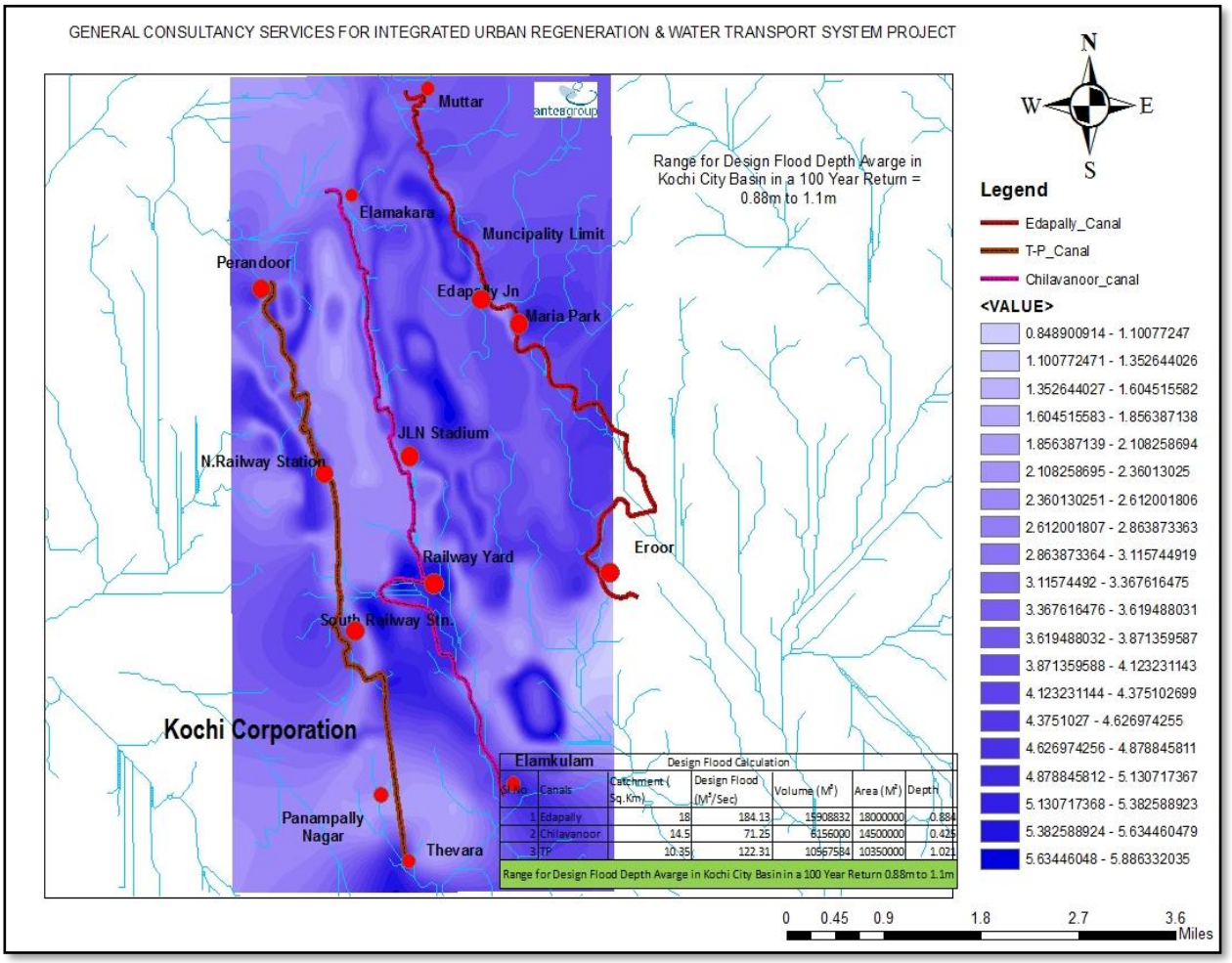


Figure 3A.8: Flood depth zoning map of IURWTS project command

The 0.5m contour interval derived from spot levels of LiDAR data of the project command has been superimposed on the flood depth zoning map and is given in **Figure 3A.9**.

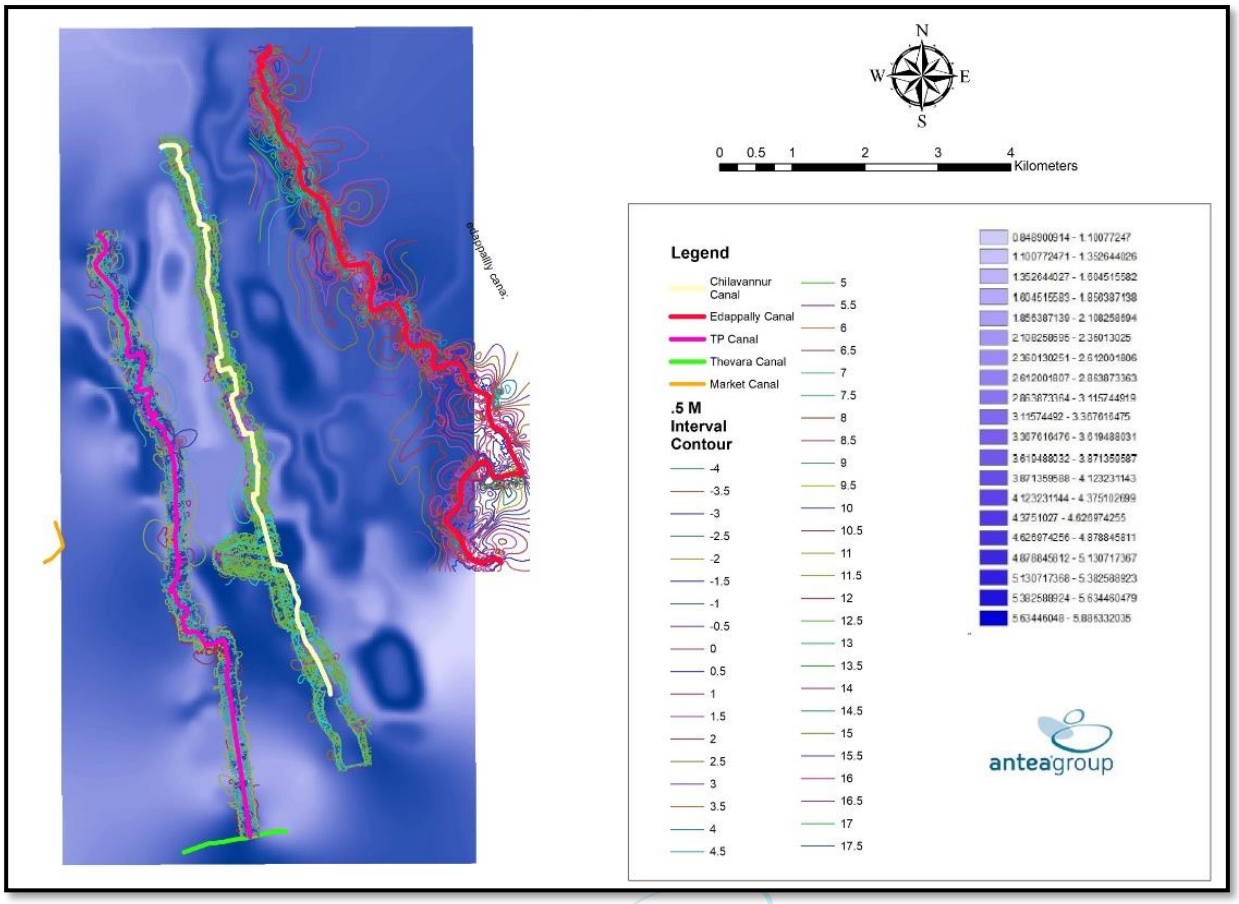


Figure 3A.9: LiDAR derived Contour overlaid on the flood depth zoning map

3A.1.1.2 Tidal impact in the Kochi estuary mouth

The high tidal levels in the coast due to extreme coastal climatic conditions retard the flood flow from Kochi lagoon to the Arabian sea. On 20th Oct 2019 Koch city had experienced a combination of 3 extreme events as explained in this chapter. For a 1 in 25 yrs. return period flood discharge from the upstream catchment, it was estimated that the water level will rise to **+0.8m** MSL in Kochi lagoon. The secondary data collected from the Cochin Port Trust for 19th, 20th and 21st Oct 2019 as given in **Figure 3A.10** shows high tidal level on 20th Oct 2019. Hence the tidal fluctuation reached a level of **+1.2m MSL at HTL** and the **LTL was +0.8m MSL**. This phenomenon resulted in estuary mouth getting closed and thus preventing flood waters from Kochi estuary to move into the sea. The closure of the estuary resulted in the rise of water level in Kochi lagoon and also flooding in the project catchment which forms part of Kochi Municipal Corporation limits.

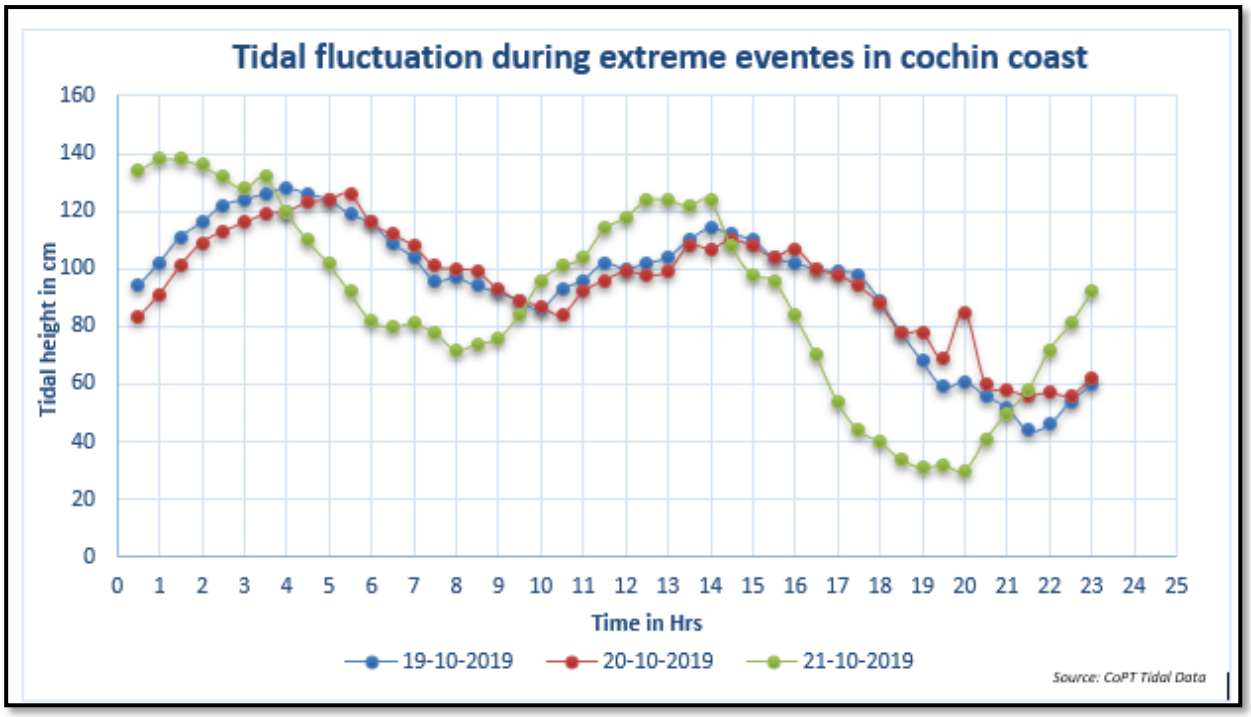


Figure 3A.10: Tidal fluctuation chart for before and after the extreme event

3A.1.1.3 Regulatory mechanism at canal ends

The canals and the surrounding water bodies of the project catchment experience fluctuation of water levels in the canals and the water bodies twice daily during the high tide and low tide conditions. The average fluctuation varies between +0.7m MSL to +0.3m MSL. For vessel movement inside the canals there is a need for a constant depth which will be maintained by setting up regulatory shutters arrangement at both ends of the canal. The regulatory shutter arrangement also helps in preventing flood flow from the surrounding water bodies entering the canal systems.

When the regulatory shutter in the canals are in a closed condition, provision has been included for a pump house and pumping arrangement to maintain the water level in the canal and mitigate the floods in the project catchment. The schematic diagram of the shutter arrangement and pumping arrangement is as given in **Figure 3A.11**.

The function of the regulatory mechanism is as follows:

1. As per tidal records of Kochi coast, the low tide level of +0.3 m MSL occurs around 6 am . At this point the shutters are kept closed and the canal water level is maintained at +0.70 m MSL. This will help navigation in the canal with a clear draft of 1.6 m in the canal (-0.9 m MSL Bottom level of canal to + 0.7 m MSL).

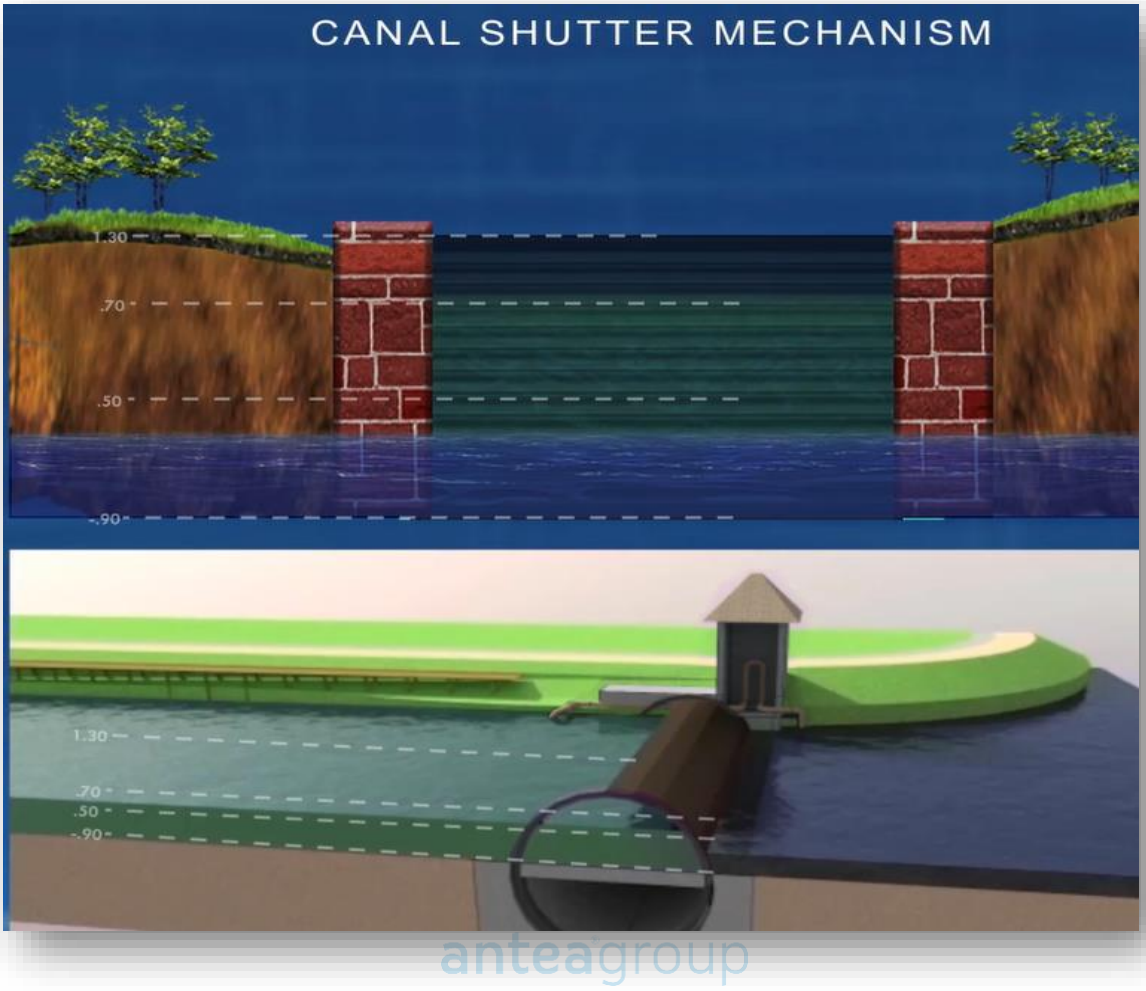


Figure 3A.11: Schematic sketch of regulatory shutter and pumping arrangement

2. As the tidal level in the surrounding water bodies starts rising with time and when the water level reaches + 0.5 m MSL the shutters are brought down below + 0.5 m MSL. As a result, the stagnant water in the canal starts flowing out.
3. During high tide level at 12.00 noon the water level in the surrounding water bodies reaches +0.7m MSL. At this point the shutters are again closed. This automatic process is repeated twice every day or at a higher interval. Through this arrangement, an assured depth of 1.6 m will be maintained in the canal.
4. During the monsoon season when the water level in the surrounding water body rises above +0.7m the shutters are kept closed. This will prevent reverse flow of water from the surrounding water body entering the canals.
5. During the monsoon period if the water level in the canal rises beyond +0.9m MSL in the canal on account of the catchment flow, arrangements to pump out the water to the surrounding water body from the canal will be undertaken at the regulatory mechanism sites.

3A.1.1.4 Sedimentation / siltation impact into the canal systems

The present condition of the canals is in a dilapidated state. The sedimentation issues will arise only when the canals have been widened and deepened. The rivers reaching the Kochi lagoon do not have a direct flow into the project canals. Sedimentation in the canal will occur only if the sediment laden flood waters reaching the surrounding water bodies enters the canal directly. Since the muddy flood waters are not allowed to flow through the canal, the impact of sedimentation into the canal is negligible. The draft for movement of the vessels is maintained at +0.5m MSL. The keel of the design vessel proposed for passenger movement is 0.5m, and hence there is a clearance of nearly 1m to accommodate the silt deposition, if any. The present proposal is that the canal will be desilted annually, and the silt accumulated removed. During the planning stage as a part of EIA studies, the total suspended and dissolved sediment will be measured, and the quantification done theoretically. After the canals are restored, based on the degree of accumulation of sediments and if found needed model study is proposed to be taken during the post implementation stage.

3A.1.1.5 Hydraulic studies to fix the optimum cross section

From the inflow hydrograph generated using synthetic hydrograph approach adopted from CWC, the routing of the flood through the canal was studied to generate an outflow hydrograph. The project catchment is an ungauged catchment and hence popular rational method has been used to generate an outflow hydrograph. Based on the outflow hydrograph the cross section of the canal for mitigating flood will be estimated during hydraulic and flood studies.

Flood routing for an ungauged catchment

Flood routing techniques are utilized to estimate the stages, or rates of flow, in order to predict flood wave propagation along the canal reaches. The Muskingum-Cunge model, the most popular method, is used to undertake the flood routing of project ungauged catchment

The catchment-derived parameters calculations for the project canal catchments required for Muskingum - Cunge method were:

1) The slopes of the canal reach and reach lengths which were derived from a digital elevation model
2) Manning's roughness coefficients were estimated from the soil conditions of the canal
3) Flow variables such as velocity, hydraulic radius, wetted perimeters, and flow depth were determined both from empirical equations and assumed cross-sections for the reaches.
4) The outflow hydrograph has been computed for the middle and the end stretches.

The inflow -outflow hydrograph computed values for Chilavanoor, Edappally, Thevara Perandoor catchments and the detailed calculation for estimation of inflow and outflow hydrograph is given in **Annexure 3A.2**. & **Annexure 3A.2 (a).**

The inflow outflow hydrograph for three canal catchments are given in **Figure 3A.12**, **Figure 3A.13** and **Figure 3A.14**.

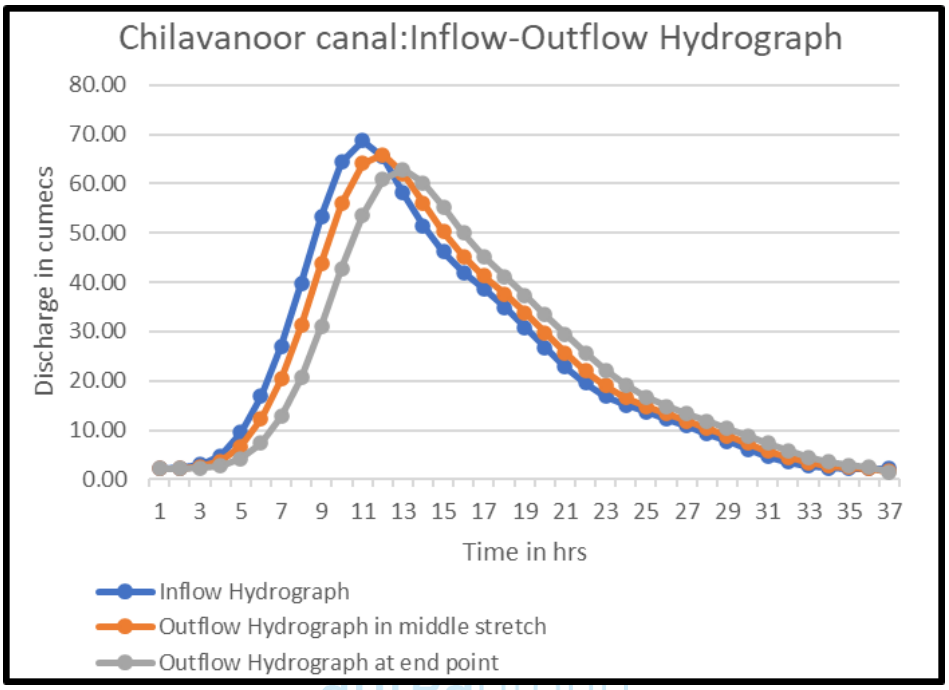


Figure 3A.12: Chilavanoor canal: Inflow-Outflow Hydrograph

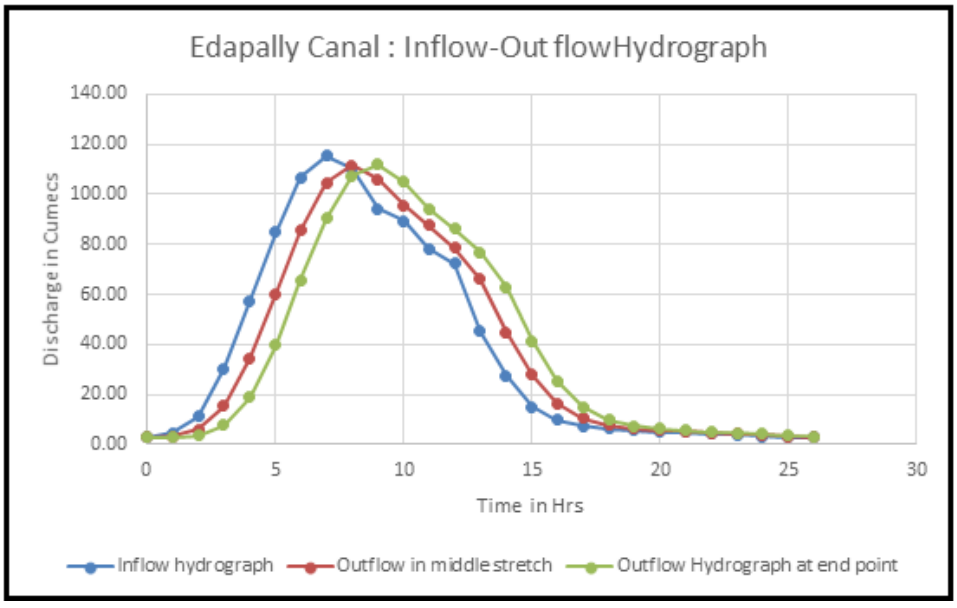


Figure 3A.13: Edappally canal: Inflow-Outflow Hydrograph

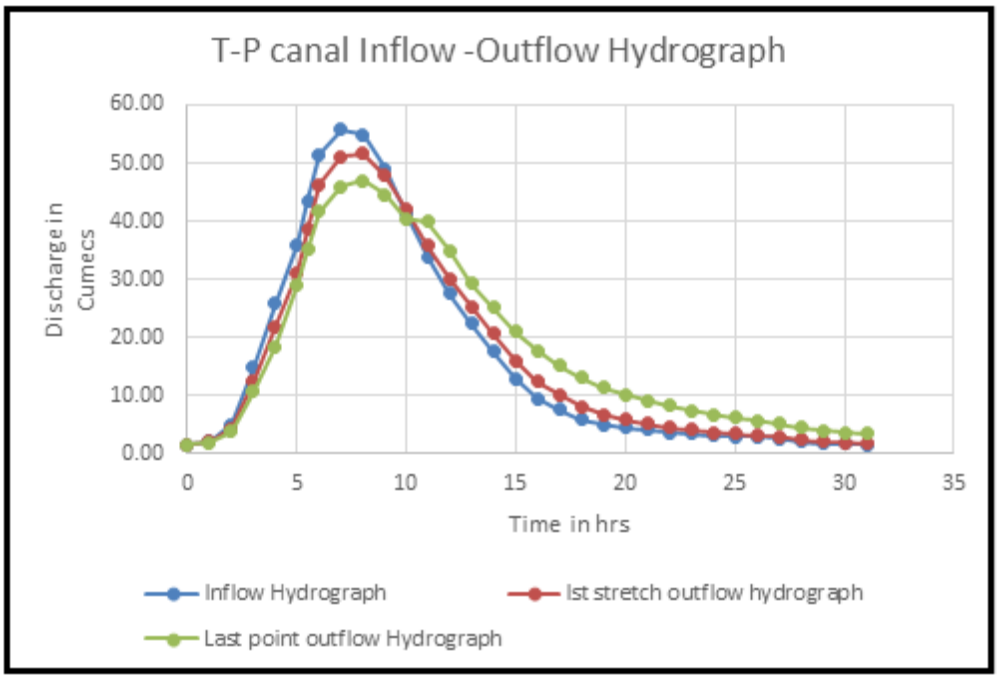


Figure 3A.14: Thevara-Perandoor canal: Inflow-Outflow Hydrograph

3A.1.1.6 Most Economic section for a rectangular canal to contain the design flood waters

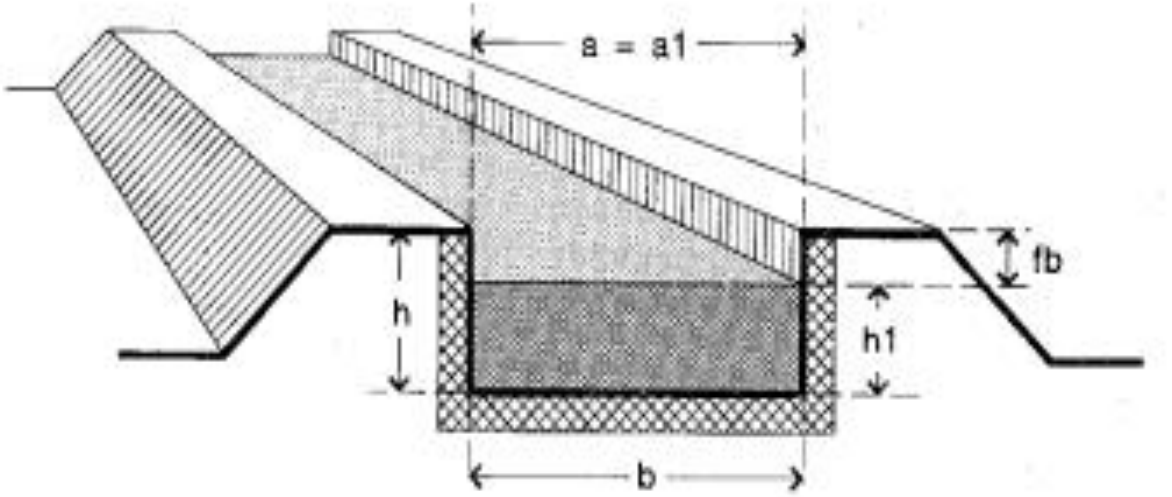


Figure 3A.15: Typical rectangular canal section

In the **Figure 3A.15**, the following symbols are used:

a: Top Width, and for rectangular canals a = a1 = b.

a1: Water Surface Width.

b: Canal bed width.

h: Height of the Embankment above the canal bed level.

h1: Depth of water.

fb: Free Board, and

ss: Side Slope (not applicable for rectangular canals).

To find out the canal dimensions a trial and error method had to be undertaken on excel equating the RHS with LHS trying out different width for the depth of 2.25 m required for navigation of vessels based on the below equation:

$$Q/A = (1/n) * R^{2/3} * S^{1/2} \quad \text{----------(1)}$$

For rectangular section, Area (A)= b* y; Hydraulic radius (R) = [(b*y)/(b+2y)] and S = Slope

$$Q/(b*y) = (1/n) * [(b * y) /(b+2y)]^{(2/3)} * S^{(1/2)} \quad \text{--------(2)}$$

Based on the existing sub soil conditions, and without disturbing the dense layer, a dredge level has been fixed as -0.9m MSL. This depth has been fixed considering the draught required for the movement of vessels also from the low tide level of +0.3m. So, assuming the depth as constant the width was computed by trial and error in equation (2) above and the same given in **Table 3A.9**.

Table 3A.9: Optimal cross section for the canals for flood mitigation

S. No.	Canal	Design reference flood Q_0 (Cumecs)	Canal dimension required for containing the flood (Breadth X Depth) (m)
1	Edappally	57.40	12.8 m X 2.25m
2	Chilavanoor	32.50	6.8m X 2.25m
3	Thevara-Perandoor	24.28	8.45m X 2.25m

Hence, it has been confirmed from the theoretical hydraulic analysis that the dimensions of 16.5 m x 2.25 m taken for the free navigation of vessels is adequate to contain the design flood calculated by Muskingum method of flood routing.

Even though the proposed catchment area under study is ungauged, computer simulation models are also being undertaken with rainfall and discharge data from nearby gauging stations. This is to validate the estimates obtained through rational methods before the preparation of the detailed estimate and drawings. The study will also incorporate the primary data obtained by bathymetry survey, LiDAR, and topographic survey data.

3A.1.2 Width and depth requirement for navigation purpose

In Netherland's width and depth are based on the assumption that the navigation canals are expected to satisfy the following four requirements, first the waterway should be deep enough to ensure good steering and control of the vessels in shallow water in such a way as to prevent grounding, second, the waterway should be sufficiently wide to enable the standard traffic flow to pass safely at normal speed, third, the vessel should be able to reach a reasonable speed to reduce the transportation costs, and finally, the navigation cross section should not be too large which reduces the flow velocity and would, be uneconomical.

It is necessary to improve the existing waterway so that uninterrupted two-way navigation for transporting the passengers can be accomplished.

[3]PIANC guidelines stipulate that the bottom width is decided on the following criteria.

The overall bottom width W, as given in **Figure 3A.16** of canal with straight sections is given as below:

For a one-way canal $\mathbf{W = W_{BM} + \Sigma W_i + W_{BR} + W_{BG}}$ ----------(1) , and

For a two-way canal by $\mathbf{W = 2W_{BM} + 2\Sigma W_i + W_{BR} + W_{BG} + \Sigma W_p}$ --------(2)

W_{BM} = width of basic maneuvering lane as a multiple of the design vessel's beam B, given as 1.2 B.

ΣW_i= additional widths to allow for the effects of wind, current etc., given for 8 kts ≤ Vs < 12 kts = 0.1 B.

W_{BR}, W_{BG}= bank clearance of the red and green sides of the canal for slow speed vessel is = 0.5 B.

ΣW_p= passing distance, comprising the sum of a separation distance between both maneuvering lanes WM (**Figure 3A.17**).

To determine additional width for passing distance in two-way traffic ,the beam of the largest passing vessel should be used whether or not it is the design vessel and the value for slow speed = 0.5 B.

[3] PIANC report N^{0}121 Maritime navigation commission (2014) "Harbour approach channels design guidelines"

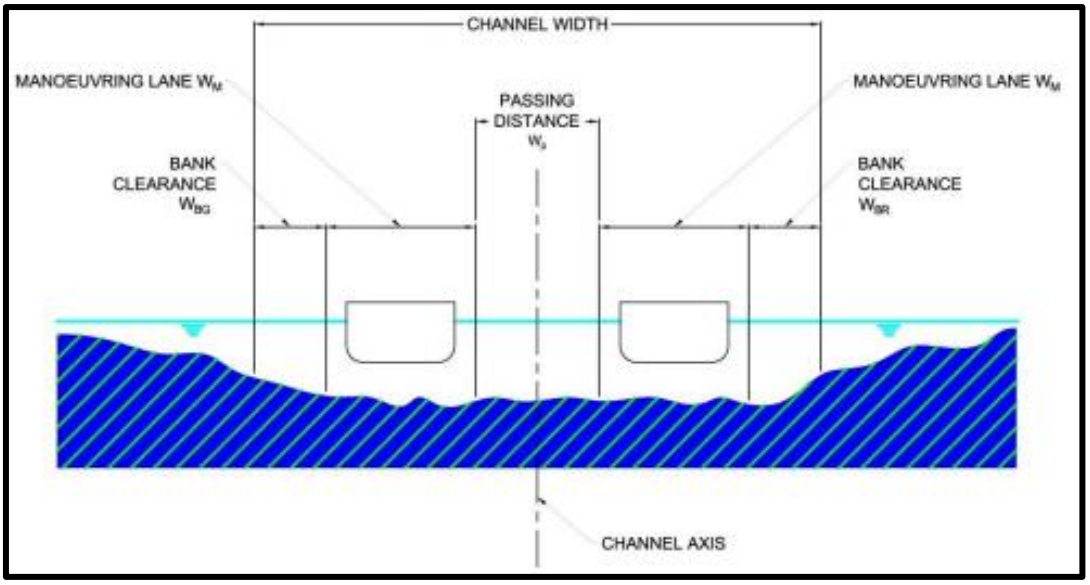


Figure 3A.16: Canal with straight section

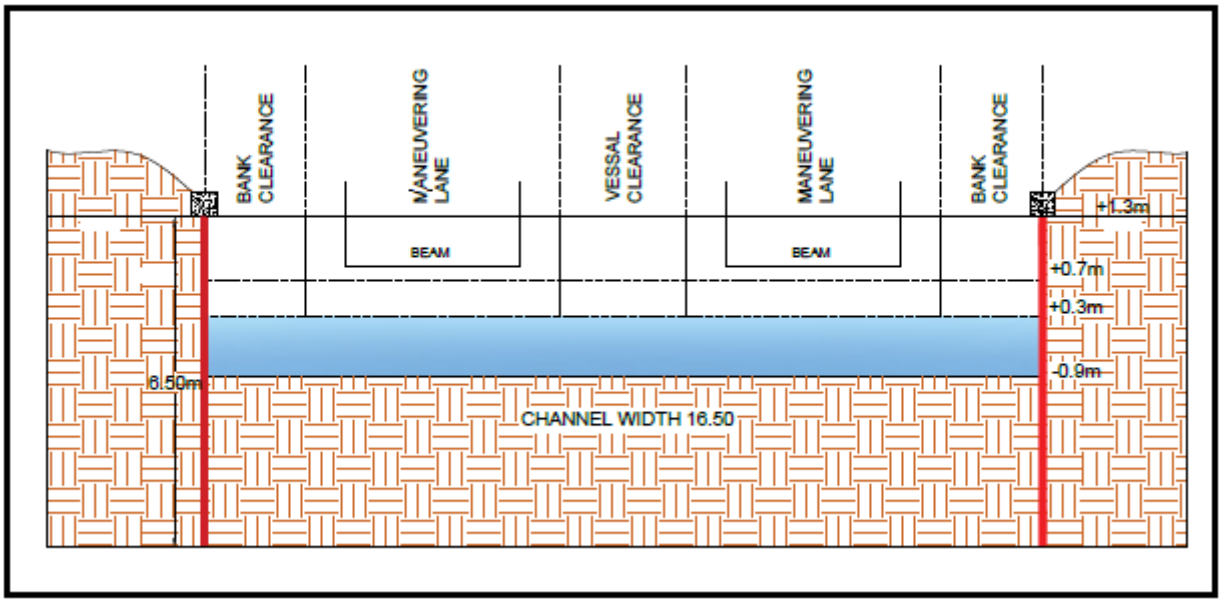


Figure 3A.17: Canal section showing maneuvering lanes

The dynamics of vessels plying in the canal are such that, when under manual control (as is usually the case in approach channels) they will follow a swept path, which, in the absence of any external forces from wind, waves, current, etc., will exceed their breadth by some amount (as given **in Figure 3A.18**). This is due to the speed of response of both the vessel-handler in interpreting the visual cues indicating the vessel position in the channel, and that of the vessel in reacting to the rudder and main engine. The width of the swept path, which is the basic maneuvering lane, will depend on several factors, but the key elements are:

- The inherent maneuverability of the vessel (which will vary from vessel to vessel and with water depth/draught ratio).
- Ability of the vessel-handler.
- Visual cues available to the vessel-handler.
- Overall visibility.

Of these, the first two are the most important.

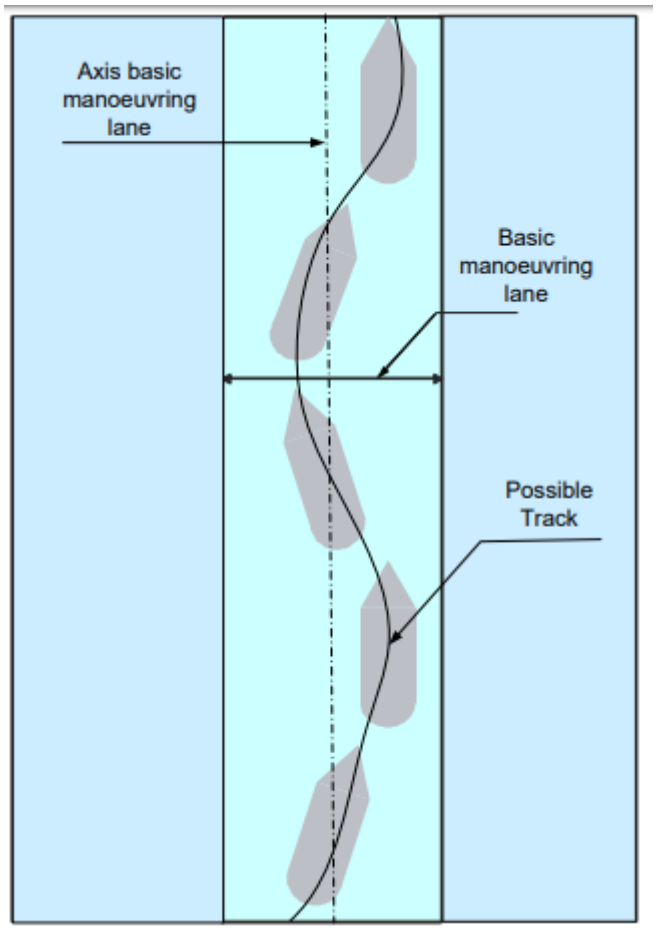


Figure 3A.18: Basic maneuvering lane for single width canals

Width of the canal = $2W_{BM} + 2\Sigma W_i + W_{BR} + W_{BG} + \Sigma W_p$

i.e. 2*(1.2*4) + 2* (0.1 *4) 0.2 +(0.5*4) +(0.5*4) + (0.5*4) = 9.6 + 0.8 + 2+2+2 = 16.4m

In order to improve the existing waterway so that uninterrupted two-way navigation for transporting the passengers can be accomplished a width of 16.5m has been proposed.

3A.1.3 Analysis of existing canal alignment

The project canal have been encroached and steps to evict the encroachers are included as part of this project. Based on the situational analysis survey undertaken by the general consultant, one of the main issues raised by the public, NGO's and the elders of the society was that the minimum width of the canal for development should be based on the village cadastral maps. Hence after collection of the cadastral maps and after studying the requirement for flood mitigation and for navigation of vessels the widths of 16.5m was estimated. In places were the cadastral maps showed a larger width, the width shown in the maps was used for estimation of the widening quantity by Antea Group. This was taking into consideration the concerns raised by the stake holders.

The Field Measurement Book (FMB) record for a typical stretch of Edappally canal traced out from Survey and land records office at Thiruvananthapuram by Antea Group is given as a in **Figure 3A.19**. These FMB records were used for ascertaining the original width of the canals. The same were digitised on a GIS platform and along with the topographic survey AutoCAD drawing the comparison with the existing situation is brought out.

The entire canal was surveyed by Antea Group and the stretches which were greater than 16.5 m and less than 16.5m were identified. The stretch wise details have been consolidated and is as given in **Table 3A.10**. The cross section at every 15m were estimated and is given in **Annexure 3A.3**.

Table 3A.10: Details of the existing width of the canals

Sl. No.	Canal	Total Length (Km)	Proposed width of canal (mt.) for development	Existing length of canal>16.5m (Km) / (%)	Length <16.5m (Km)	Protection* works Proposed (Km)
1	Edappally	11.23	16.5	7.11 (63.3%)	4.12Km	2.1Km
2	Chilavanoor	9.88	16.5	3.2/ (32.29%)	6.68 Km	4.2Km
3	Thevara-Perandoor	11.15	16.5	3.7/ (37.48%)	7.45 Km	4.3Km
4	Thevara	1.41	16.5	1.09/ (77.8%)	0.315 Km	nil
5	Market	0.66	16.5	0.510 (76.8%)	0.154 Km	nil

- The total length of protection for either banks will be 21.2Km

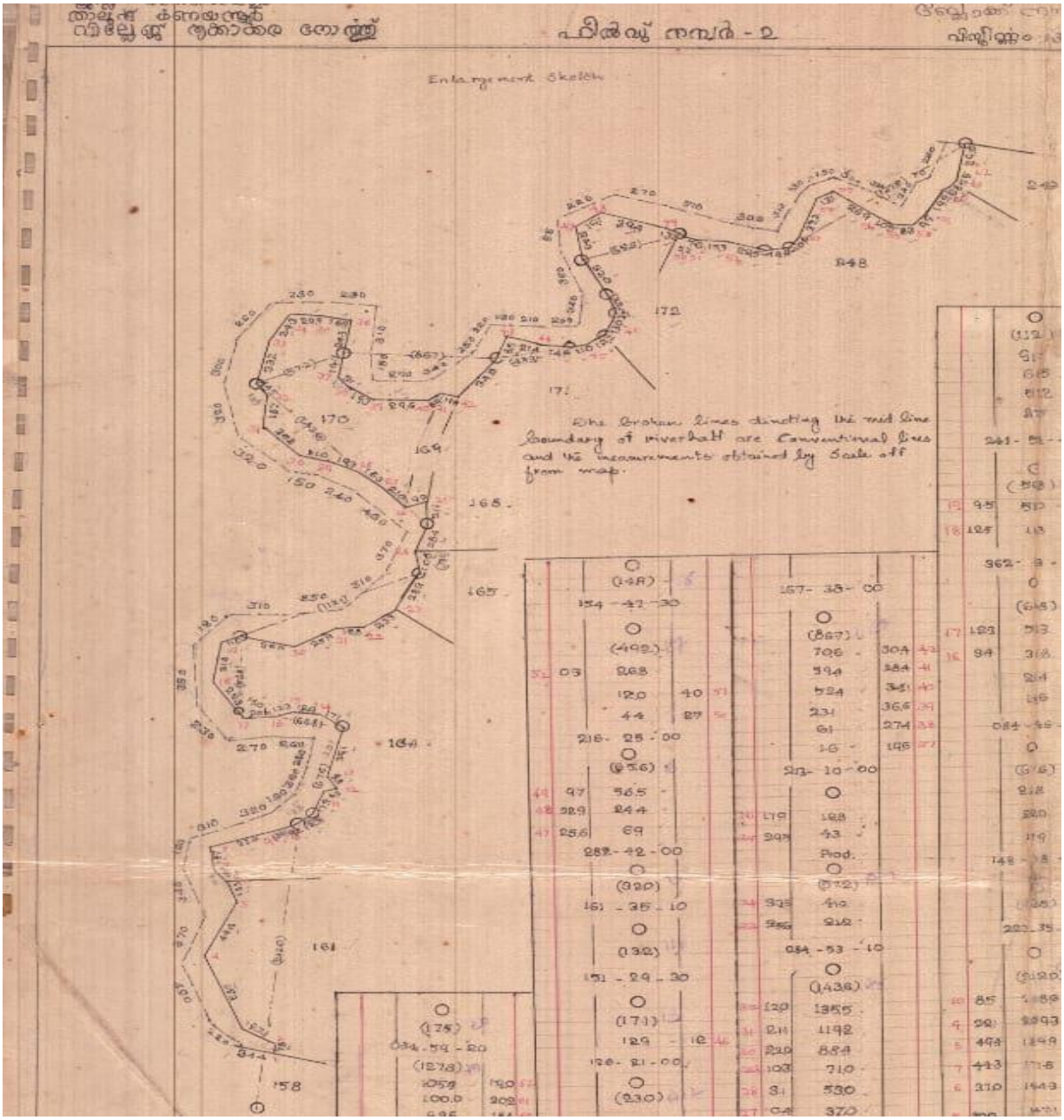


Figure 3A.19: Snapshot of FMB record of Edappally canal (Thrikkakkara North village)

The existing canal condition is as shown in photographs in **Figure 3A.20**.

Figure 3A.20 (a) Busy Market canal in early 1900's

Figure 3A.20 (b) Market canal present state

Figure 3A.20 (c) Edappally canal south of Lulu mall

Figure 3A.20 (d) Edappally canal near pipeline road

Figure 3A.20 (e) Thevara canal near Thevara bridge

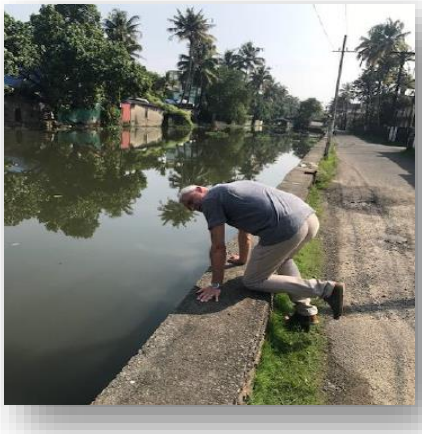


Figure 3A.20 (f) Thevara canal inspection on 18-11-2019 by Antea Netherlands team

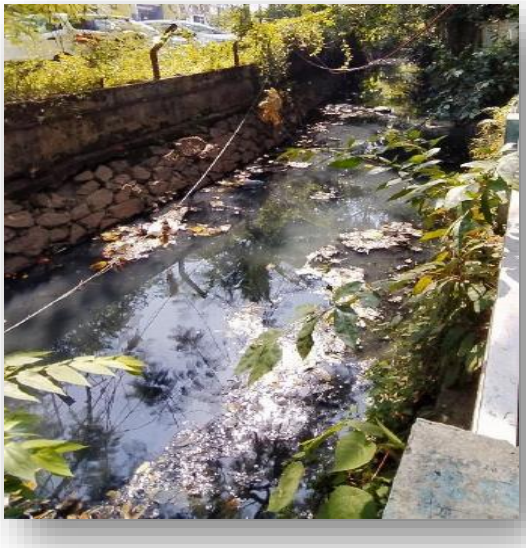


Figure 3A.20 (g) Chilavanoor canal near Kaloor stadium

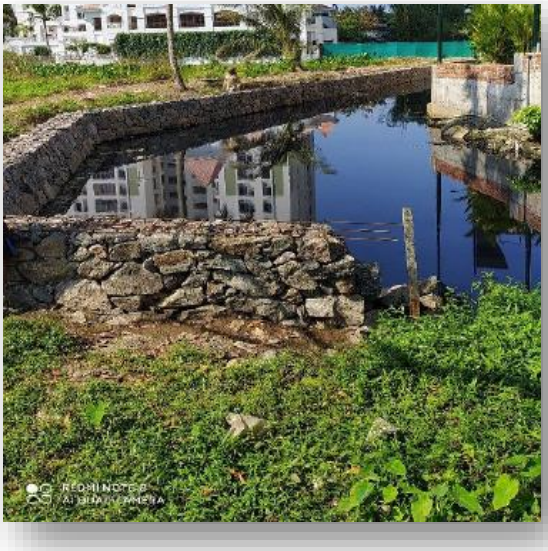


Figure 3A.20 (h) Chilavanoor canal near IMA Kadavanthara

Figure 3A.20: Existing state of the IURWTS canals

3A.1.4 Primary LiDAR Survey data for Validation

The existing width and depth of the canals were surveyed by (NATPAC 2018) and as part of the validation process LiDAR survey was undertaken for all the 5 canals. The spot levels were captured, and contours generated for an Area Of Interest (AOI) of 250m on either side of the canal. The spot levels were arrived by connecting to the DTS benchmark established through Global Positioning System. To cross check the authenticity of the levels, TBM stations are also established on both banks of the canal. For validation of Lidar data, topographic survey and bathymetry survey is being undertaken by Antea Group.

The plan and sections have been generated for all the canals from the LiDAR DTM by using HEC-RAS mapper software on a GIS platform. A typical stretch of Edappally canal is given in **Figures 3A.21**. The Lidar generated cross section data for other sections of Edappally canal is given as **Annexure 3A.4** and is being worked out for other canals also. This data will also be used for the hydraulic modelling, gravitation flow sewer network modelling and final quantification of the deepening and widening quantities and used in preparation of detailed estimate and drawings.

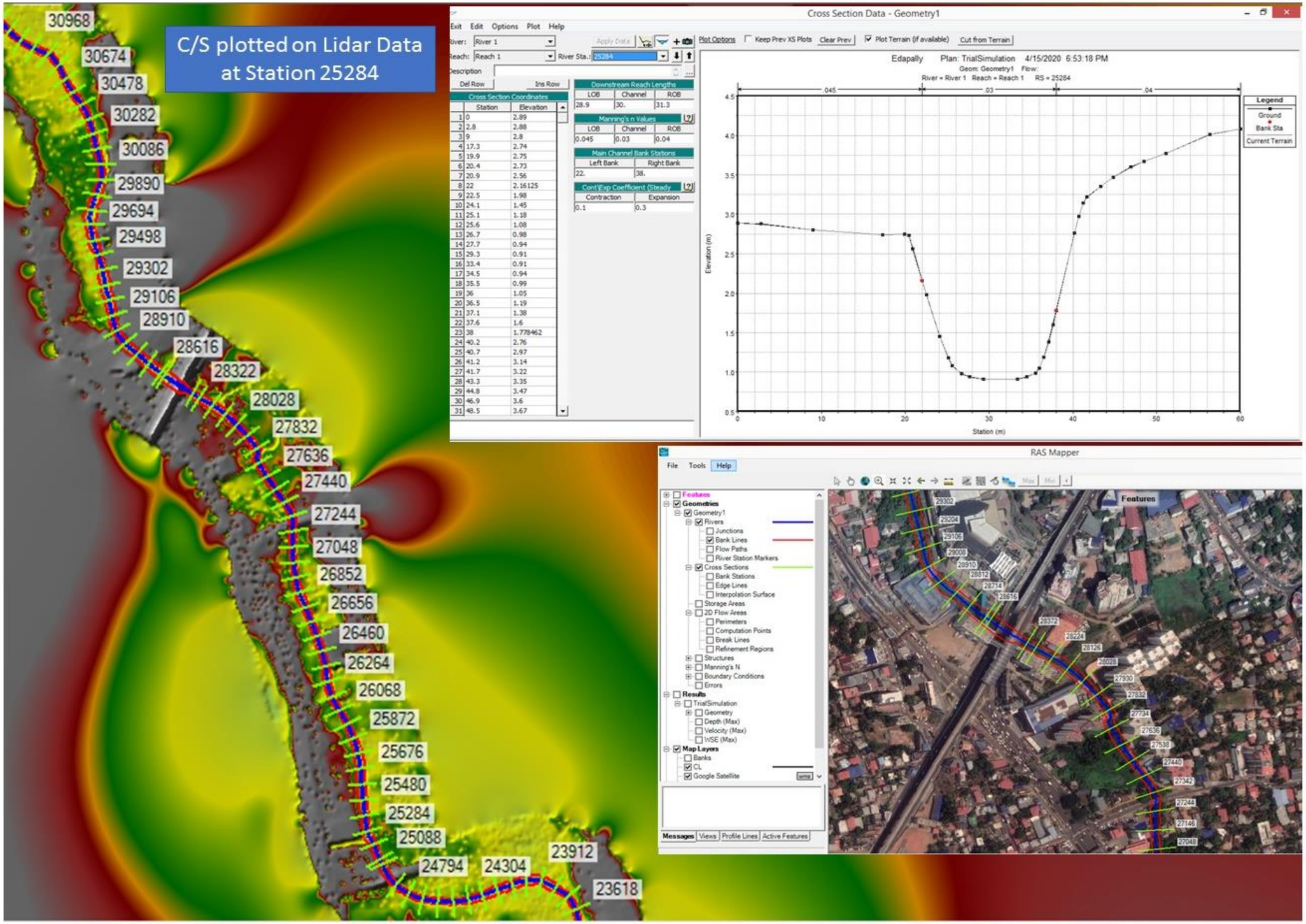


Figure 3A.21: Lidar data for deriving the plan (CS 23618 to 30963m) and cross section of Edappally canal for CS-25284m

3A.2 Weed Management

Concept of weed management instead of control is important. Weed management is a system approach whereby the invasion of weeds is not allowed in aggressive forms. Weed prevention comprises all measures which deny the entry and establishment of weeds in the water body area. All practices that help discourage the weeds from becoming a problem over time, form the subject of weed prevention. Weed prevention is essential against noxious weeds which once allowed to establish, become extremely difficult to control.

A Pre-requisite of a successful weed management programme is to gain knowledge of the biology of weeds under attack before choosing a system for their control. The nature of weed problems must be surveyed in the target area.

Maintenance activities in canals include removal of aquatic weeds, both from the water body and the slopes of the canal. Several methods are available for the maintenance of canals. A distinction can be made in mechanical, chemical, and biological methods and the method that will be used will depend on the function of the canal.

3A.2.1 Weed Control Methods for Canals and surrounding water bodies

Floating Aquatic plants can be divided into three types: emergent species, submerged species and floating species as given in **Figure 3A.22**.

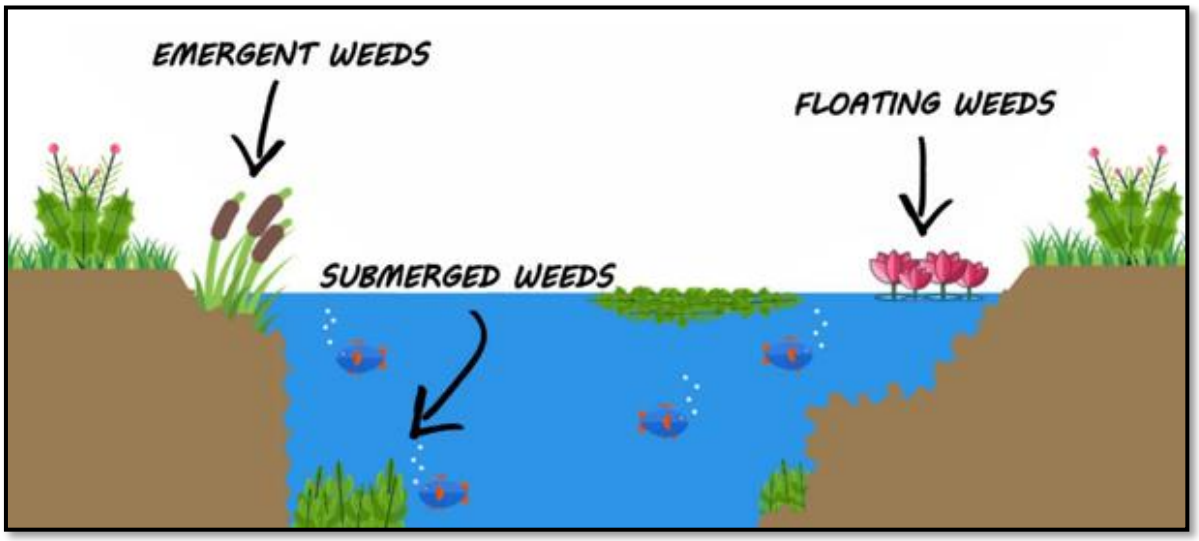


Figure 3A.22: Pictorial representation of 3 types of Aquatic weed

Emergent plants. These plants have their roots in the soil at the canal bottom and their foliage above water. As these plants can only grow in shallow water (less than 1 m deep), their development can be prevented by, creating greater water depths.

Submerged plants. These plants grow entirely under water. They can occur even in deep waters, provided that the water is clear enough. These plants will not survive in canals that periodically fall dry.

Floating aquatic plants. These aquatic plants are similar to submerged plants but differs from them in that the leaves are lying flat on the water. Their comparatively thin stalks scarcely form any obstacle to the flow of water while their usually large leaves block out most of the light, thus preventing the growth of other aquatic plants. Free floating aquatic plants thrive in calm water with little current and no wave movement. Under the influence of wind and/or current, enormous masses of these plants can accumulate at certain locations from where they can be removed.

Filamentous algae are considered as a fourth category. Algae is commonly referred to as slime, moss, or pond scum. Algae can be found at the bottom of the pond or on the water surface

Aquatic weeds can be controlled by either cutting (mowing), dredging or harrowing methods. Cutting leaves a stubble, resulting in a (rapid) regrowth of the weeds, but the stubble protects the canal bottom against erosion. Dredging on the other hand removes a proportion of the parts of the plants which are buried in the mud from the bottom. It is much slower and more costly operation than cutting. Harrowing tears the plants loose and stirs up the mud, thus retarding their regrowth. This is not possible in canals with a hard bottom since the tools cannot penetrate to cut and uproot the plants. When there is a risk of erosion, aquatic plants should preferably be mown.

The most common weeds seen in and around the water bodies of project canals is shown in **Figure 3A.23**.

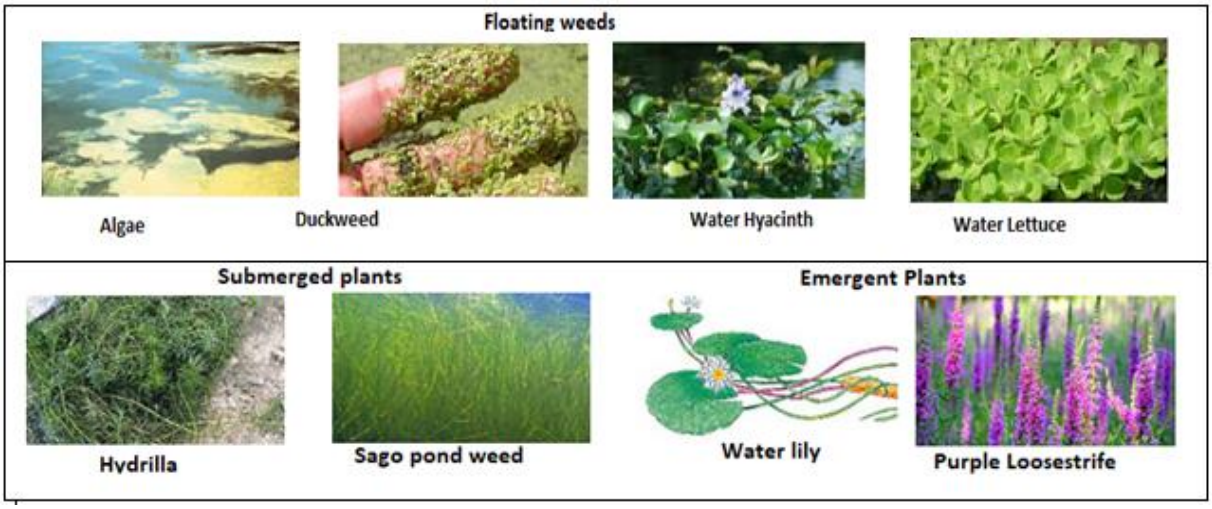


Figure 3A.23: Most common weeds

Aquatic plants must be cut before they have developed fully, and the operation must be repeated rather frequently. Delaying the operation for too long results in a low rate of work, while the large quantities of cut material floating in the canal may block the flow at curves and obstructions.

By cutting the aquatic plants without removing them out of the eco-system the water is enriched with plant nutrients, which stimulates the growth of weed. So, the cut material should be removed. This results in higher costs, but the productivity of the soil decreases gradually.

3A.2.2 Vegetation control with hand tools in embankments

Hand tools were the most important and often the only way of maintenance. Because of the rising labour costs and the disappearance of skilled labourers the manual operation has been replaced by other maintenance methods.

1. **Weed control with mechanical machinery**

With growing maintenance requirements and vanishing use of hand tools, maintenance carried out by mechanical machines has assumed enormous proportions. Gradually, a wide variety of equipment has been developed, which seems difficult to oversee at first glance. An important list of photographs of the machinery used are detailed in sec 4A.1.1 of **Chapter 4A** (Engineering Design) of this report.
An important factor in the development and choice of various equipment is the accessibility.

2. **Chemical Weed control management in canals**

Controlling aquatic weeds with chemicals involves various aspects to be considered:

- there are many kinds of weeds that may occur.
- there is a great variety of location-specific factors, each of which causing its own problems and requiring its tailor-made solutions.
- there is a wide variety of chemicals and application methods.
- considerations of environment and nature conservation, let alone the personal safety of the personnel, are gaining more and more attention, and put limitations on the applications.

Each type and even variety of vegetation asks for its specific chemicals to be treated with. To develop a program for chemical control it is therefore required to know what types and varieties are most dominant. Moreover, in determining the types and quantities of chemicals one must be careful not to "overdo" the treatment. For instance, a too drastic attack on side slopes may lead to bare banks which are then likely to erode or collapse.

With all the risks involved in vegetation control by chemicals, it is very important that strict regulations be laid down for their use. The consequences on the environment can be very serious. In the Netherlands use of chemicals has become very restricted and is only applied under well specified circumstances.

By killing the aquatic plants without removing them out of the eco-system the water will become enriched with plant nutrients causing excessive growth of e.g. algae. The commonly used herbicides are diquat, endothall, fluoridone, glyphosate, Imazapyr, triclopyr, copper sulphate etc.

Diquat Herbicide is the most common herbicide used in Netherlands because it is labeled to treat many different submerged, emerged, and floating weed types and is cost-effective. Before mixing and application, you will need to calculate the size of the water body you wish to treat to determine how much Diquat you will need.

Some weeds are best treated with a granular herbicide like Cutrine Plus when weeds are submerged as blankets under the water surface, in deep areas of the pond or in ponds with flowing water. These heavier granules can be applied with a hand spreader and will sink directly onto the weed beds.

After applying herbicides, Vision Pond Dye is applied. This non-toxic dye will give the water a natural blue color and filters UV light to inhibit algae and weed growth. Follow the label directions for proper application rate and pour it at the edge of the pond. The water's natural movement will disperse the dye.

Continuous application of herbicides may result in a build-up of organic debris in the bottom of the canal. Furthermore, a repeated application of one and the same herbicide on **a** certain spot tends to repress the less harmful plants while the hard to control species expand their territory.

3. Biological weed control maintenance in canals

Gradually, canals become a more important element in the conservation of the aquatic eco-system. Therefore, in the management and maintenance of canals more attention is now being paid to their function for nature conservation.

Chinese grass carp: Generally, all species of aquatic plants are consumed, though the grass carp prefers submerged plants. Unfortunately, it will not propagate outside its natural habitat so that each individual fish must be imported or made to reproduce itself under artificial conditions. Screens or gates must be installed in canals or culverts to prevent the grass carp to escape their "working area". (**Figure 3A.24)**

Figure 3A.24: Chinese Grass carp

Adult grass carp Juvenile grass carp

It has to be taken into account that a certain time must elapse before effects become obvious for biological weed control. Over 10 years, grass carps are used in Netherlands to prevent a high growth rate of aquatic plants. Up to now the results seems good. It is rather difficult to forecast the efficiency of this method because it concerns living organism which are strongly affected by the conditions of the environment.

Among the 3 methods explained above based on site specific conditions, mechanical means of controlling the weed s is proposed for the IURWTS project.

3A.2.3 Frequency of weed control maintenance operations

The cost of canal maintenance is mainly determined by the frequency of maintenance. Substantial reductions in total costs can only be achieved by working out the optimal frequency. The required frequency is determined by various factors.

- **The growth rate of the vegetation**: This may vary both from time to time and from one area to another. Also, the quality of the water (chloride content, eutrophication), the water depth, shade etc, are important.
- **The function of the canal**: A canal used for the navigation only, needs frequent maintenance than a canal which is also used for other purposes. Exactly how often will depend on the type and rate of plant growth and local conditions.
- **The size of the canal:** A big canal with a large water body is maintained more frequently than small canals with lesser water body.

In Netherlands, for canals in which weed control is undertaken only once a year, the maintenance is undertaken in the period September to November, the start of the wet season. If maintenance work is done twice, the months June/July and September/October. Hence a suitable decision on the interval for maintenance of project canals needs to be fixed based on local enquiry.

[4]Methods for disposal of the collected weeds

There are several techniques for cutting and removing aquatic weeds. Normally, the method is selected principally to suit the type of weed and the character of the watercourse, with less consideration being given to the method of disposal. Riparian and aquatic plant material can be disposed of in three main ways.

- Leave the material on the bank
- Spread the material on suitable land
- Dispose of material at a landfill site

[4] Disposal of Cut Vegetation "Best Practice Guidelines Research and Development" Technical Report W138, IACR, Centre for. Aquatic-Plant Management, Swindon, Wilts SN5 SYF

Removing plant material from water is an energy-expensive -operation because large quantities of entrained water are also removed. It is estimated that for every 100 kg 'of weed; up to 90 kg of entrained water is lost, leaving about 10 kg of fresh weight of weed. After this weed has dried and lost a further 90% of water content in the cells, 'only about 1 kg remains.

In most situations, weed can be deposited on the bank, but there may be site-specific reasons why this would be unacceptable, and it may be necessary to transport the weed for disposal elsewhere. For example, there might be insufficient space on the bank, or there may be a recreational function which precludes the placement of weed.

Factors Affecting Method of Disposal

There are several factors which influence the method of disposal. The three main factors which influence how material will be disposed of are:

1. How the weed is cut.
2. How the weed is removed from the water.
3. How the weed is deposited on the bank or collected for subsequent disposal.

In practice, the conditions which determine these three factors are the type and quantity of weed and the characteristics of the watercourse.

Weed control activity and appropriate methods of disposal is shown in **Table 3A.11.**

Table 3A.11: Weed control activity and disposal methods

Weed Control Activity	Suitable methods of disposal
Hand Cutting	• Leave to float downstream uncollected • Collect at boom downstream and remove to heap • Deposit on bank in small heaps, or chop and spread • Leave cut bankside vegetation situ
Weed Cutting Boats (including amphibious boats)	• Leave to float downstream, collect at boom and put in a head • Remove with weed rake or bucket at cutting site • Deposit in large or small heaps along bank, or chop and spread
Weed Harvesting Boats and Weed Collecting Boats	• Deposit on either bank in small heaps • Deposit at central collection point in large heap

Weed Control Activity	Suitable methods of disposal
	• Deposit in tender boat for offloading later
Weed buckets and Weed Rakes	• Deposit in small heaps on bank top, or chop and spread
Flail Mower, Strimmer, Forage Harvester, Allen Scythe, Spider and Bicycle Mowers	• Leave in situ to decompose • Do not spread invasive plants to un infested areas
Chain saw	• Burn or chip material in situ, leave to decompose or remove from site

Emergent Aquatic Plants: Disposal options

If deposited on the bank, rushes, reeds, and sedges rot slowly and may suppress underlying vegetation or impede access to the banks. Decomposition can be accelerated by chopping the cut vegetation with a flail mower. Reeds and sedges dry out quickly and can be collected and burnt after drying where this is appropriate.

Floating-Leaved Plants: Disposal options

The rooted floating-leaved plants seldom grow in sufficient quantity to create a problem if deposited on the banks where they rot quickly. Free-floating plants also rot quickly.

Submerged Plants: Disposal options

Submerged macrophytes rot- quickly and cause few problems. if spread or deposited along the banks in small heaps. In some situations, where the. soil is acid or low in organic matter, submerged weeds; particularly (Ranunculus spp.) are used as soil fertilisers and conditioners.

Algae: Disposal options

Some species of filamentous algae, particularly Vaucheria dichotoma, form a persistent, thick, blanket which kills underlying bankside vegetation. Chopping the dry mats with a flail mower and spreading the-material thinly may help to prevent damage. to underlying vegetation, but, where this is not possible, it may be necessary to remove weed to an alternative disposal site if unacceptable damage to bankside flora is likely. The death -of underlying flora may lead to bank destabilisation and slippage due to loss of surface root-binding strength.

3A.2.4 Selection of Disposal Options

Waste plant material arising from weed cutting operations must be disposed of in a way which does not cause harm to humans or to the environment. The first stage in the disposal process is to ensure that sufficient material is removed from the water to prevent deoxygenation, or other problems, which could arise as weed rots in water. The second stage is to decide whether it can safely be left on the bank or whether it is necessary to move it to another disposal site.

Moving the vegetation for a second time clearly incurs additional costs. There are also environmental considerations in deciding whether to move the material to another site or to leave it in situ. There may be environmental risks associated with moving the material which could be as great, or greater than, those arising from leaving it on the bank.

Of the three principal methods of disposing of-riparian and aquatic vegetation, disposal along the bank has been used for longest and is still the most-commonly used.

Disposal on agricultural land, or land belonging to the operating authority, or at a licensed landfill site is generally. the second option. This is used-mainly when there are overriding reasons why the material cannot be left on the bank, due for example to amenity and recreational land use or to prevent any adverse impact on sensitive riparian vegetation.

Material deposited on the bank should be organised so as to cause minimal inconvenience to anglers and other riparian users. Material should be spread in thin layers less than 30 cm thick.

1. Disposal of material-on banks

Advantages

1. Very quick, with no additional transport or handling costs.
2. Rapid aerobic decomposition for many species in layers less than 30 cm thick.
3. Well placed small piles and heaps are not likely to fall back into water or create liquor seepage.
4. Allows escape of some vertebrates and invertebrates back into water.

Disadvantages

1. Poor placement causes leaching of liquor and risk of weed falling back into water course.
2. Poisonous plants may be eaten by livestock.
3. Thick layers can cause suppression of bank vegetation, leading to bank instability.
4. May cause nutrient enrichment of soil.

1a. Disposal of material-on banks in large heaps

Advantages

1. Easy and efficient method of disposal when collection is at a boom
2. Easy to arrange transport to land or landfill.
3. Access by public and livestock is controllable.
4. Maximum permitted volumes unlikely to be exceeded.

Disadvantages

1. Risk of noxious odours.
2. Risk of leaching.
3. Risk of Health and Safety problems.

2. Disposal of weed on land

Advantages

1. Agricultural benefit and/or ecological improvement to soil is likely to occur.
2. Limits damage to banks and nutrient enrichment of bank soils.
3. Reduces the risk of liquor leaching into watercourse.
4. Removes problems of livestock and public access.

Disadvantages

1. Incurs additional handling and transport costs.
2. Collection sites may not be close to collection site.
3. Access to land may not be available at right time of year.
4. Temporary bunded storage areas may be required.
5. Potential growth of weed species in crop land.
6. May require sorting to remove foreign matter.

3. Disposal at a landfill site

Landfill sites are relatively few and are often distant from rivers, making transport costs high. Therefore, this method of disposal is generally used where it is impossible to leave the. weed on the bank and where no other suitable disposal site is available.

Advantages

1. Disposal of weed containing foreign material is acceptable.
2. Remove problems caused by decomposing weed in urban areas.

3. Limits damage to banks and nutrient enrichment of bank soils.
4. Eliminates leaching of liquor into watercourse.
5. Removes problems of livestock and public access.

Disadvantages

1. Additional costs from transport and landfill.
2. Environmental impacts from transport and landfill.

Other methods of weed disposal

Apart from the three basic methods described above, there are a number of other methods of disposing of aquatic weed which are in limited use at present, but which may become more useful in the future.

Aquatic weeds are difficult to collect and heavy to transport so that, unless very local uses can be found, there is likely to be a high cost of delivery which would make their use uneconomic.

Composting

Water plants do not compost well by themselves but may do so if, mixed with other organic material. Composting of aquatic and riparian weeds is currently practised in the Netherlands and Germany. Reductions in disposal costs of up to 90% have been achieved by composting compared with landfill, as there is, a saleable end-product to offset.

Thatching, basket making and weaving

Rushes and Reeds and some Willow species are used for thatching, basket making and other forms of weaving. The increasing interest in rural crafts may help the uptake of material to this market.

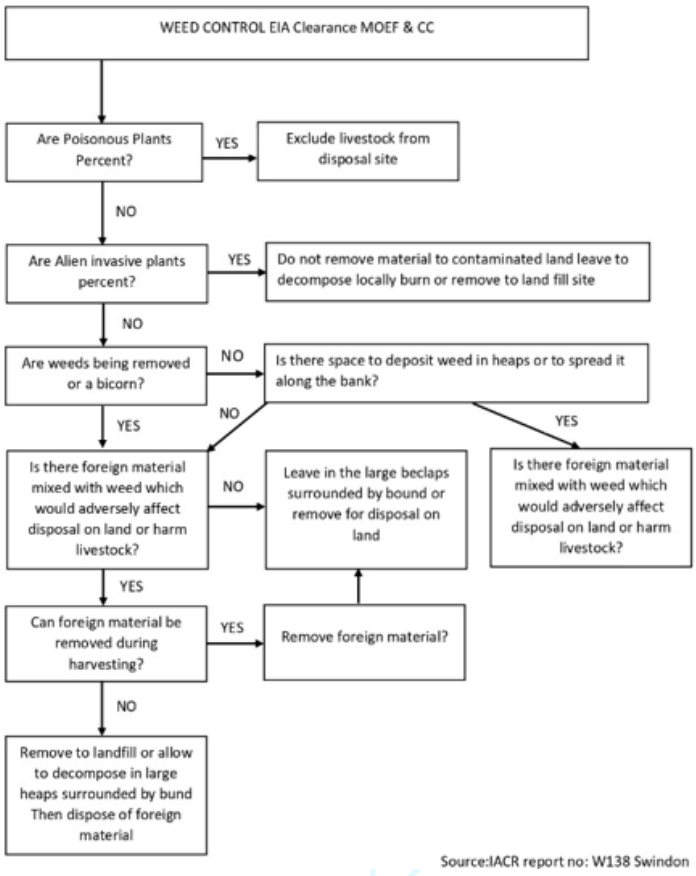


Figure 3A.25: Process involved in Weed Management

3A.2.5 Conclusion

The details given above explains the general procedures and method of disposal of weed (**Figure 3A.25**). In the project site, the canals are in dilapidated state and during the planning and preconstruction stage the issues related to weed removal is meagre. The main issues are removal of deposited solid waste and bottlenecks for the free movement of water. The weed growth is expected only during the implementation stage and the post implementation stage of the project. Among the 3 methods explained above based on site specific conditions, mechanical means of controlling the weed s is proposed for the IURWTS project. For proper weed management lumpsum cost provision has been proposed during the Strat of the project and during the completion phase of the project.

3A.3 Canal Shore Protection Works

3A.3.1 Requirement

The flood zone map generated for the project canal catchment as given in **Figure 3A.8** & **Figure 3A.9** were used to identify the low-lying areas along the canal. Shore protection along the canals in the low-lying areas, is proposed to prevent overtopping from the canals into the catchment. Protection and raising the low-lying areas proposed using the excavated earth from widening will also prevent sediment flow from the project area into the canals. The abstract of the length along the canal having width less than 16.5m and for lengths greater than 16.5m that needs to be protected is given in **Table 3A.12** and the details are given in **Annexure 3A.5**.

Table 3A.12: Canal wise length requiring side protection

Canal	Length of protection required (Km) on either side for canal width less than 16.5m	Length of protection required (Km) for canal width greater than 16.5m requiring reconstruction
Edappally	2.1	1
Thevara-Perandoor	4.3	1.5
Thevara	0	0
Chilavanoor	4.2	1.5
Market	0	0
Total	**10.6**	**4**

3A.3.2 Different kinds of shore protection

There are different kinds of shore protection works and the commonly adopted are rubble masonry, RCC retaining walls, pile and slab system and sheet piles. A choice among these kinds is a site-specific issue and hence parametric analysis on the pros and cons has been studied and is brought out in **Table 3A.13**

The Rubble masonry is the commonly adopted kind. Considering the periodic ban imposed by the district administration in the quarrying activities there is a considerable risk involved in going for rubble masonry for the entire stretch. The quarry contractors prefer to produce smaller sizes stones for building and road works considering their personal gains. Hence rubble masonry is suggested only for rectifying the existing masonry in reaches where width of the canals are greater than 16.5m and in very essential stretches fro new construction along the canals.

Considering the site-specific attributes (like land cost, availability of rubble for rubble masonry and concrete masonry and the construction difficulty in pile and slab system) for this project, sheet piles protection is suggested as the best alternative.

Table 3A.13: Parametric analysis of different kinds of protection

Description	Sheet pile	Random Rubble masonry	RCC retaining walls	Pile and slabs
Approximate Cost /10m of wall	INR 7,40000	INR 4,70000	INR 6,00000	INR 4,30000
Time of construction	Construction time is less due to the ease in the installation.	Construction time is high	Construction time is high	Construction time is high
Structural stability	High stability	Stability decreases with time	High stability	Stability decreases with time and the possibility of slabs gets displaced while placing is high
Maintenance	Very low maintenance cost	High and regular maintenance required	low maintenance	high maintenance
Aesthetics	Good	Medium	Good	poor
Durability	High	low	High	Low since the steel rods in piles& slabs getting exposed due to degradation of concrete in high
land required	Very less land required	High	High	High
Material availability	Readily available	low**	low**	low**
Ease in construction	Easy	Difficult considering canal condition	Difficult considering canal condition	Difficult considering canal condition maintaining the verticality while driving the piles
Space constraints	less space required as	More space required for	More space required for	More space required for stacking materials

Description	Sheet pile	Random Rubble masonry	RCC retaining walls	Pile and slabs
	available in smaller segments	stacking materials	stacking materials	
Material transportation and handling	Very easy to transport and handle	Difficult considering canal condition and social issues frequent lorry movement	Difficult considering land availability and social issues frequent lorry movement	Difficult considering urbanized site condition and social issues frequent lorry movement
*Note** - Issue of Availability of material due to issues in quarries*				

The final decision on the type of shore protection will be site specific. The cost of sheet piles is mainly based on the length and the thickness. In order to undertake a comparative estimate with the different types a preliminary design analysis was undertaken.

3A.3.3 Sheet piles

In this project, land acquisition is proposed for a 2m right of way towards the land side of the canal to aid in the related activities of the project. The final alignment of the shore protection measures, and the stretches identified for shore protection will be validated after the land acquisition process is complete. The field survey has been completed during reconnaissance survey to identify any overhead obstructions, particularly power lines to ensure vertical clearance to accommodate for sheet pile driving and construction operations.

Geotechnical Considerations: The existing secondary data of bore logs near canal stretches provided by SPV, revealed that there is not much variation in the soil profiles and subsurface conditions along the canal that would impede pile driving. Hence, existing secondary data was used in the preliminary design of cantilever steel sheet piles. For validation, a detailed geotechnical investigation is being carried out to understand the foundation soil profile along the canals. This data will be used for the detailed design, and estimation purpose.

The sheet piles driven can be either cantilever type or anchored type depending on the soil conditions, the depth of the sheet pile required and the space consideration at site. For the project being developed in an urbanized area and due to less land availability on the landward side, the cantilever type structure has been designed.

A typical sheet pile used for driving showing the plan view and the cross-sectional view of anchored and a cantilever type are shown in **Figures 3A.26, 3A.27, 3A.28 and 3A.29**.

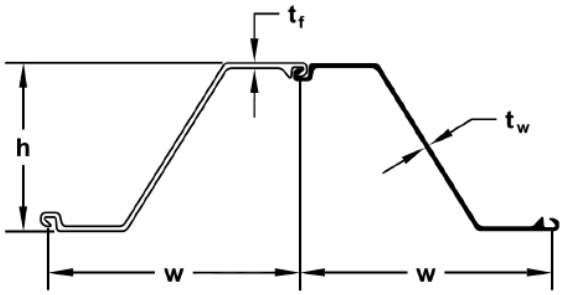


Figure 3A.26: Joining systems between Z type

Figure 3A.27: Typical anchored sheet pile

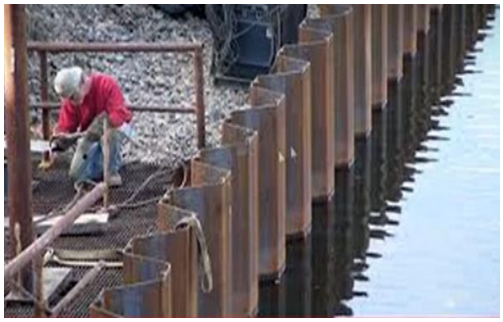


Figure 3A.28: Typical view of cantilever sheet pile

Figure 3A.29: Cross sectional view of steel sheet pile

The equation used to estimate the depth of a sheet pile is of the order 4 and hence a trial and error method has to be adopted which is cumbersome. Hence software's available to solve these types of equations faster was used. A factor of safety between 20% and 40% has been added to arrive at the final value of the depth as per the relevant design codes and is detailed in **Chapter 4A** (Engineering Design) of this report.

Design assumptions

The following assumptions are considered for sheet pile design:

- The Soil investigation report provided by SPV as BH-6 report (CH: 19300 at Ernakulam South Railway station) are considered in the analysis of sheet pile design. These reports are dated February 2013.
- Surcharge of 10kN/m^2 (minimum surcharge load as per BS 8002 code) which was considered to be at least 3 m away from the wall and extension of 3 m further.

- A concentrated load generated by the concrete pile cap (assumed size: 0.5m x 0.5m) exactly on to the top of sheet pile. This can also act as separator or unmountable kerb of at least 0.15 m above from the virgin ground.
- Ø = 0 analysis was done in undrained conditions due to the presence of cohesive soils i.e., for normally consolidated clays.
- No unplanned excavation during the service life of the structure is considered as this is used for general canals with no wave action or no action of scour.
- The worst condition for the design of retention structure is the ground water at ground level on retention side i.e., fully submerged soil and low water level on river / canal side. The same condition is considered in the design.
- The partial load factors as per BS 5950 and Euro code & part -1 is specified as 1.5. Yet, the Indian Standard IS 9527 Part 3 recommend to use 2.0 on Bending moment.
- The structure must be designed for a service life of minimum 30 years with a maximum of 50 years.
- Design life of the structure is considered as permanent and with maximum 50 years service life.
- All design calculations are carried using DC-Pit software. Design basis is on Euro Code.
- General protective coating is considered for aesthetic view and for 50-year service life of the structure complete sacrificial thickness loss for the entire service life is considered.

Secondary data of bore holes used for the design is as given in **Figure 3A.30**. The final design input provided in the software of cantilever sheet pile protection is as given in **Figure 3A.31.** Further details on the engineering aspects are dealt with in **Chapter 4A** (Engineering Design) of this report.

PROJECT : GEOTECHNICAL INVESTIGATION FOR DELHI METRO RAIL CORPORATION LTD.

CECONS — COCHIN ENGINEERING AND CONSULTANCY SERVICES PVT LTD

Project	: Metro Rail	Boring Started	:25.02.2013
Bore Hole No	: BH-6	Boring Completed	:27.02.2013
Type of Boring	Rotary	Ground water table	0.35m
Termination Depth	: 50m	CH : 19300 (ERNAKULAM SOUTH RAILWAY STATION)	

LOCATION : SOUTH RAILWAY STATION, ERNAKULAM

DEPTH	SOIL PROFILE	DESCRIPTION OF STRATA	THICKNESS OF STRATA	DEPTH in M	SAMPLES TEST DEPTH IN m	BLOWS/15cm 15cm	15cm	15cm	SPT "N"	CORRECTED "N" VALUE	UDS	REMARKS
0.60		FILL	0.60									
2.10		VERY SOFT SANDY CLAY	1.50	1.50	1.50-1.95	1	0	1	1	1		
3.70		VERY LOOSE SAND	1.60	3.00	3.00-3.45	1	0	2	2	2		
5.10		DENSE SAND	1.40	4.50	4.50-4.95	16	19	14	33	24		
				6.00	6.00-6.45	1	0	1	1	1		
				7.50	6.00-6.45	1	1	1	2	2		
				9.00	7.50-7.95	1	1	2	3	3		
		VERY SOFT TO SOFT CLAY	11.30	10.50	10.50-10.95	1	0	2	2	2		
				12.00	12.00-12.45	1	2	2	4	4		
				13.50	13.50-13.95	1	0	3	3	3		
16.40				15.00	15.00-15.45	1	0	3	3	3		
				17.00	17.00-17.45	3	2	3	5	5		
		MEDIUM STIFF CLAY	3.60	19.00	19.00-19.45	2	2	3	5	5		
20.00				21.00	21.00-21.45	1	1	3	4	4		
22.40		DECAYED WOOD	2.40	23.00	23.00-23.45	1	3	3	6	6		
				25.00	25.00-25.45	1	1	4	5	5		
		MEDIUM STIFF CLAY	5.40	27.00	27.00-27.45	1	4	4	8	8		
27.80												

Figure 3A.30: Site Geotechnical report bore details as provided by KMRL

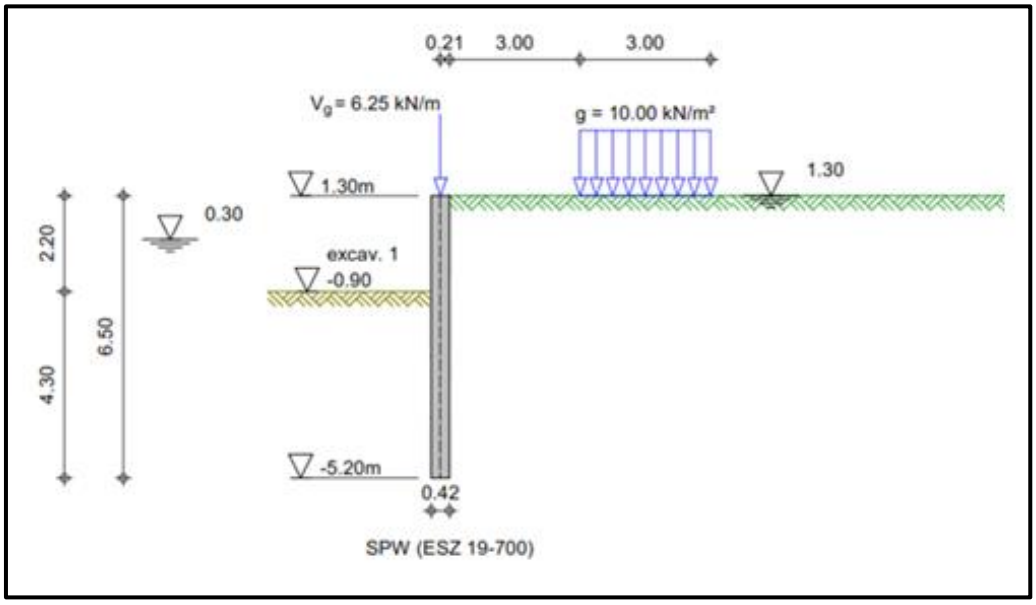


Figure 3A.31: Functional design concept of cantilever sheet pile protection

3A.4 Navigational facilities

The canals in Kochi were used for both passenger and cargo transport until the last century. The urbanization, encroachments, and lack of maintenance of water bodies led to the decline in canal navigation. This project will make these canals more vibrant by providing transport connectivity with a water metro network and a metro network.

3A.4.1 Functional Design

The boats, jetties, navigation aids, walkways and other infrastructure are planned anticipating the holistic development of the five canals thus making the entire stretch navigable. The boating network and infrastructure is customizable and need to be made conducive to the exact situation of these five canals. Hence, during the entire implementation phases of the project, proposed design to be continuously revised against any changes that might occur.

3A.4.1.1 Route network

The canal metro network integrates and overlaps with the water metro as well as with metro lines. Hence the proposed canals metro navigation becomes a feeder service to the existing water metro routes in the vicinity of surrounding water bodies.

a) Near Kuzhuvelippadam Jetty, the canal metro navigation can make an overlap with the water metro routes for some distance as shown in **Figure 3A.32**. Major terminals like Thevara which will be used by both services and will also serve as an 'interchange terminal'. Also, depending on the traffic requirements, the boats plying in one canal can be sent to another canal crossing via the inland waters where water metro will be operating.

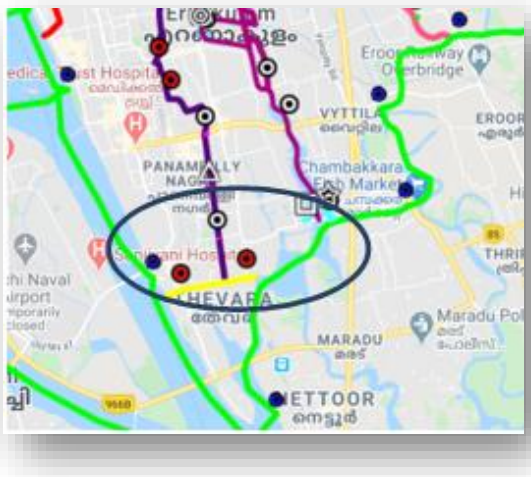


Figure 3A.32: Interchangeable mode (Canal Metro- Water Metro)

b) On the northern end of Thevara-Perandoor Canal and Chilavanoor Canal, the Canal Metro is limited by the irreplaceable railway over bridge as given in **Figure 3A.33**. There is a need to close the gap by extending the Water Metro unto the railway bridge to provide seamless integration between both networks.

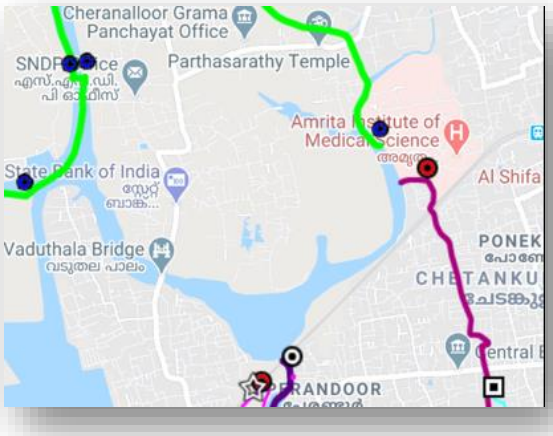


Figure 3A.33: Canal north end: Railway bridge limitation

3A.4.1.2 Traffic study

A traffic study undertaken by NATPAC (2018) shows a preference of the number of passengers and tourists who wish to use the canal metro once the navigation of vessels is restored and made functional in the project canals. This is used as the basis to decide the specification of boats and numbers for the proposed Canal Metro. In addition to that certain boat types are also proposed added based on anticipated functionality which is discussed in the subsequent sections of this chapter

The traffic study undertaken by NATPAC (2018) has two parts:

1. The route survey, traffic study and estimation of passenger ridership.
2. The fleet size requirement for the riders, assuming the frequency and trip duration of boats.

Part (1) of the study has been accepted as will be used for fleet design.

Part (2) was used assuming design speed of 30 kmph (~16 knots) for the boats. Given the cross section of the proposed navigable canal, the distance between the jetties, and the bends in the canal, it is expected that the highest speed of the canal boats will not exceed 11 kmph (~6 knots).

This assumption was applied to decide the fleet capacity in this DPR which is estimated as higher than the NATPAC estimates.

3A.4.1.3 Fleet capacity

The indicative fleet size is decided based on passenger demand, speed of the boat, purpose, time taken per trip etc. **Table 3A.14** shows the indicative fleet size.

Table 3A.14: Fleet size guideline estimation

Adapted from NATPAC Report				Guideline fleet size based on speed				
			Passenger boats				Speed boats	
Sl. No.	Name of canal	Length (km)	Passenger demand/ hour	Minutes per trip with speed of 11 kmph	No. of trips per hour	No. of boats required with capacity of 35	No. of tourists' demand	No. of boats required with capacity of 15
1	Edappally	11.15	379	60.82	1	11	230	15
2	Chilavanoor	11.02	572	60.11	1	16	194	13
3	Thevara - Perandoor	11.25	614	61.36	1	18	56	4
4	**TOTAL**	**33.42**	**1,565**			**45**	**480**	**32**

The above figures run as a guideline however the fleet size was finalized based on jetty service times, size of boats, mix of boats of various capacities etc. These are the indicative numbers for estimation and costing purposes. It is expected that one jetty can service only 3-4 boats in an hour. Also, the number of commuters per hour as per traffic survey has been considered as the upper limit as the reduction in speed may detract some of the office commuters, originally anticipated to be onboard. During the start of the project one boat each for the 3 canals is proposed to be purchased and based on the passenger demand the number of boats has been suggested to be increased by private participation and considered as a possible source for revenue generation.

Increment in the speed will require more CAPEX and OPEX per boat. However, it will result in the reduction of number of boats. Hence the balance on costing can be maintained while customizing the fleet to the real time requirements. The fleet capacity also depends on the uptime of boats, the standby vessel requirements (e.g. Ambulance), the overall jetty utilization and increase in traffic due to canal access by non-metro boats.

3A.4.1.4 Categories of floaters

The following types of vessels that will operate under various agencies were identified as potential candidates for the canal (**Table 3A.15**).

Table 3A.15: Types of vessels with potential candidates

Sl. No.	Type	Potential candidates
1	Canal Metro	1) Passenger Boats; 2) Water taxis; and 3) Luxury Tourist
2	Canal Sports	1) Speed Boats; 2) Kayaks; 3) Water Scooter; 4) Water cycle; and 5) External boats for Competition/Event participation
3	Support system	1) Weed cutters; 2) Dredgers; 3) Garbage collector 4) Floating Pontoons; and 5) Marinas
4	Private/Cargo boats	1) Barges; 2) Mini cargo boats; and 3) Country boats
5	Miscellaneous	1) Chartered customizable pontoons
6	Service Boats	1) Police boats/ RIBS; 2) Patrol Boats; and 3) Fire

Following additional functionalities could be met by this canal network on top of being a Canal Metro service (**Table 3A.16**). Water transport of cargo is less polluting and cheap compared to other modes of transport. Provided a feasible network of markets, logistics hubs will evolve, and transport of cargo will further develop.

Table 3A.16: Additional functions of vessels

Cargo	1) Alternate to road trucks/autos; 2) Pelletized or crated Cargo; 3) Local Produce; 4) products of Coastal small-scale industries; 5) Supplies to/from Ernakulam Market canal; 6) Fish / vegetable market - Alternative to autos at Champakkara market; and 7) Adhoc cargo (sand, cement, silt etc.)
Pontoons	1)Floating Stages; 2) Performance; 3) Floating Jetties; 4) Multipurpose pontoons; 5) Floating advertisers; 6) Floating sports/attention grabbers; and 7) Fireworks.
Barges and Event Boats	1) Water Parades; 2) Wedding reception; 3) Corporate parties; 4) Dinner/ High Tea cruise; 5) Overnight Stay /Night shopping shuttles

However, limiting the scope of floater functionalities to the studies undertaken earlier, and the canal utilization, the following types of fleet mix /vessels are proposed for the project fleet (**Table 3A.17**).

Table 3A.17: Fleet mix proposed for IURWTS project

Type	Cost Header	Unit	Quantity
12m Catamaran (45 pax)	Luxury tourist	no	3
Support system	Software	LS	1
	hardware	LS	1
Wash, Traffic study	Studies	LS	1

3A.4.1.5 Management of boat routes

Canal Metro boats is suggested to be managed in lines and collaboration with the Water Metro. This makes interoperability of boats possible. The large sized boats of Water Metro cannot service the canals, however, vice versa is possible. This gives the extra flexibility for Canal Metro to make some overlap and use the major jetties of Water Metro as the interconnectivity terminals. This also helps to switch the canals via the Inland waters in case of fleet redistribution owing to some public event occurs. Furthermore, for tourist vessels plying in the canals will also give the flexibility to conduct tours like sunset trips and making it possible to venture to the harbor mouth or beyond to visit the sea without changing boats .This is suggested as a source for revenue generation from this project.

The Canal Metro connects to other modes of transport at the following locations (**Table 3A.18**).

Table 3A.18: Interconnection points between Canal Metro and Water Metro

Canal	Canal Metro Jetty	Water Metro Jetty	KMRL Metro Station
Edappally Canal	Edappally	-	Edappally Metro
	Kuzhuvelippadam	Kakkanad	-
Thevara-Perandoor Canal	Perandoor Railway Bridge south	Perandoor Railway Bridge north	-
	Kaloor Market	-	Kaloor Metro
	Kadavanthara		Kadavanthara Metro
	(Extended route)	Thevara KSINC Yard	
	Amrita Hospital Railway Bridge south	Amrita Hospital Railway Bridge north	

Canal	Canal Metro Jetty	Water Metro Jetty	KMRL Metro Station
Chilavanoor Canal	International Stadium		Stadium Metro
	Elamkulam		Elamkulam
	Chilavanoor Bridge/Vallon Road	Vallon Road	

3A.4.1.6 Implementation phases for routes

The followings routes have been identified to be implemented as part of the phase 1 development of the canal.

Phase 1

The following routes is suggested for the Phase 1 operations of the canal through public private partnership.

Route 1: Muttar/Kunnumpuram Recreation Area (Figure 3A.34)

- Trip Type : Water sports
- Vessel types: Kayaks, pedaling boats, mini motorized family boats
- Frequency: Day time, peak at evenings & holidays

Figure 3A.34: Water sports route near Muttar

Route 2: Water sports circuit Edappally (Figure 3A.35)

- Trip type: Circuit

- Vessel type: Catamaran
- Frequency: Day time
- Stoppage: Charging at noon

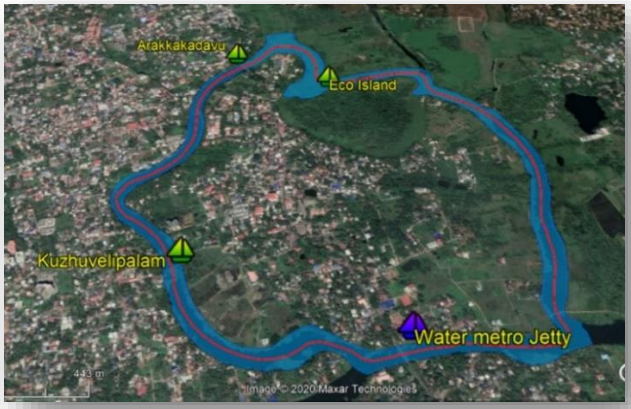


Figure 3A.35: Water sports route near Eroor, around Eco island in Edappally canal

Route 3: Metro Rail – Water Metro Connector (**Figure 3A.36**)

- Trip type: Edappally – Kakkanad Metro Jetty
- Vessel type: Hybrid Catamaran (12 meters)
    - A/C Tourist (35 pax),
    - Cruiser (45-50 pax)
- Frequency: Day time,
- Stoppage: Charging at noon (if feasible)

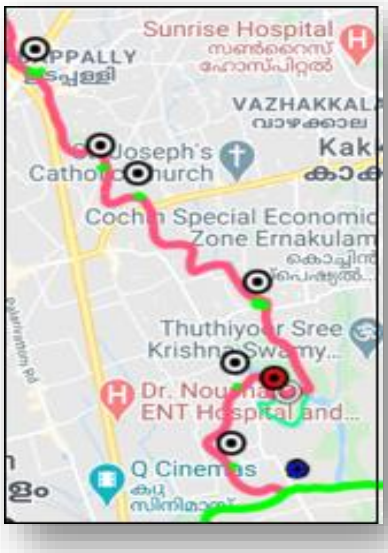


Figure 3A.36: Edappally – Kakkanad Metro Jetty

Route 4: Perandoor/Chinmaya Water Metro Hub Feeder (Figure 3A.37)

- Trip type: Perandoor/ Chinmaya Metro Feeder
    - Color code: Yellow highlight
- Vessel type: Less capacity, 20 pax
- Frequency: As required
- Trip type: Bridging service
    - Color code: Red line
    - Water Metro connectivity expected

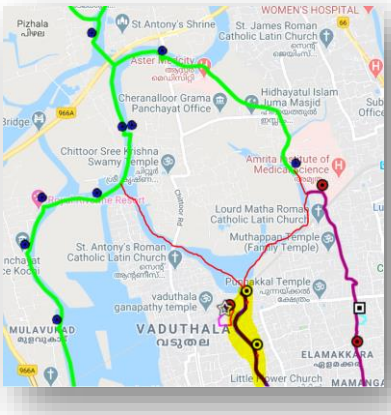


Figure 3A.37: Perandoor/ Chinmaya Metro Feeder

Phase 2

The following Routes shall be considered for Phase 2 operations of the canal:

Route 5: Kaloor-Amrutha Water Ambulance Service (**Figure 3A.38**)

- Trip type: Ambulance service
- Stretch: North of Kaloor metro to over bridge near Amrutha Hospital
- Vessel type: Marine ambulance
- Frequency: On call
- Both end land connectivity is required

Figure 3A.38: North of Kaloor metro to over bridge near Amrutha Hospital (ambulance service)

Route 6: Thevara Hub Canal Feeder (**Figure 3A.39**)

- Trip type: Feeder service to Water Metro
- Stretch: Kadavanthara metro – Thevara KSINC Jetty
- Vessel type: 12 m catamaran
- Frequency: regular

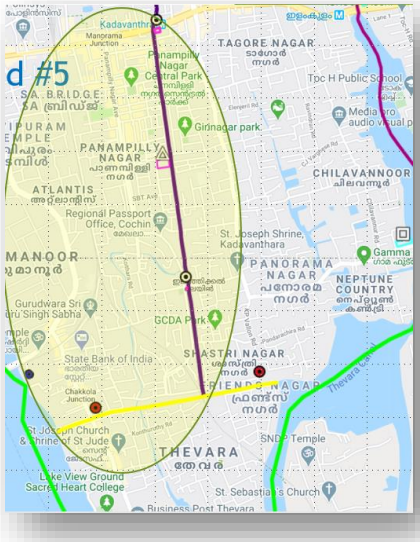


Figure 3A.39: Feeder service to Water Metro (Kadavanthara metro – Thevara KSINC Jetty)

Route 7: Canal Breeze

- Trip type: Tourist boat/ Passenger cat
- Coverage: Entire stretch except state highway bottlenecks
- Edappally Canal
- Thevara Perandoor Canal
- Chilavanoor Canal

The routes identified are very preliminary in nature. These will have to be customized to the external parameters such as progress in canal rejuvenation, location and operation of water gates, Water Metro routes.

Fleet rollout

Although the boats are going to be one the first ones to ply in the rejuvenated canals, currently it is not possible to provide data to predict the requirement of the boats for each canal system. Hence, it is suggested to rollout the boats in phases. The first few boats will be rolled out during a pilot and run extensively in these canals. The lessons learned from the initial phase will be used to refine the specifications to determine and reshape of new boats as well as fleet mix. Later, vessels will be built under series production. Reducing the size of the boat will increase the cost per passenger. This is accounted for, as an added cost in the boat cost calculation (see **Chapter 6** of this report).

3A.5 Navigation Aids

Navigational aids are provided to assist guarantee safe navigation in the canals. Fixed shore structures are to be erected at bridge sites and places where canal joins the water bodies or any other important junction point. Floating light weight moored buoys are to be erected in the wide water bodies to demarcate the waterway at suitable interval to identify the star board limit of the channel at wise sections.

Canal fairway markers, information, warning, and direction signboards are proposed in the canal stretch. Information boards should show the adjacent places with distance. At road bridges, these boards can give the details of the nearby places via road also. Warning signs will show the headway restrictions under bridges, narrow canal, depth constraints, and feeder canal crossings. Canal markers are proposed for marking the fairway passage in wider reaches.

The lights will be fitted on both the facing sides and beneath the structures. It will give the directions to canal and road users. The buoys consist of the following:

3A.5.1 Lateral Buoys or Spars

(a) Port hand marks : These marks indicate the left side of the canal.

By day: Red Buoys, preferably cylindrical (CAN), or red spars. Red cylindrical top mark is compulsory on the spars and on the buoys if they are not cylindrical.

By night: Rhythmic red lights of any type as given in **Figure 3A.40**.

Figure 3A.40: Port hand marks

(b) Starboard hand marks : These marks indicate the right side of the channel.

By day: Green buoys, preferably conical, or green spars. A green conical top mark point upward is compulsory on the spars and on the buoys if they are not conical.

By night: Rhythmic green lights, of any type as given in **Figure 3A.41**.

Figure 3A.41: Starboard hand marks

For the canal having vertical banks on both sides, the buoy markers are not that critical as compared to the estuaries where the starboard sides of the navigable area are marked at every 200 m distance.

3A.5.2 Estimates

The estimates for Navigational items are taken as shown in **Tables 3A.19** and **Table 3A.20**.

Table 3A.19: Estimates for navigational items

Total distance of water way	35 Km
Total Number of turns	25 nos.
Total number of Jetties	30 nos.
Total number of water way intersections	10 nos.
Total number of low draft bridges	60 nos.

Table 3A.20: Quantities of navigational items

Navigational Aid	Item	Quantity	Rational
Sign Boards	Turn Sign board	50	2 sign boards for every turn
	Speed limit Sign board	70	in every 500 m

Navigational Aid	Item	Quantity	Rational
	Hazard Sign board	20	as per site conditions
	General Information Sign	50	as per site conditions
	Jetty Sign board/Name boards	180	4 sign boards for every Jetty
Buoys	Centre line buoys in water way	140	in every 300m
	In Jetties	60	2 in every jetty
	Water way intersections	40	in every intersection
	Emergency& reserve deployable Buoys	10	as per site conditions
Overhead arch sign boards	Low air draft warnings	120	2 in every low draft bridge
	Direction sign boards	70	in every 500m

**Note: These are normal illuminated signboards. Electronic/ IT enabled systems on jetties and onboard is not accounted for here.*

3A.6 Jetty and Jetty Terminals

3A.6.1 Need for jetty and jetty terminals

The lack of connectivity of ferry service into the urban fabric through the inland canals is considered as a major limitation for development of water transport in Kochi city limits. Water transport systems in cities like Amsterdam and Venice have been successful due to a large network and connectivity to different parts of the city. Even then, water systems find it hard to compete with the convenience provided by the door-to-door connectivity of roadways. This project's main aim is to restore navigation in 5 inland canals cutting across the heartlands of Kochi city.

The northern and southern side of the project catchment provides a good waterfront for ferry movement. The connectivity of ferry service to both ends cutting through the heart of the city through the inland canals is not possible in the project command as per the present condition. These canals are narrower and do not have the required navigable depth. Unchecked encroachment through illegal construction activity and dumping of solid waste has further reduced the capacity of these systems to support transportation.

This project aims at restoring the canal systems to its original state and make it pollution free. This will help in extending the ferry service from the northern end to the southern end for the 5 canals in the project command. Outside the project command and inside the Kochi city limits there are 6 more important canals which are in the same state as given in **Figure 3A.42**. A holistic approach to restore these

inland canals and make them navigable and pollution free is also the need of hour and action needs to be taken by the administrative authorities in this regard.

The activities involved in this project are to 1) restore the canal to its original state and provide navigation facilities, and 2) to provide jetties and jetty terminals for embarking and disembarking based on PHPDT of the passengers.

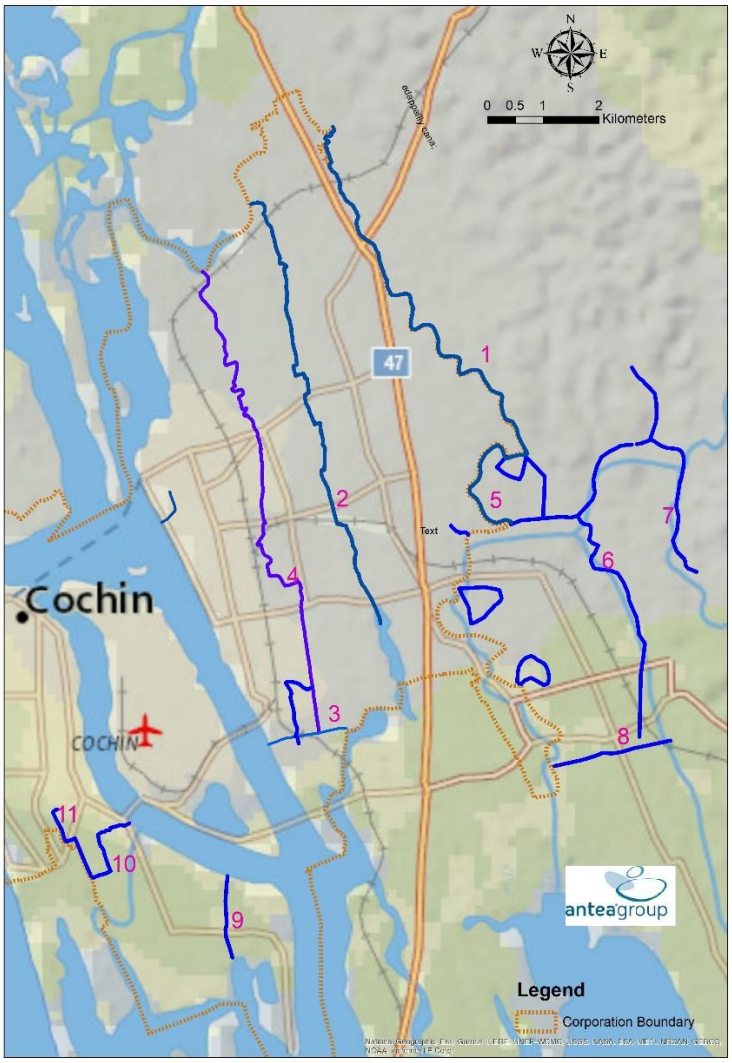


Figure 3A.42: Major canals under Kochi corporation limits needing improvement

3A.6.2 Traffic survey

Canals are artificial waterways made for the purpose of irrigation or navigation or both. Canal transport requires a huge amount of capital investment in construction and maintenance of its track. Hence the cost of the canal transport is, therefore, higher than that of river transport. To add to it, the cost of maintaining water in the canals is also a big problem of canal transport. Hence traffic survey and the PHPDT results

based on the survey are very important for the development of better infrastructure and to decide on the location and facilities to be provided at the Jetties along the canal. Traffic survey can also help to

1. Increase the efficiency and life of canal systems
2. Decide on managing the traffic volume at a particular jetty
3. Provide better means for development of infrastructures
4. Provide better means to utilize water transport in case of special events in the city
5. Provide estimate of number of boats required against the number of passengers using this service.

Detailed traffic study data obtained from secondary sources were used for deciding on the PHPDT of passengers. Traffic survey undertaken for the inland canals in 2018 by National Transportation Planning and Research Centre (NATPAC), a Govt. of Kerala institute of eminence in transportation and planning, and Centre for Public Policy Research (CPPR), a think-tank dedicated to intensive research on economic, social, and political issues (2015), for the ferry service in the surrounding water bodies was used. Based on the passenger traffic survey undertaken by CPPR[5], the apprehensions of passengers utilizing the existing ferries and jetties in the surrounding water bodies is given in **Figure 3A.43, Figure 3A.44** and **Figure 3A.45**.

The major improvements sought based on the above survey results have been addressed for the facilities provided at the jetties, jetty terminal and in boats for this project.

The PHPDT to decide on the hourly passenger density for the jetties proposed under the project canals were analyzed from the secondary sources referred above and details given in section 2.4 of **Chapter 2**, (Requirement/Demand Analysis) and under navigation section 3A.4 of this chapter.

[5] CPPR "A study on inland transportation in Kochi city region", Working paper series (2012)

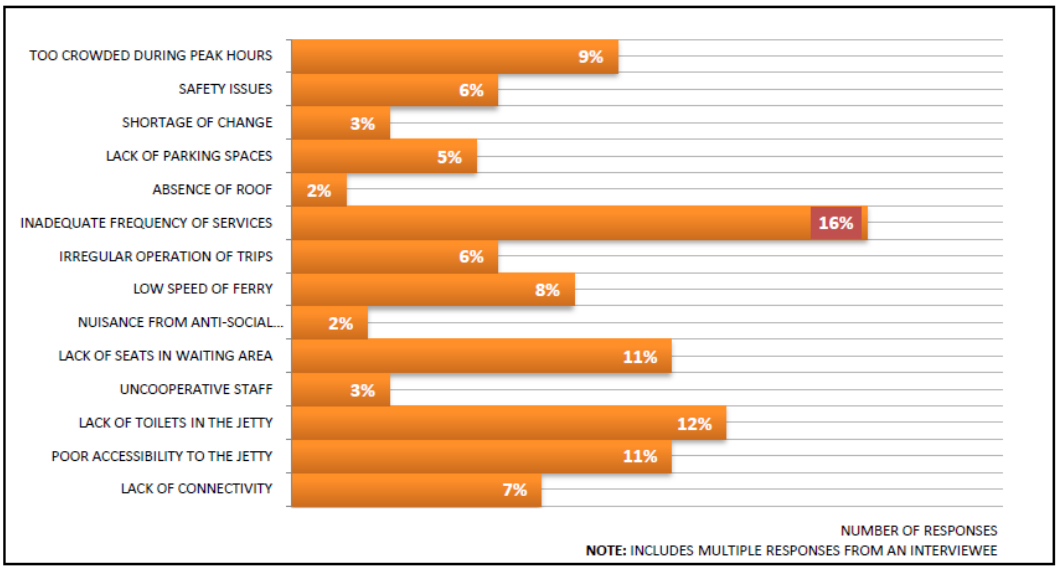


Figure 3A.43: Problems faced by ferry users *(Source: CPPR (2015))*

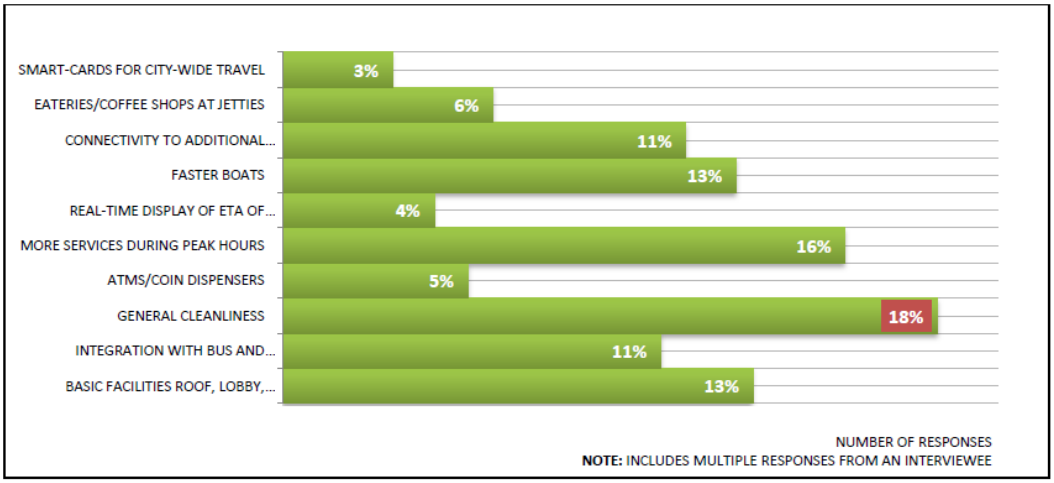


Figure 3A.44: Improvements sought in the ferry system as a whole *(Source: CPPR (2015))*

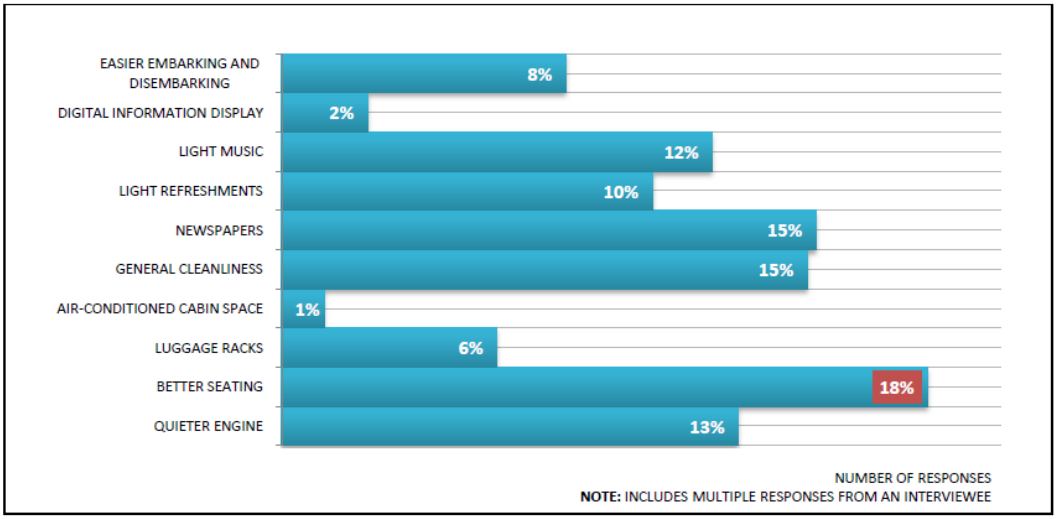


Figure 3A.45: Improvements sought in the ferry vessels *(Source: CPPR (2015))*

3A.6.3 Parametric analysis for fixed and floating jetty

The design features of the Jetty will have the greatest impact on the capital costs particularly dimensions of the jetty, type of jetty, structural capacity, material selection, provision of services, compliance and decisions about safety, existing site conditions, design life. Considering these factors Jetties can be either constructed as floating jetties or as jetties with a fixed height depending on the expected changes in water levels/ tidal range. The comparison between fixed and floating jetty is given in **Table 3A.21**.

Table 3A.21: Comparison: Fixed and Floating type jetty

Description	Fixed	Floating
General	Level does not change with respect to the tidal variations, hence different stepped levels have to be provided	Level varies along with the change in tile levels
Length of jetty	Length of the jetty will be long where there is large tidal fluctuation to aid for different levels	Length of jetty can be comparatively small
Cost	Low capital and maintenance cost	High capital and maintenance cost
Space requirement	Space requirement less for area where there is less tidal variation	More area required
Additional structures	No major additional structures required	Additional structures such as gangway, restraining piles etc. required.
Maintenance cost	Comparatively less	Comparatively high
Desilting	No issues while desilting	Jetty need to be moved while desilting and frequency of siltation is high.

Taking into consideration these factors a fixed type jetty is proposed for the project.

3A.6.4 IURWTS project: Jetty

In the planning process of fixing the locations of the jetties the first and last mile connectivity was one of the primary factors considered. The navigational width of 16.5 m has been estimated for 2-way movement in these canals.

The passenger's willingness to shift from public transport mode to canal mode have been studied in detail by a passenger traffic survey undertaken by NATPAC (2018). The next factor considered for fixing the location of the jetty and jetty terminals was based on the analysis of the passenger traffic survey to use the locations. A total of 30 jetties and jetty terminals along the 5 canals is proposed in this DPR.

The location details of the jetty and jetty terminals for the 5 canals are given in **Annexure 3A.6** to this DPR.

The IURWTS jetty location plotted on a google map shows the interconnectivity with Water Metro and Rail Metro (**Figure 3A.46)**.

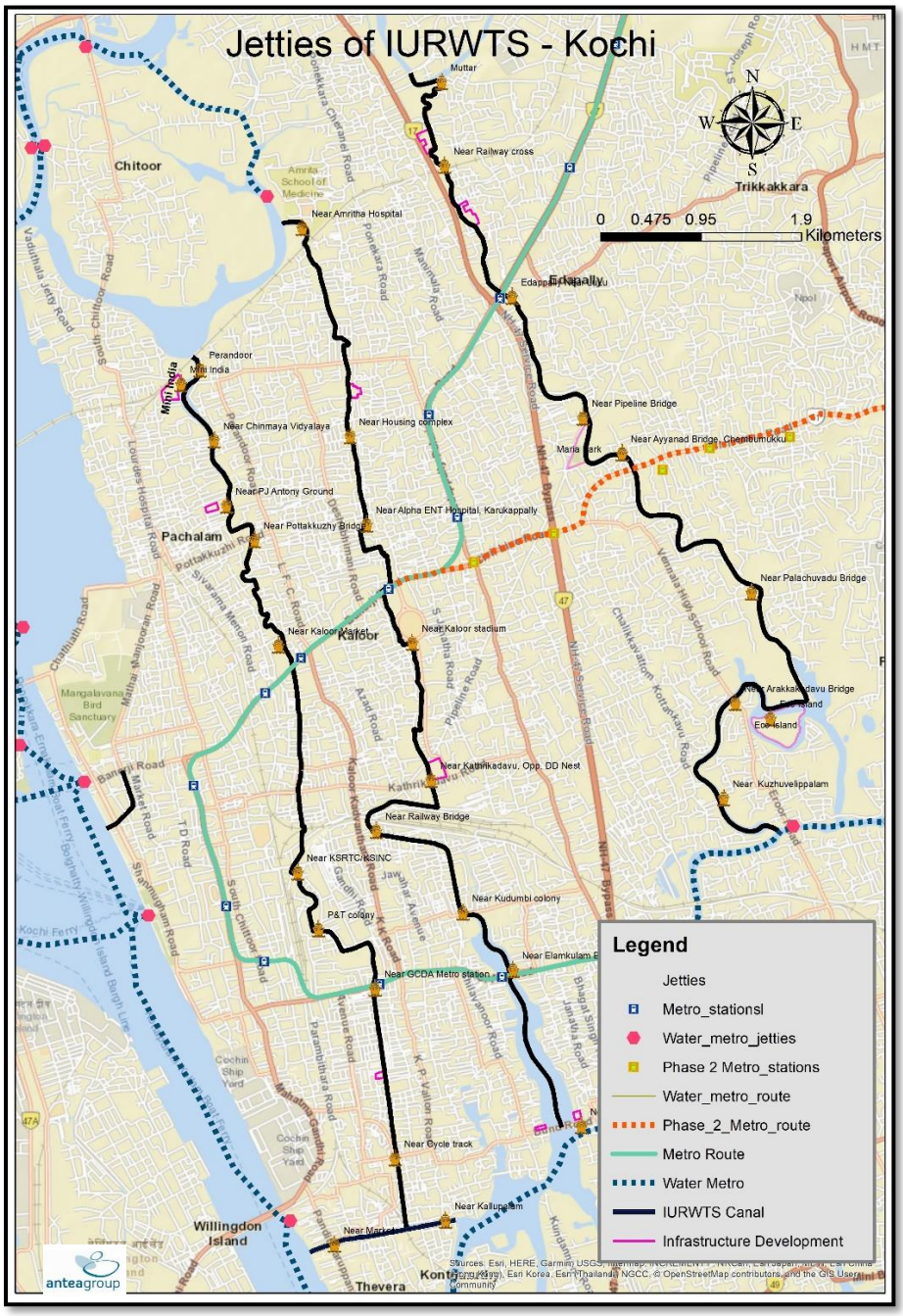


Figure 3A.46: Intermodal connectivity of the Canal Metro- Water Metro- Metro Rail

The jetties proposed are along the shoreline without any protrusions into the canals so that there is no hindrance in the movement of the vessels in both directions. The depth of capping beam over the sheet piles is increased to aid for the berthing of the boat. Taking into consideration the tidal variation the jetty is proposed to be of two level (+)1.0m an (+)1.2m. Taking in to consideration the passenger capacity, the vessel dimensions, standards for physical disabled etc. the dimension of the berthing area is fixed as 10.4

m x 3.0m. Two number bollards are provided on the jetties for the mooring of the vessels. To prevent any aberration for the vessels and the jetty fenders are provided at different heights. provision for EV charging facility is also provided at 10 selected jetties, as the vessels proposed for the project is electric.

The jetty terminals can be categorized as presented in **Table 3A.22**.

Table 3A.22: Area based categorization of jetty terminal facilities

Sl. No	No. of Jetties	Category	Size
1	3	Type A	Built-up area = 80 sqm
2	27	Type B	Built-up area = 70 sqm

The facilities proposed for the individual jetties are fixed based on the land availability at the jetty terminals and passenger density. Minimal facilities have been provided in majority of the jetties reducing the capital cost and operating cost arising while manning the jetties. The terminal structures are mainly aesthetically pleasing steel structures with more opportunity for revenue generation through advertisements. In commercially viable locations the plan area is increased, and all the facilities have been provided to increase the comfort level of the passengers.

The general facilities provided at the jetty terminal are presented in **Table 3A.23**.

Table 3A.23: General facilities provided at the jetty terminal

Category	Facilities provided	Area	Nos.
Type A	Parking Space	30m X 20m	
	Waiting area	9.55m X 2.67m	
	Toilets	2.26m X 3.80m	2 nos.
	Landing area	4.00m X 3.00m	2 nos.
	Ramp1	2.00m X 4.80m	
	Ramp2	2.40m X 3.00m	
Type B	Parking Space	30m X 20m	
	Waiting area	9.55m X 2.67m	
	Landing area	4.00m X 3.00m	2 nos.
	Ramp1	2.00m X 4.80m	
	Ramp2	2.40m X 3.00m	

Based on the total land availability, the car parking facilities provided for the jetty terminals are brought under 4 categories and given in **Table 3A.24**.

Table 3A.24: Details of parking facilities provided at Jetty terminals

Sl. No	Jetty #	Nos	Category	
1	#3	1	Category I	**'Type A'** with parking space 600 sqm
2	#5, #6,#15,#18	4	Category I	**Type B'** with parking space 600 sqm
3	#17, #27	2	Category II	**Type A'** with parking space between 600sqm- 150 sqm
4	#1, #2, #4, #7, #8,#13,#22,#23,#24	9	Category II	**Type B'** with parking space between 600sqm- 150 sqm
7	#10, #12, #14, #16,#25,#26,#30	7	Category III	**Type B'** with parking space less than 150sqm
8	#9,#20	2	Category IV	**Type B'** without parking space
9	#29	1	Category V	**Type B'** with parking space less than 150sqm
10	#19, #11,#21,#28	4	Category IV	**Type B'** without parking space

3A.6.5 Access Road to Jetty Terminals & Electric Buses

For the nearest road to the jetty terminal improvement and reconstruction of roads will help the electric buses operating from the terminals at regular intervals to have a comfortable access to the next mode of connectivity for the passengers. Land acquisition proposal for a length of 300 m from the terminal at required jetty terminal locations have been included in this DPR.

3A.6.6 Corporate Office of SPV, Operation Control Room and Lab

To manage the post development activities of the project, a corporate office building for special purpose vehicle (SPV) will be constructed at Edappally Lulu jetty. A laboratory is also considered vital in the project

to periodically test the water quality in the canal and record tidal fluctuations. A master operational control room is also proposed to be built at this location connected to the CCTV installation. This is to ensure the proper control on the navigating vessels and to take care of the safety aspects of the passengers and the boats plying in the canal.

The building planned has 3 floors with a plinth area of 1200 m^2. At regular intervals along all canal stretches, CCTVs will be installed to monitor the activities along the canals and to provide emergency help if required.

The typical concept design of an IURWTS jetty type is as given in **Figure 3A.47**.

The detailed engineering part of Jetties and related structures is given in **Chapter 4A** (Engineering Design) of this DPR.

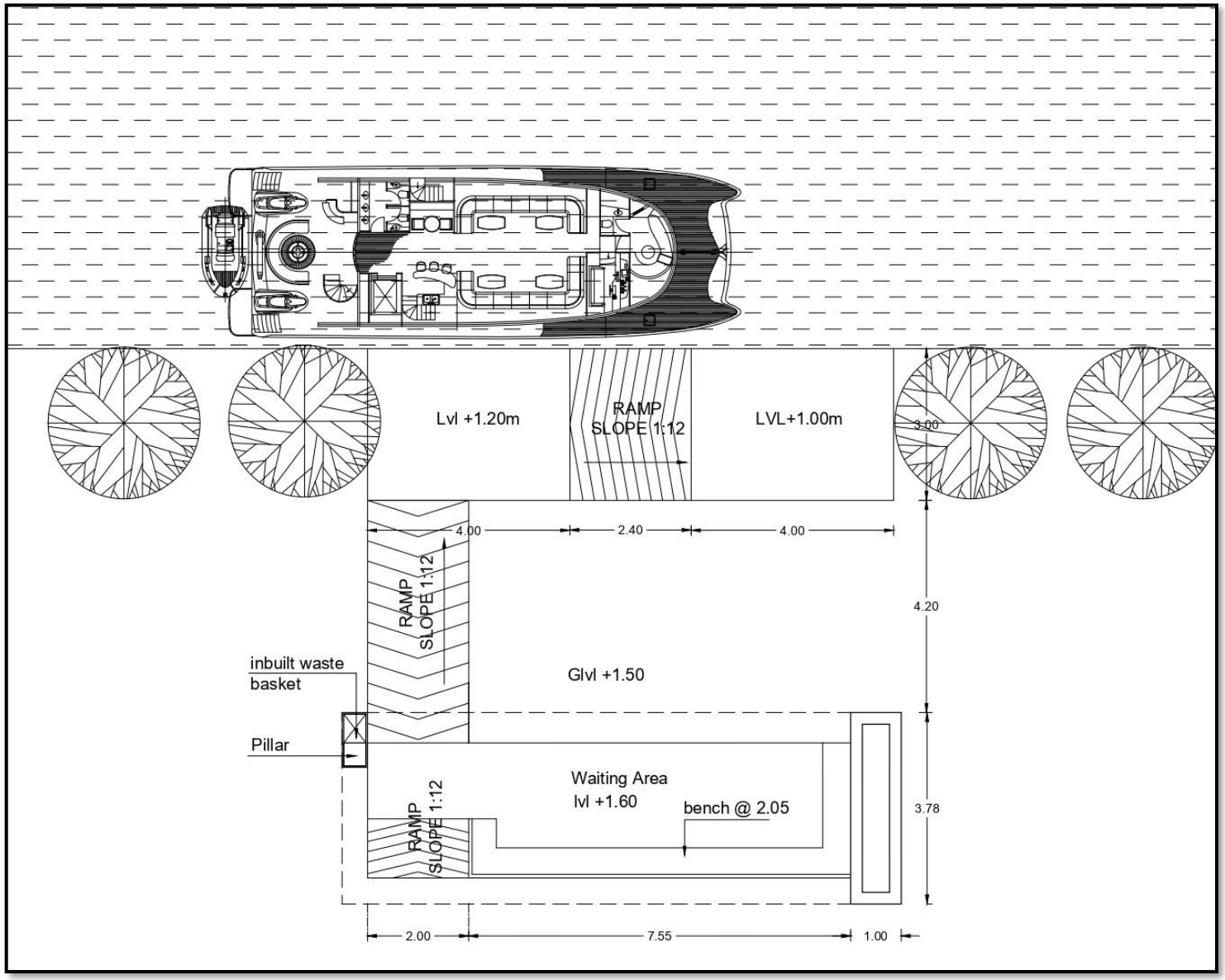


Figure 3A.47: Concept design of proposed IURWTS jetty

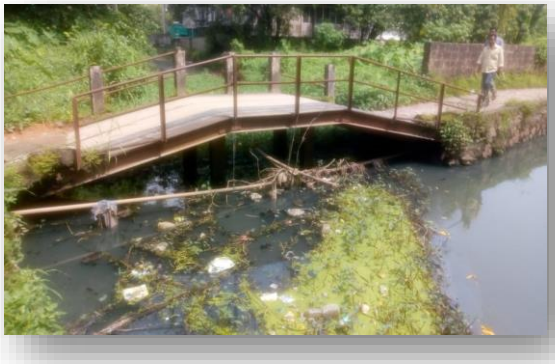
3A.7 Cross Structures: Road and Foot Bridges

Reconnaissance survey conducted by Antea group, revealed that the road bridges and foot bridges are constructed in an unplanned manner across the canals by different stakeholder departments and private agencies. The bridges constructed were by reducing the existing vent ways and without adequate vertical clearance. The situational analysis of a few road bridges and foot bridges showing constriction in the vent way and lack of vertical clearance is shown as photographs is as given in **Figure 3A.48**.

Ch8700 Bridge constructed reducing vent way (T-P canal)

Ch 8300 Vent way encroachment bridge across Chilavanoor canal

Ch 5570 Chilavanoor canal vertical clearance less than a metre



Ch 3460 Chilavanoor canal reduction by private foot bridge and creating blockage

Ch 8200 Foot bridge construction reducing water way in Chilavanoor

Ch7330 Lack of vertical clearance of foot bridge and utility crossing at Chilavanoor canal

Ch 4150 Private bridge to infrastructure property (T-P canal) with encroachment in Vent way

Private bridge encroachment in vent way by private owners in Chilavanoor canal

Figure 3A.48: Situational analysis of bridges in IURWTS project command

As a part of restoring navigation in the canal, road bridges and foot bridges need to be reconstructed to the navigation standards for two way movement and adhering to a vertical clearance of 4m. From field survey undertaken by Antea Group in December 2019, it is estimated that 56 road bridges constructed by Government department (PWD, Corporations) and 31 foot bridges need to be reconstructed across the 5 canals. The canal wise abstract of Road bridges/FOB to be reconstructed is given in **Table 3A.25**.

Table 3A.25: Abstract of bridges to be reconstructed

Description	Road bridges (nos.)	Foot bridges (nos.)
Edappally Canal	11	1
Thevara – Perandoor Canal	23	13
Thevara Canal	2	0

Description	Road bridges (nos.)	Foot bridges (nos.)
Chilavanoor Canal	20	16
Market Canal	-	1
Total	**56**	**31**

The road bridges and foot over bridges to be reconstructed for all the 5 canals, as plotted on a GIS platform and the image is given in **Figures 3A.49, 3A.50, 3A.51, 3A.52, 3A.53** and **3A.54.** The tabular form (with chainage, latitude & longitude, and photographs) is given as **Annexure 3A.7**.

Figure 3A.49: Road bridges to be reconstructed in Thevara canal

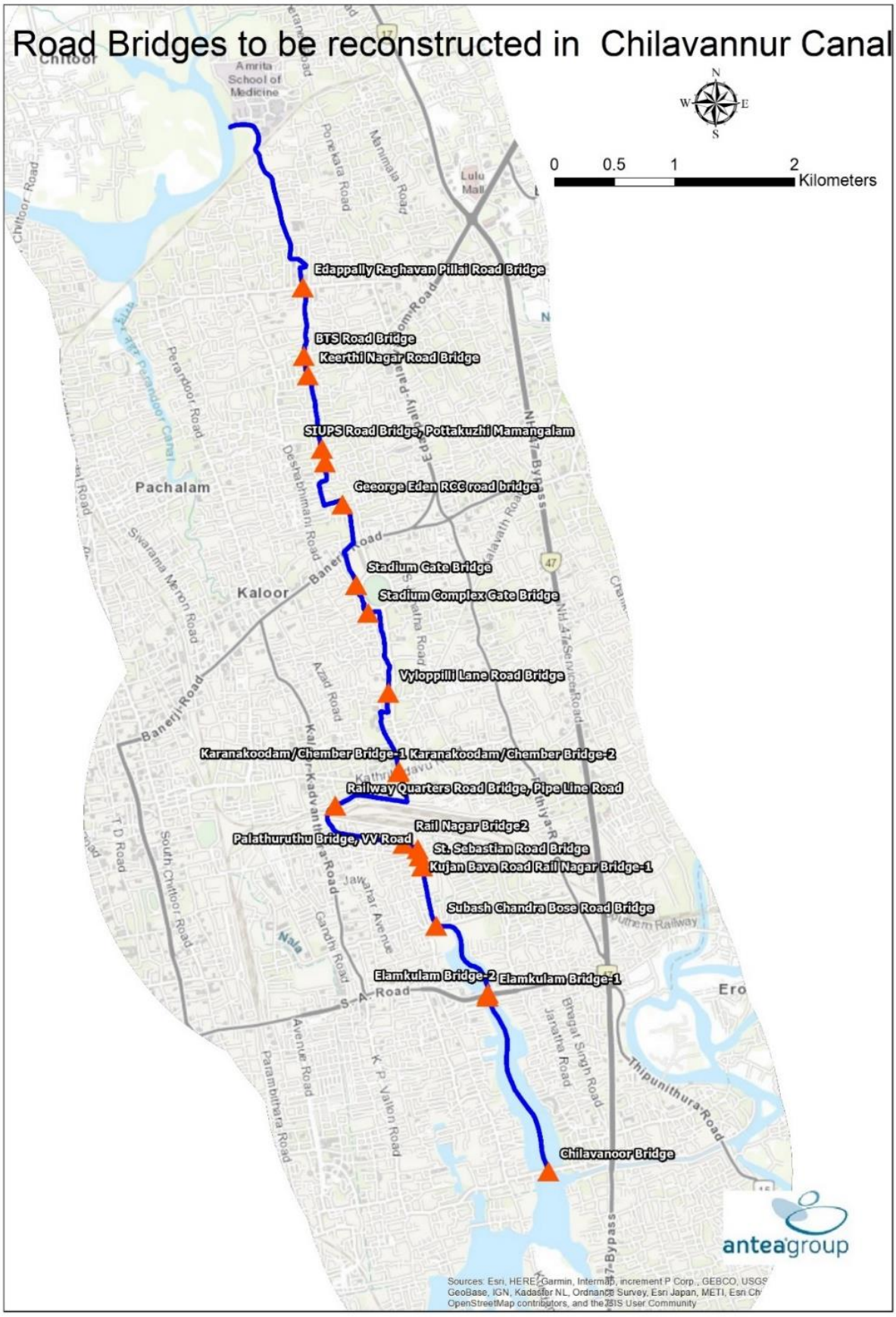


Figure 3A.50: Road bridges to be reconstructed in Chilavanoor canal (1)

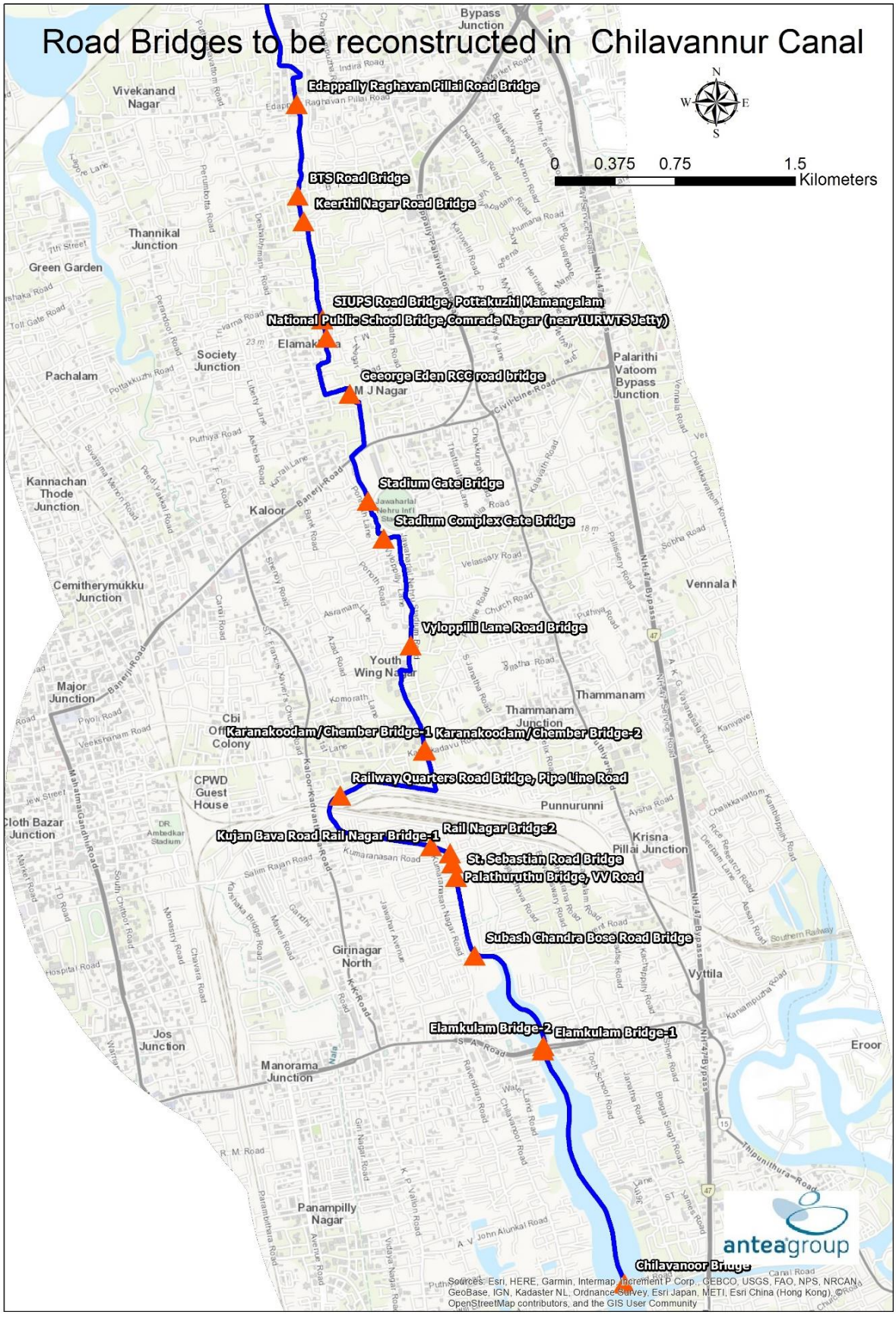


Figure 3A.51: Road bridges to be reconstructed in Chilavanoor canal (2)

Figure 3A.52: Road bridges to be reconstructed in Edappally canal

Figure 3A.53: Road bridges to be reconstructed in TP canal (1)

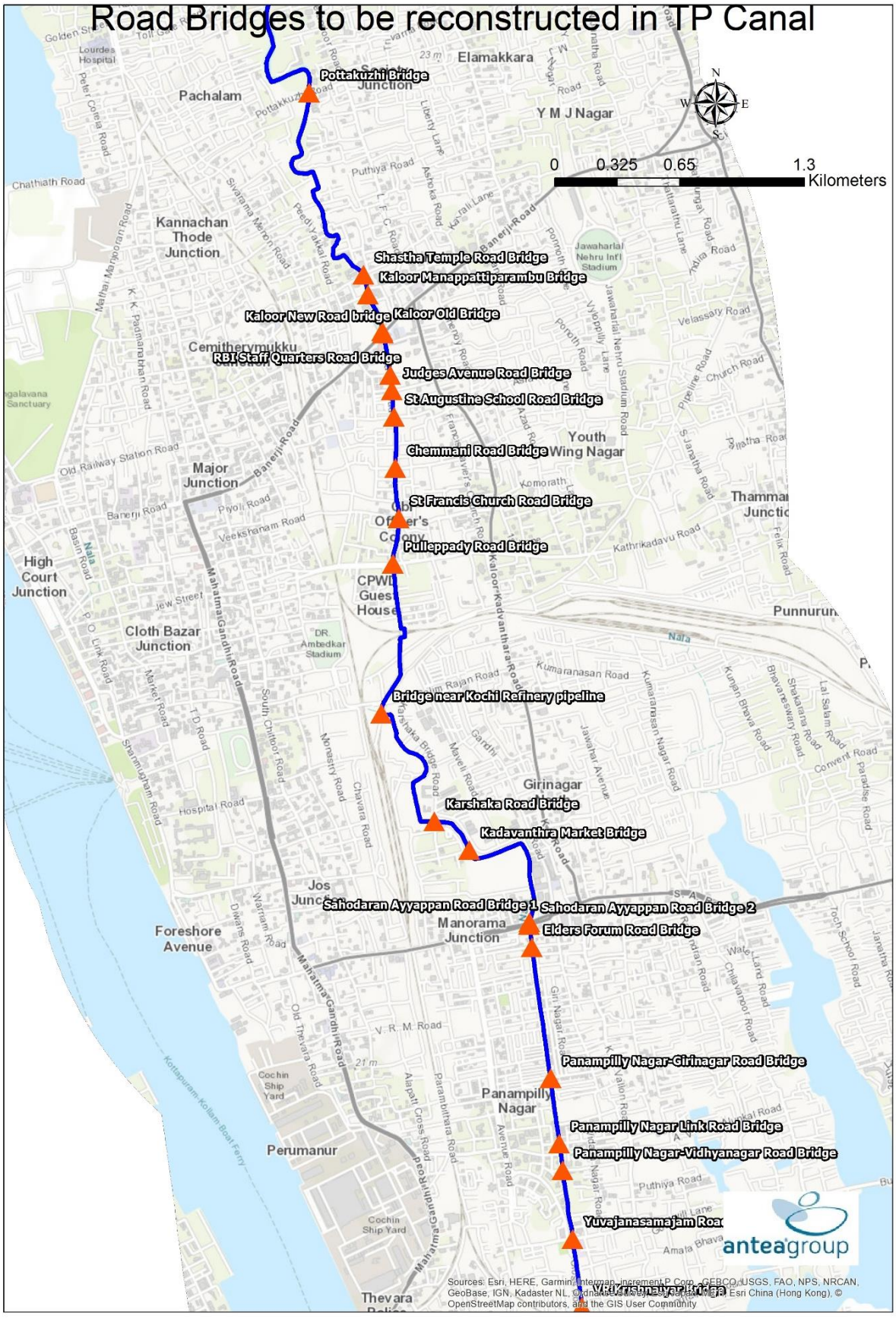


Figure 3A.54: Road bridges to be reconstructed in TP canal (2)

In addition to the reconstruction of foot bridges, 15 numbers of new foot bridges are also proposed for crossover of new sewer lines under this project and to accommodate the demand from other stake holders like KWA (pipe lines), KSEB (electric cables), etc. during the course of the development activities.

During floods, the afflux on the upstream sides of the bridges causes overtopping of flood waters and resulting in recurrent flooding in the low-lying areas of the command. The photographs of flooded state of the project command during an extreme rainfall event on 20th Oct 2019 is given in **Figure 3A.55**.

The design width required to accommodate the flood mitigation and navigation requirement is estimated as 16.5m. The vertical clearance of 4m is to be provided as per the guidelines of Inland Water Ways in India (IWAI) regulations (Amendments), dated 07-11-2016.

Flooding in South railway station, Ernakulam

Railway lines flooding with train service stopped

Flooding in Panampally Nagar -Thevara Perandoor canals side, Kochi

Flooding in M-G road, Kochi

Flooding in Edappally junction, Kochi

Kochi interiors flooding

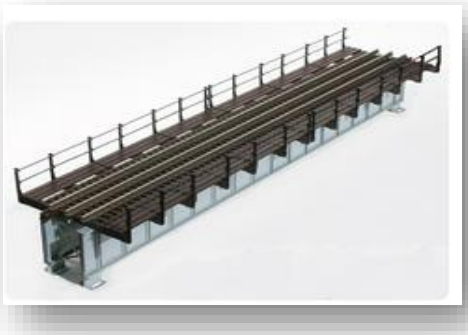
Figure 3A.55: Photographs of flooded state of the IURWTS command

3A.7.1 Different types of bridges

Bridges are classified based on function, material, and type of construction. A parametric analysis is made to study good practices based on the site condition, ease of construction, appearance & sustainability aspects. A few types of bridges are given in **Table 3A.26**.

Table 3A.26: Classification of Bridges

Classification of Bridges Based on Function	
Roadway Bridge- For the Vehicular movement across the canal	
Foot Over Bridge (FOB)-For Pedestrian & Cycle movement across the canal	

Railway Bridge- For the Rail movement across the canal	
Classification of Bridges Based on Material	
Concrete Bridge- Made up of RCC as Arch bridge, Girder bridge or Rigid frame bridge	
Steel Bridge-Made of Steel structure as Truss girder or plate girder.	
Timber Bridge-Made of Timber with a truss configuration	

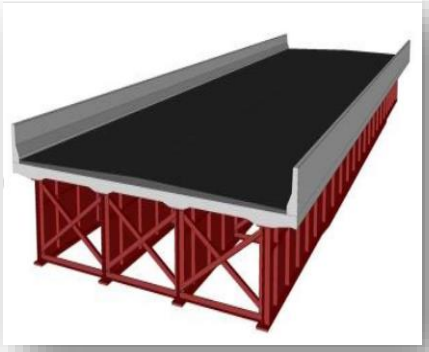
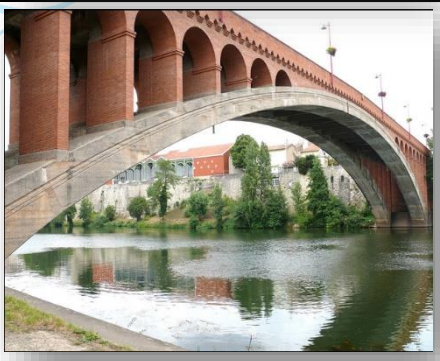
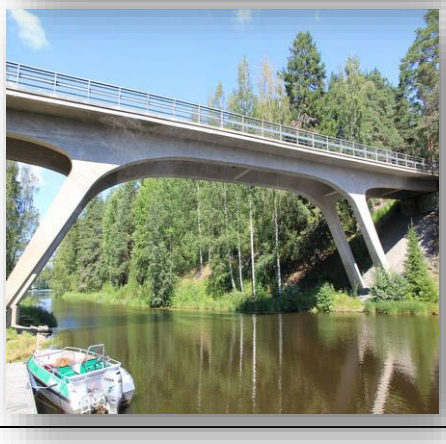
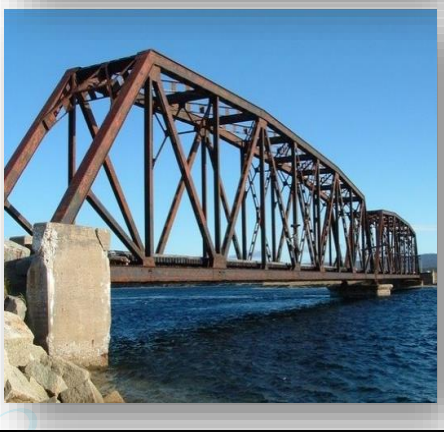
Composite Bridge-Comprises of Steel or Concrete girder with RCC deck slab over Corrugated decking sheet	
Classification of Bridges Based on Type of Construction	
Suspension Bridge-A suspension bridge is a type of bridge in which the deck is hung below suspension cables on vertical suspenders. The basic structural components of a suspension bridge system include stiffening girders/trusses, the main suspension cables, main towers, and the anchorages for the cables at each end of the bridge	
Arch Bridge-An arch bridge is a bridge with abutments at each end shaped as a curved arch. Arch bridges work by transferring the weight of the bridge and its loads partially into a horizontal thrust restrained by the abutments at either side	
Rigid Frame Bridge-A Rigid-frame bridge is a bridge in which the superstructure and substructure are rigidly connected to act as a continuous unit. Typically, the structure is cast monolithically, making the structure continuous from deck to foundation	

Plate Girder Bridge-A girder bridge, in general, is a bridge that uses girders as the means of supporting the deck. A bridge consists of three parts: the foundation (abutments and piers), the superstructure (girder, truss, or arch), and the deck	
Truss Girder bridge-A truss is a bridge superstructure made up of members whose ends are linked together at joints. Each member are subjected principally to axial loads only. A girder, on the other hand, is a horizontal member made from extruded steel section ion or built up by welding steel plates to form a solid webbed member.	
Corrugated steel plate arch bridge (CSP): -A bridge which, through interaction between an arch of corrugated steel plates founded on concrete or steel footings. and the surrounding soil, provides the required bearing capacity	

A comparison study was undertaken for a few commonly used types of bridges suitable for this project command and is given in **Table 3A.27**.

Table 3A.27: comparison study for a few commonly used types of bridges

Classification	Suspension Bridge	Steel Truss /Girder Bridge	RCC Bridge	Precast Prestressed Girder Bridge	Corrugated steel plate bridge
Features	Better to withstand earthquake movements than heavier and more rigid bridges	Steel can fully meet the structural requirements with even small sections	Arches are preferred when more bending moments occur	Material & labour savings on mild reinforcement. Enhanced corrosion resistance	Material & labour savings by introduction of arch of corrugated steel plates
Maintenance cost	Maintenance cost is high as cable needs to be changed	Maintenance for rusting of steel must be done regularly which increases the cost of maintenance	Maintenance cost is very small	Maintenance cost is low	Maintenance cost is very small. Galvanised corrugated sheet is highly durable and long lasting
Appearance	Good aesthetic features	Aesthetic features are not good due to stiffeners and cross diaphragms	Fare aesthetic features can be achieved with arch bridge option	Generally considered as acceptable	Very Good aesthetic features
Installation time/cost	Installation takes time	Quick Installation	Take longer time for Installation	Installation cost is high as heavier cranes are required	Quick Installation
Approx. cost for 16.5m span / 8 m width	INR 2,25,00,000	INR 1,88,00,000	INR 1,55,44,000	INR 1,80,00,000	INR 1,34,00,000

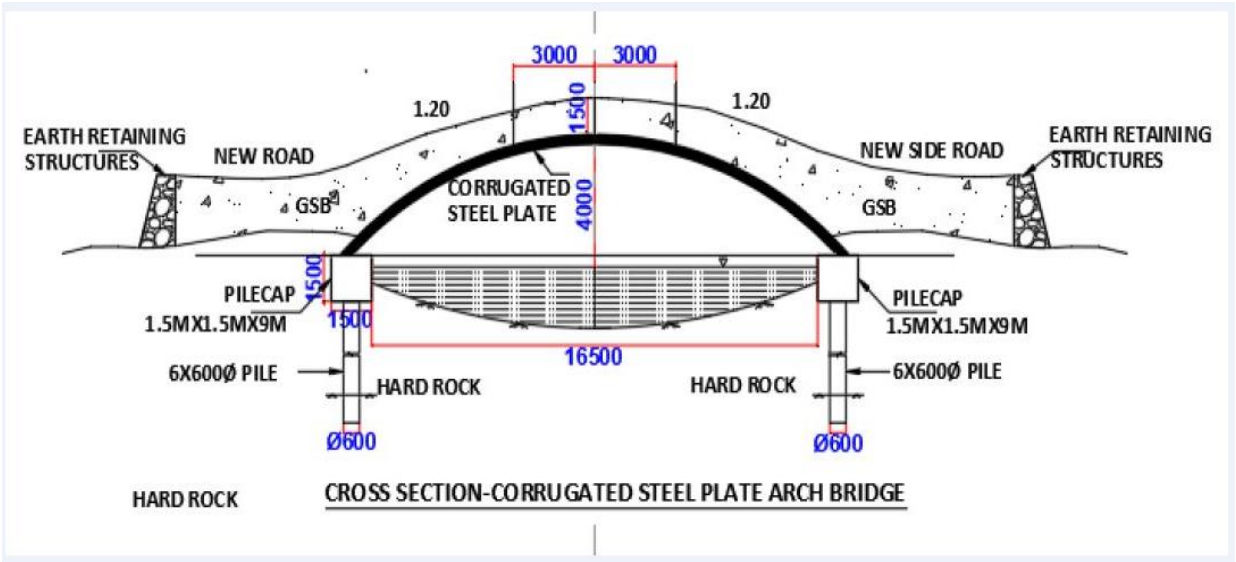
Based on the parametric analysis undertaken and to have an aesthetically pleasing innovative design a few types of bridges have been analyzed. A detailed cost estimation is worked for CSP option only. Corrugated Steel Plate arch bridge has been preferred and studied for the reconstruction of road bridges. Most of the existing bridges which has to be demolished and rebuilt are experiencing heavy/medium traffic and time required to finish the work should be kept bare minimum as possible.

Even though CSP arch bridge is more advantageous over other types of bridges as per limited data available during the concept design, a site specific suitable type of bridges will be selected during the detailed design & estimation phase (based on site condition, geotechnical data, resource availability etc.).

Global examples are given in **Figure 3A.56**.

CSP arch bridge across river

CSP road bridge



Typical Cross Section of CSP arch bridge

Figure 3A.56: Global example of CSP arch bridge

A landscape architect's perspective of CSP arch bridge across canal is shown in **Figure 3A.57**.

Figure 3A.57: A landscape architect's perspective of CSP arch bridge across canal

Depending on the function they serve, virtually all crossover structures accommodate a variety of users (i.e., 4-wheelers, heavy load vehicles, 2-wheelers, pedestrians, cyclists, etc.).The road and foot bridges crossing canals are already functional and serve the need of the users and hence no separate traffic study has been undertaken.

3A.7.2 Approach Road to Road Bridges with Gradient Correction

The existing bridges have only an average vertical clearance of 1.5 m to 2.0 m above the mean tidal level of +0.5m MSL. In order to restore the canals to navigational standard a minimum vertical clearance of 4 m is needed. By way of raising the clearance height to 4 m, gradient correction is needed on either side of the road bridge for a length 30m taking a gradient of 1: 12. It is also proposed to develop the approach road on either side by 100 m of the newly reconstructed bridge. The additional land required on either side is included in land acquisition proposal.

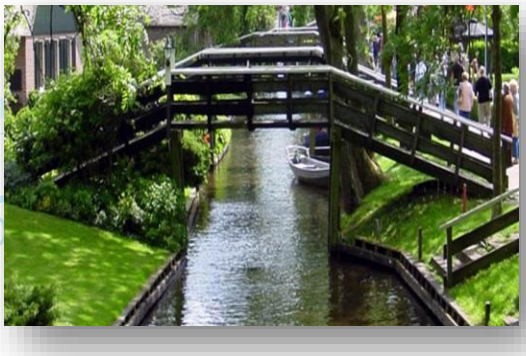
3A.7.3 Foot bridges

Safe, convenient, and well-designed foot over bridge facilities are essential to encourage use by pedestrians, and cross over by cyclists. Foot over bridges designed to accommodate pedestrians are mainly used by young children who may require special consideration in the design to cross over particularly onto neighborhood streets, in recreational areas, and close to schools.

A parametric study of various types of Foot over bridges most commonly used are presented in **Table 3A.28**.

Table 3A.28: Comparison of various types of Foot over bridges

Comparison of RCC, Steel, Suspension, and wooden Foot over bridges			
Classification	**Features**	**Approximate cost for 16.5m span/2 m wide**	**Typical Project photos**
Suspension Bridge	Most suitable for longer spans and which require good architectural Features	INR 7,500,000	
Steel Truss /Girder Bridge	Steel bridge is the most common FOBs used in the world for longer or shorter span with wide range of architectural Features. Made of Steel structure as Truss girder or plate girder with concrete deck or checkered plate as floor element	INR 4,000,000	

Comparison of RCC, Steel, Suspension, and wooden Foot over bridges			
Classification	**Features**	**Approximate cost for 16.5m span/2 m wide**	**Typical Project photos**
RCC Bridge	For short spans, the simplest form of bridge deck is a concrete slab. Arch bridges are widely used bridge system for FOB of short to medium span	INR 3,500,000	
Timber Bridge-Made of Timber with a truss configuration	Is used in short span only. Not common in public places and durability also less	INR 7,000,000	

Out of the available FOB options depending on material, Steel bridges with good anti corrosive protections are preferred as compared to RCC or wood bridges due to following reasons:

- Ease and time of construction due to use of prefabricated structure
- Only Light crane can be used, and space required for installation is also very less.
- Any type of architectural features can be introduced in steel bridges
- Impact on pedestrian/cycle movement is very low due to very low construction time

The existing foot bridges across the 5 project canals are all serving the needs of the pedestrian for cross over. Considering the need to widen the canals after removing the encroachers, a reconnaissance survey was undertaken by Antea Group in December 2019. The location details of proposed reconstructed foot bridges are given in **Annexure 3A.7**.

A total of 31-foot bridges need to be reconstructed. Steel foot bridges are the best option as the design of these bridges are aesthetically pleasing as well as functionally and environmentally sustainable. Considering the need for cross overs for sewer lines, pipelines and other utilities and also anticipating future need an additional 15 bridges is also included.

A conceptual design of a steel foot bridge with a span of 16.5 m and with vertical clearance of 4 m is given in **Figure 3A.58**.The engineering design aspects of the foot bridge is provided in **Chapter 4A.**

Figure 3A.58: Concept drawing for a foot bridge across IURWTS canals

Global examples are given in **Figure 3A.59**.

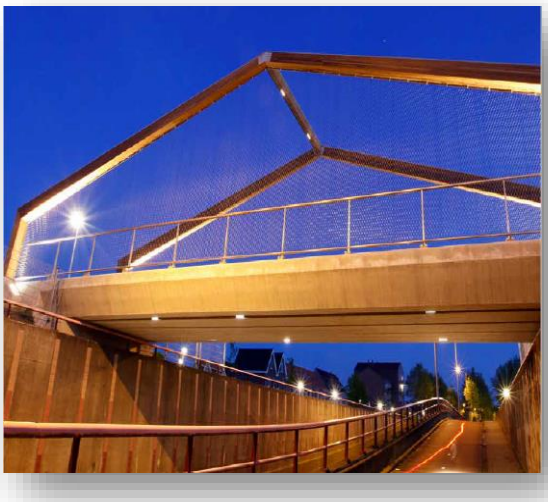


Figure 3A.59: Global example of Foot over bridges

3A.8 Development of Konthuruthy Canal (Additional work)

Introduction

Konthuruthy canal starts from Thevara canal at latitude 9^0 56'40.95" N and longitude 76^0 17' 49.32"E. The canal traverses in a southerly direction from Thevara canal for a length of 657m and joins Konthuruthy puzha. The location sketch as seen in a google image is given in **Figure 3A.60**.

Figure 3A.60: Konthuruthy canal as seen on a google map

3A.8.1 Situational analysis

The local resident in and around Konthuruthy canal claim that as per village records the original width of the canal was 48m and due to rampant encroachment the width has been reduced to less than 5.8m and in a closed condition for length of 280m in the initial stretches as given inn **Figure 3A.61**. The encroachment gained importance when a public litigation (PIL) was filed by a resident in the Hon'ble High

court of Kerala in 2016. In Nov 2019, the court passed an order directing the district administration to remove the encroachment and retain the width of the canal to its original state.

Figure 3A.61: Revenue stones planted fixing the original canal boundary

The residents claim that the encroachment became rampant after the construction of a road bridge which resulted in concrete piles filling the canal width and blocking the water way. The residents also claim that due to the dilapidated condition of the canal they are suffering from many health issues.

As per revenue records it is understood that there are 178 families living by the side of the canal who will have to be resettled in the restoration process. About 42 families are said to have possession records for their land as per list of beneficiaries under the LIFE mission housing scheme.

Due to rampant encroachment flooding in the adjoining colonies of this canal is a common phenomenon. Konthuruthy canal was not a part of the scope of the present study assigned to Antea Group, but for a holistic development of the Thevara and Thevara-Perandoor canals and adjoining areas it is highly essential that Konthuruthy canal is also restored and hence brought as an additional component under this project proposal.

Areas that will be benefitted by improving Konthuruthy canal flowing towards south of Thevara canal

1) Kairali Nagar.
2) Areas between Pandit Karuppan road and Konthuruthy canal like Mattumal and adjoining colonies.
3) Jyothi Nagar.

Present Proposal

1) To widen and deepen the canal to a width of 40m and depth of 1.6m after removing the encroachment
2) To provide permanent protection to the canal banks
3) Reconstruction of road and foot bridge obstructing the flow of water.

The estimate for the same has been framed and the cost estimate given in **Chapter 6** of this report.

Benefit that will be derived by the development of the canal

1) Konthuruthy canal will be an alternate route for Water Metro Navigation of vessels.
2) A scenic attraction for tourists and It will be a revenue generation water route.

The detailed functional study for this canal need to be undertaken before the detailed design and estimation stage on approval from SPV.

CHAPTER 3 FUNCTIONAL DESIGN

3B. URBAN REGENARATION

(sewer, sewage treatment, sanitation, and solid waste)

3B. URBAN REGENARATION

Introduction

The White Paper on "City sanitation for Kochi" (2011) for Kochi Municipal Corporation (KMC) assessed the adequacy of the sanitation facilities available in Kochi city. The report recognizes that KMC having a total area of 94.88 km^2 is served with an area of only 4 km^2 by sewerage network (i.e. less than 5%). Also, a comprehensive 30-years strategic framework has been brought out for the long term plan that KMC has set out for improving the sanitation facilities of Kochi city. This document was prepared building on the objectives set as per National Urban Sanitation policy (2008) of Government of India.

Chapter 10 of this DPR deals with the present environmental issues caused on account of the disposal of sewage and solid waste into the canals and the health hazards faced by the inhabitants in the project command.

The IURWTS Project has considered the following measures for improving the sanitation facilities in the project command:

1. Construct community toilets with latest technologies as required on both sides of the canal.
2. Provide drainage/sewerage facilities to the settlers.
3. Conduct public awareness programmes to the local community.
4. Involvement of NGO's and government agencies from polluting the canals.

The importance of taking up the planning process for designing the sewer system on a catchment area basis for this project command has already been detailed in **Chapter 2** (Demand / Requirement analysis).

To improve the environment and sanitary conditions of project command, and thereby the water quality of the canals, this DPR proposes a de-centralized treatment and disposal mechanism for the catchment area north and south of NH 544 as it forms a ridge line for the catchment. The STP locations identified in the project catchment is such that it will not detriment the environment or public health in the command.

For designing the sewer systems, a clear understanding on the methodology and tools that can aid in the design process is essential. Hence a process-oriented approach has been adopted to design the sewer systems, as is further explained in the following sections of this chapter.

3B.1 Design process: sewerage catchment

The 3 major canals and their catchments are delineated. The catchment area of Thevara canal falls inside Thevara-Perandoor and hence it is treated as a single catchment for calculation of sewer loads generated. The catchment map is overlaid with the wards map and the individual catchment is clipped to assess the population contributing to the respective canals. The present proposal is to have 5 STP's. The NH-544 forms a ridge line cutting the catchment in the east-west direction. The wards falling on the southern side and the northern side catchments of the 3 canals (Thevara-Perandoor (combined) , Chilavanoor, and Edappally canals) was segregated. Based on the population projections estimated till 2051 the sewer loads were estimated for the catchment areas on the northern and southern side catchments using Sewer DEM software.

The sewer load flow on southern side of Thevara- Perandoor and Chilavanoor catchments is proposed to be treated at Elamkulam STP and Sewer load on the southern side of Edappally catchment at Vennala STP. On the northern side sewer load from each of the 3 canals is proposed to be treated at Perandoor STP (T-P canal), Puthukkalavattom STP (Chilavanoor) and Muttar STP (Edappally).The sewer flow diagram for the catchment is given in **Figure 3B.1**.

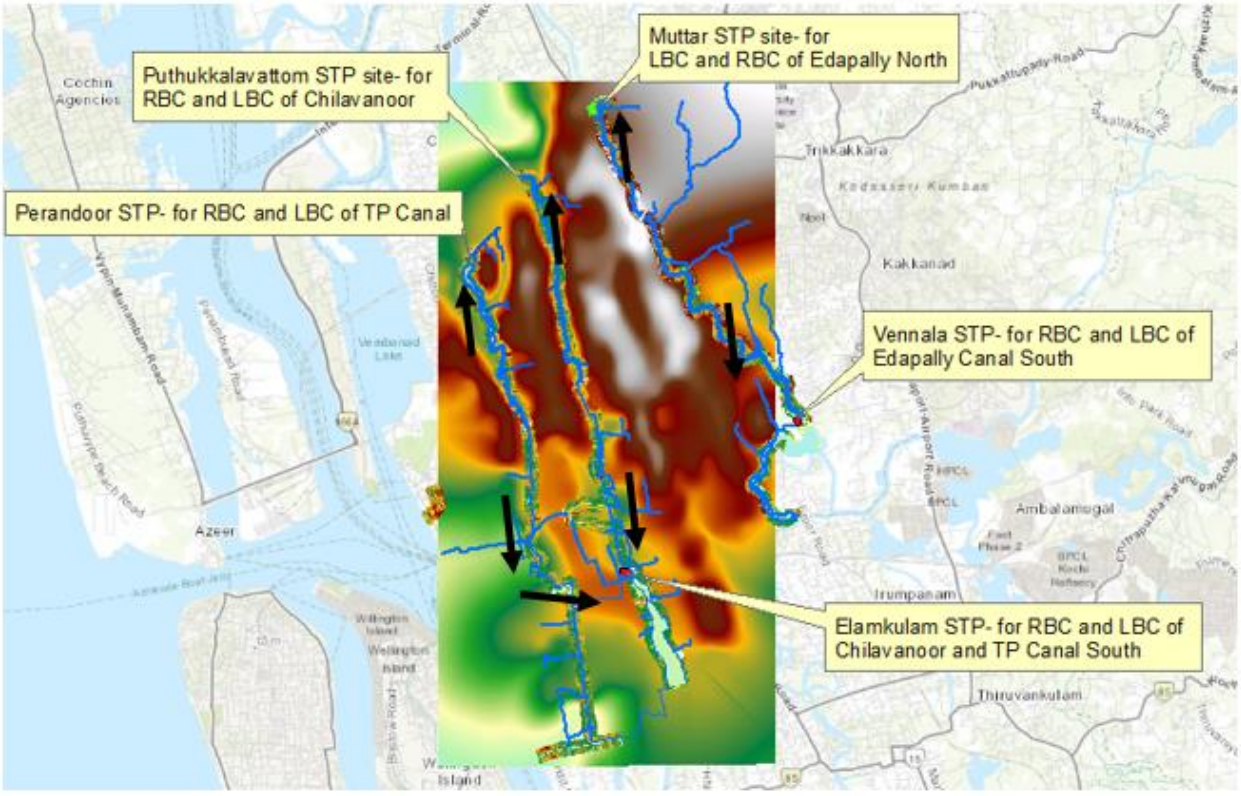


Figure 3B.1: Sewer flow diagram for IURWTS catchment

3B.2 Methodology

The methodology starts with a detailed canal inventory, collection of data related to present condition of the canal, details of households/encroachments, and its location. The collected data (2019-2020) were analyzed to find out the existing problems and to assess the development strategy and future development potential of the canal. The detailed methodology adopted for this study is described below.

Collection of Secondary Data

Secondary data was collected during the reconnaissance survey to assess the condition of the canal stretch, the availability of utilities, obstacles, etc. Discussions were held with officials of Coastal Shipping and Inland Navigation Directorate, Irrigation Department, Revenue Department, Inland Waterways Authority of India, Survey of India, District Tourism Promotion Council, Kochi Municipal Corporation, Municipalities, and other various stakeholders including residents. The data used was from the secondary sources obtained from various agencies and mainly primary survey data from LiDAR (AutoCAD drawings, spot levels, contour map at interval of 0.5m, DEM data, and 3D walk through).The sub canals reaching the main canal in each of the canals was surveyed by GC, to account for the sewer load calculations.

Population, Water demand, Wastewater and Solid waste generation

The ward wise population data were collected from secondary sources. The project affected population along the canal in an Area of Interest (AoI) of 20.5 m width of the canal was taken from the Social Impact Assessment survey undertaken by Antea Group in first 3 months of 2020.

The significant demographic fact about Kochi is that the city lies in Ernakulam District which is the most urbanized region in the state. The percentage of urban population of district (47.56%) is far beyond the urban content of the state (25.96%). The Kochi City Region which forms the core area of the district holds more than one third of the district population.

The population growth has mainly the following components:

a) Increase by natural growth.
b) Increase by migration.
c) Increase by floating population.

Population projection

Exponential rate of growth is adopted by Expert Committee of Govt. of India on population projection. Hence this method is adopted for determining the increase of population by natural growth in the Kochi city region. In this method, rate of growth is an influencing factor. Hence local bodies which have higher growth rate for the previous decades shows higher projected population.

- In addition to the natural growth, there will also be migration from other areas to the city. The large-scale projects already in progress and those envisaged in this area may also considerably influence population increase.
- The rate of migration and floating population assumed for each local body and the final population of Kochi City Region is projected.

Thus, the exponential rate of growth has been used for the population projection ward wise for the year 2051, by Kochi City Development Plan. This ward wise population projection was superimposed on each catchment map of project canals and clipped the area of wards and population for STP's load calculation.

For sewerage calculation, 80 % of the drinking water demand (135 LPCD) and 10% of Floating Population Per Capita Demand (35 LPCD) has considered.

3B.2.1 Sub canals draining into main canal

3B.2.1.1 T-P Canal

The T-P canal catchment is about 1,008.6 Ha. There are 20 sub-drains flowing into the main canal having a length of 9.88 Km. The total length of the sub-drains is 10.84 Km. The name of individual drains and length are mentioned in **Table 3B.1** and shown in **Figure 3B.2.**

Table 3B.1: T-P canal sub-drains

Sl.No.	Name of drain	Length in Km	Sl.No.	Name of drain	Length in Km
1	Perandoor Temple	0.43	**11**	Panambilly Nagar	0.57
2	Vivekananda Nagar	0.55	**12**	Mullassery Canal	1.51
3	Swami Vivekananda Road 2	0.43	**13**	Kottaikanal	0.43
4	Swami Vivekananda Road 1	0.31	**14**	Koithara Canal LS	1.54
5	Sastha Temple Road	0.16	**15**	Kasthoorba Nagar	0.39

Sl.No.	Name of drain	Length in Km	Sl.No.	Name of drain	Length in Km
6	Railway line parallel	0.63	**16**	Karshaka Road	0.21
7	Pourasamithy Road	0.10	**17**	K C Abraham master Road	0.73
8	Perandoor Road	0.55	**18**	Gandhi Nagar Road	0.89
9	Perandoor Road	0.55	**19**	Chinmaya Vidyalaya	0.14
10	Parambithara Road	0.14	**20**	Aryapadam thodu	0.56

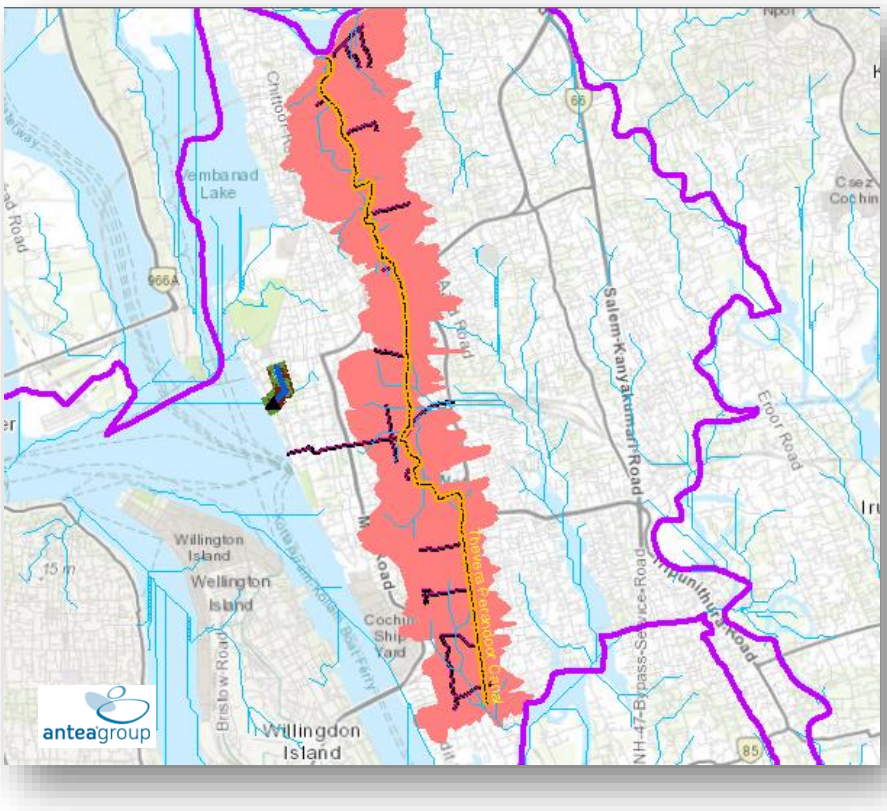


Figure 3B.2: T-P Canal catchment with sub-drains

3B.2.1.2 Chilavanoor Canal

The Chilavanoor Canal catchment is about 1,436.0 Ha. There are 24 sub drains flowing into the main canal having a length of 11.15Km. The total length of the sub-drains is about 11.72 Km. The name of individual drains and length are mentioned in **Table 3B.2** and shown in **Figure 3B.3.**

Table 3B.2: Chilavanoor canal sub-drains

Sl. No	Name	Length in Km	Sl. No.	Name	Length in Km
1	Thammanam-Pulleppady Road	0.15	**13**	Ponnurunni junction	0.47
2	Water land road 2	0.25	**14**	Parallel to Railway line	0.37
3	Water land road 1	0.18	**15**	Paradise Road	0.75
4	Vylassery Road	0.26	**16**	Near Fathima Church Road	0.64
5	Vasanth Nagar	0.17	**17**	Near DLF Apartment	0.42
6	Subash Nagar	0.14	**18**	Meenchira Road	0.82
7	Stadium Link Road	1.01	**19**	Kumaranasan Road	0.14
8	Sakhavu Abu road	0.62	**20**	Kumaranasan Nagar	1.90
9	Railyard 1	1.12	**21**	Kousalya Nagar	0.10
10	Rail Yard 2	0.19	**22**	Friends avenue road	0.15
11	Rail Nagar 2	0.14	**23**	BTS Road	0.15
12	Rail Nagar 1	0.93	**24**	Adimury Road	0.65

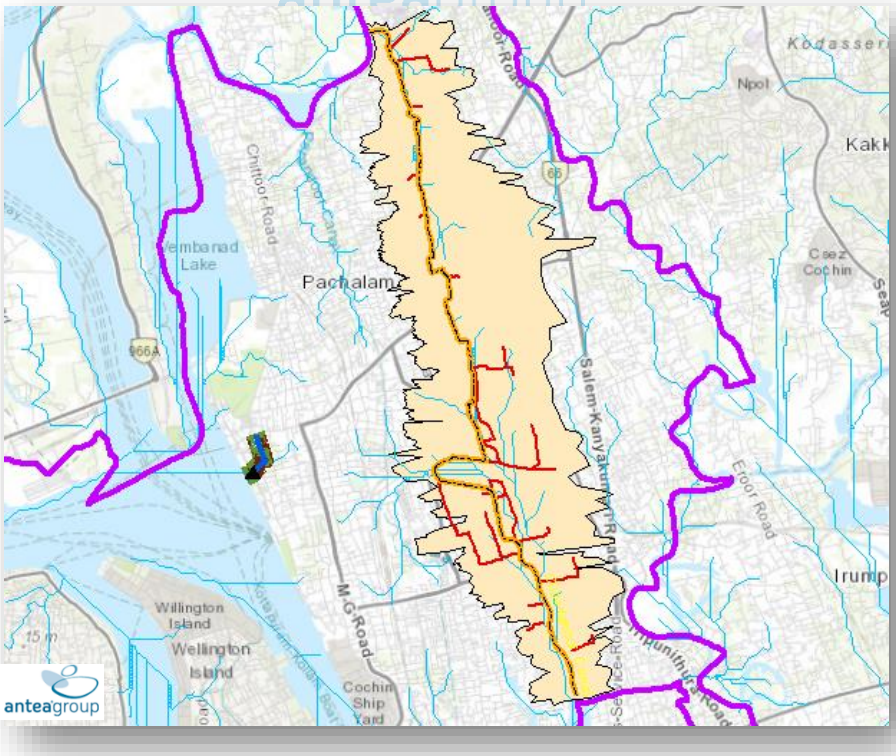


Figure 3B.3: Chilavanoor canal catchment with sub-drains

3B.2.1.3 Edappally canal

The Edappally canal catchment is about 1,780 Ha. There are 21 sub-drains flowing into the main canal having a length of 11.23Km. The total length of the sub-drains is about 15.30 km. The name of individual drains and length are mentioned in **Table 3B.3** and presented in **Figure 3B.4**.

Table 3B.3: Edappally canal sub-drains

Sl. No	Name	Length in Km	Sl. No	Name	Length in Km
1	Vattekunnam Near Muttar	0.23	**12**	Near Railway line	0.30
2	Vattekunnam near highway	0.11	**13**	Near Kallikuzhy	0.35
3	Vattekunnam Near Muttar	0.41	**14**	Near Flyover	0.35
4	Thammanam-Pulleppady Road	0.15	**15**	Mulepadam thodu	1.83
5	Puravankara	1.10	**16**	Koonamthai Road	2.08
6	Paruthelil Road 3	0.40	**17**	Thammanam-Pulleppady Road	0.15
7	Paruthelil Road 2	1.27	**18**	Thammanam-Pulleppady Road	0.15
8	Paruthelil road 1	0.98	**19**	Chembumukku 2	0.86
9	Palachuvadu road	0.97	**20**	Chembumukku 1	2.12
10	Near Vennala HS	0.60	**21**	Chembukkadavu Road	0.10
11	Near Thrikovil road	0.79			

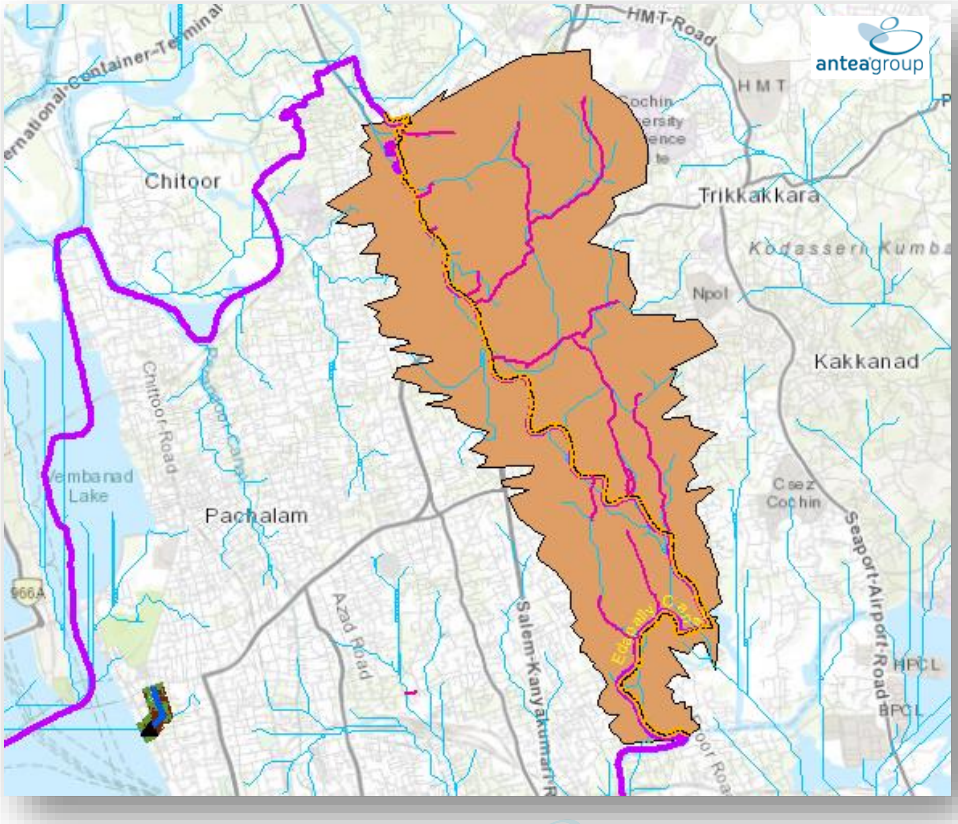


Figure 3B.4: Edappally canal catchment with sub drains

The consolidated list of canal wise population projection is given in **Table 3B.4**. The ward wise population of project canal command for which the sewer load projection estimated is provided in **Annexure 3B.1** to this DPR.

Table 3B.4: Canal wise population projection statistics

Sl. No.	Zone/Area	Projected population statistics (based on 2011 KMC data)			
		Population (2021)	Population (2031)	Population (2041)	Population (2051)
1	**T-P Canal Catchment**	89254	91659	92754	90605
2	**Chilavanoor Catchment**	106405	109273	108644	108016
3	**Edappally Catchment**				
a)	KMC Boundary	36601	37588	37372	37155
b)	Municipality				
b.1	Kalamassery	31177	32016	31833	31649
b.2	Thrikkakkara	34880	35819	35614	35409

Sl. No.	Zone/Area	Projected population statistics (based on 2011 KMC data)			
		Population (2021)	Population (2031)	Population (2041)	Population (2051)
b.3	Thripunithura	4183	4296	4271	4247
	Total	**302500**	**310651**	**310488**	**307081**

3B.2.2 Catchment area and ward details under the project canals

To assess the sewer load under all the 3 canals catchments, the ward map is superimposed on the catchment map and the apportioned area coming under each ward is estimated. The details for Thevara-Perandoor canal catchment is given in **Figure 3B.5**, Chilavanoor canal catchment given in **Figure 3B.6** and Edappally canal given in **Figure 3B.7**.

Sl. No	Ward Number	Ward Name	Area in Ha
1	32	Vaduthala East	22.48
2	33	Elamakkara North	59.50
3	34	Puthukkalavattom	62.45
4	52	Elamkulam	10.61
5	53	Giri Nagar	47.61
6	54	Panampally Nagar	78.23
7	55	Kadavanthra	3.66
8	56	Konthuruthy	11.96
9	57	Thevara	9.72
10	58	Perumanoor	78.52
11	59	Ravipuram	38.52
12	60	Ernakulam South	48.10
13	61	Gandinagar	133.82
14	62	Kathrukadavu	49.26
15	63	Kaloor South	60.30
16	64	Ernakulam Central	52.02
17	65	Ernakulam North	1.18
18	67	Thrikkanar Vattom	24.45
19	68	Kaloor North	69.08
20	69	Elamakkara South	54.51
21	70	Pachalam	91.31
22	71	Thattazham	1.32
		Total	1008.61

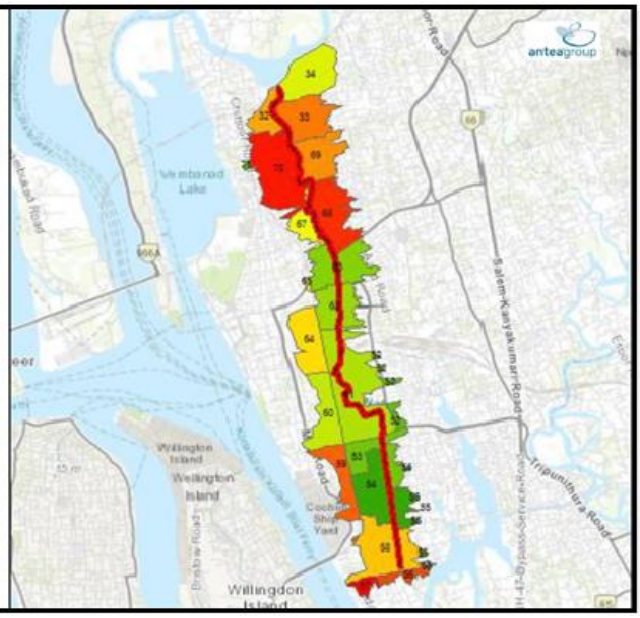


Figure 3B.5: Details of TP canal catchment

Sl. No	Ward Number	Ward Name	Area in Ha
1	33	Elamakkara North	34.5
2	34	Puthukkalavattom	42.7
3	35	Ponekkara	110.3
4	37	Edappally	31.8
5	38	Devankulangara	68.1
6	39	Karukappilly	113.9
7	40	Mamangalam	87.0
8	41	Vennala	4.4
9	42	Palarivattom	49.9
10	43	Karanakodam	131.6
11	44	Thammanam	113.4
12	47	Ponnurunny East	14.4
13	48	Vyttila	1.6
14	49	Poonithura	2.5
15	50	Vyttila Janatha	116.7
16	51	Ponnurnny	107.6
17	52	Elamkulam	119.7
18	53	Giri Nagar	27.6
19	55	Kadavanthra	38.7
20	61	Gandinagar	24.2
21	62	Kathrukadavu	68.6
22	63	kaloor South	1.1
23	68	Kaloor North	34.2
24	69	Elamakkara South	42.2
		Total	1386.72

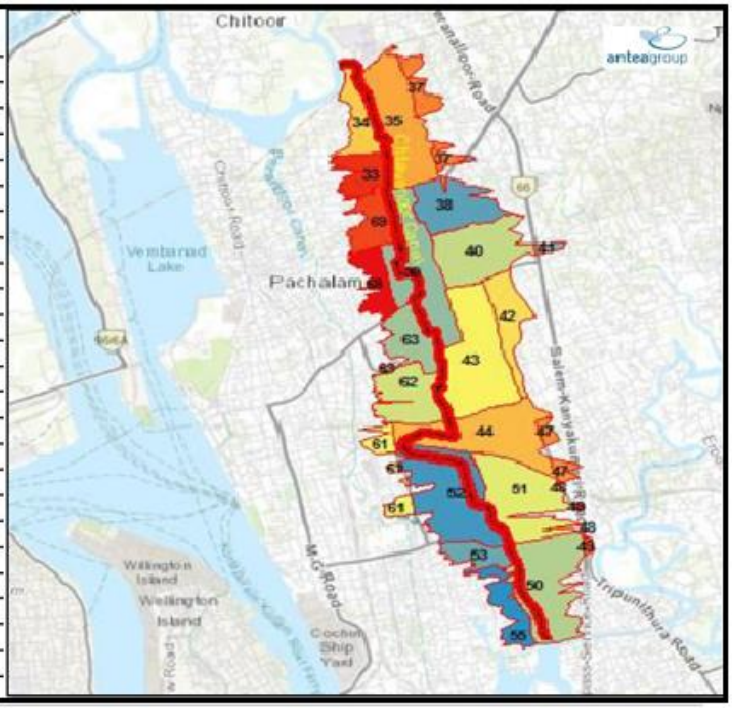


Figure 3B.6: Details of Chilavanoor canal catchment

The left side of Edappally canal comes under Kochi municipal corporation comprising of 8 wards with an area of 640ha. The right side of Edappally catchment includes areas under 3 municipalities. Kalamassery municipality having 19 wards and an area of 506.07 ha, Thrikkakkara municipality having 19 wards and area of 566.18 ha., and Thripunithura municipality having 2 wards with 67.9 ha. The total area under Edappally catchment is estimated as 1780.18 ha. The details of the wards under Edappally catchment is given in **Table 3B.5**. The wards clipped into the catchment area map is given in **Figure 3B.7**.

Table 3B.5: Total area of Edappally canal catchment

Kochi Municipality Corporation (left side of canal)			Municipality on right side of canal					
			Kalamassery		Thrikkakkara		Thripunithura	
Ward	Ward Name	Area	Ward	Area	Ward	Area	Ward	Area
35	Ponekkara	2.26	23	6.96	1	26.36	1	36.21
36	Kunnumpuarm	45.04	24	24.58	2	15.76	2	31.70
37	Edappally	129.2	25	24.15	3	9.71		
38	Devankulangara	109.4	26	35.25	4	21.26		
40	Mamangalam	7.48	27	17.81	22	7.02		
41	Vennala	191.3	28	23.58	28	6.47		
45	Chakkaraparambu	108.5	29	27.90	29	65.74		
46	Chalikkavattom	46.63	30	32.29	30	70.05		
			31	19.68	31	67.02		
			32	29.87	32	79.13		

Kochi Municipality Corporation (left side of canal)			Municipality on right side of canal					
			Kalamassery		Thrikkakkara		Thripunithura	
Ward	Ward Name	Area	Ward	Area	Ward	Area	Ward	Area
			33	22.27	33	55.75		
			34	62.66	34	35.81		
			35	22.06	35	20.28		
			36	23.84	36	4.64		
			37	41.79	38	1.20		
			38	24.68	39	20.47		
			39	26.71	40	19.20		
			40	17.92	41	18.35		
			41	22.05	43	21.93		
Total Area of municipality (ha)		**640.0**		**506.07**		**566.18**		**67.91**
Total Area of Edappally (ha)		**1780.18**						

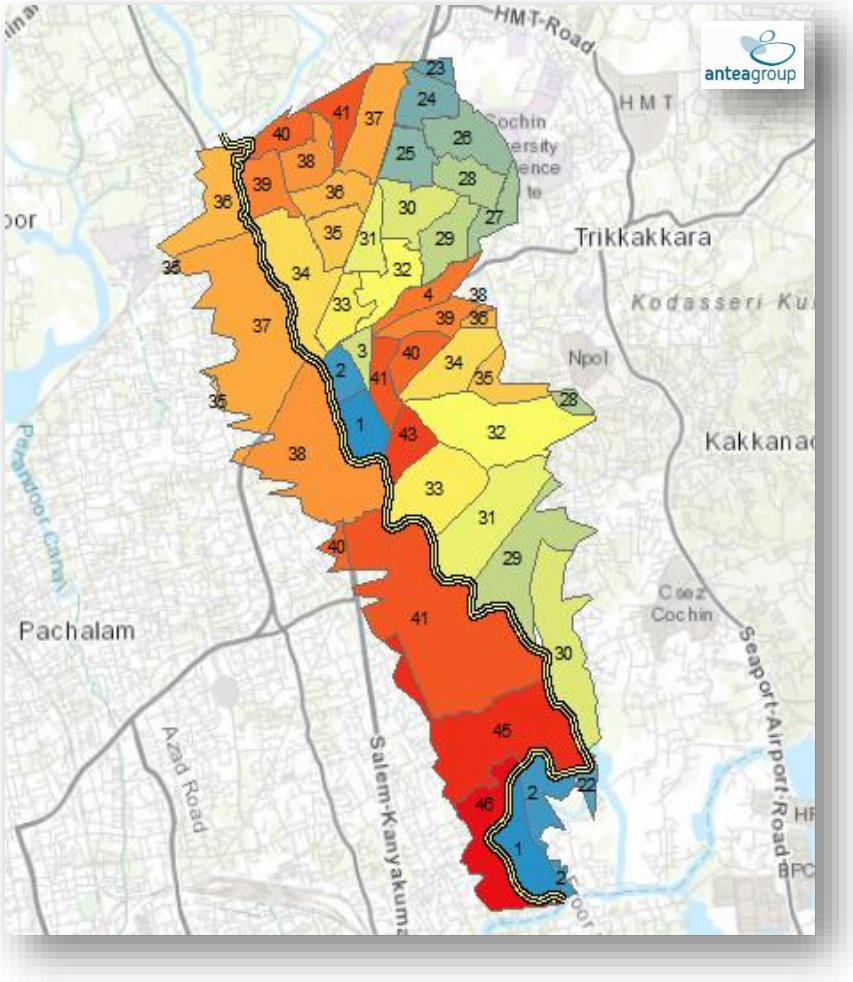


Figure 3B.7: Details of Edappally canal catchment

3B.3 Sewer load estimation and sewage treatment sites

3B.3.1 Southern side catchment

1. **Elamkulam STP:** The sewer from 14 wards on the southern side of NH 544, has a shape area of 623.51ha. for T-P canal and the sewer from 15 wards on the southern side of NH 544, has a shape area of 866.86 ha. for Chilavanoor canal, which is proposed for treatment at Elamkulam. The total sewer network length estimated is 27.17Km. The total projected population for the year 2051 is 123502nos. The catchment area map to be treated is as given in **Figure 3B.8.** The total sewer load to be treated at Elamkulam is estimated as 13.68MLD (**Table 3B.6** and **Table 3B.7**). Under AMRUT scheme already a 5MLD plant is proposed at Elamkulam. Hence a 10MLD plant is proposed for upgradation of the old plant constructed in 1971. The detailed analysis is given in **Annexure 3B.2**.

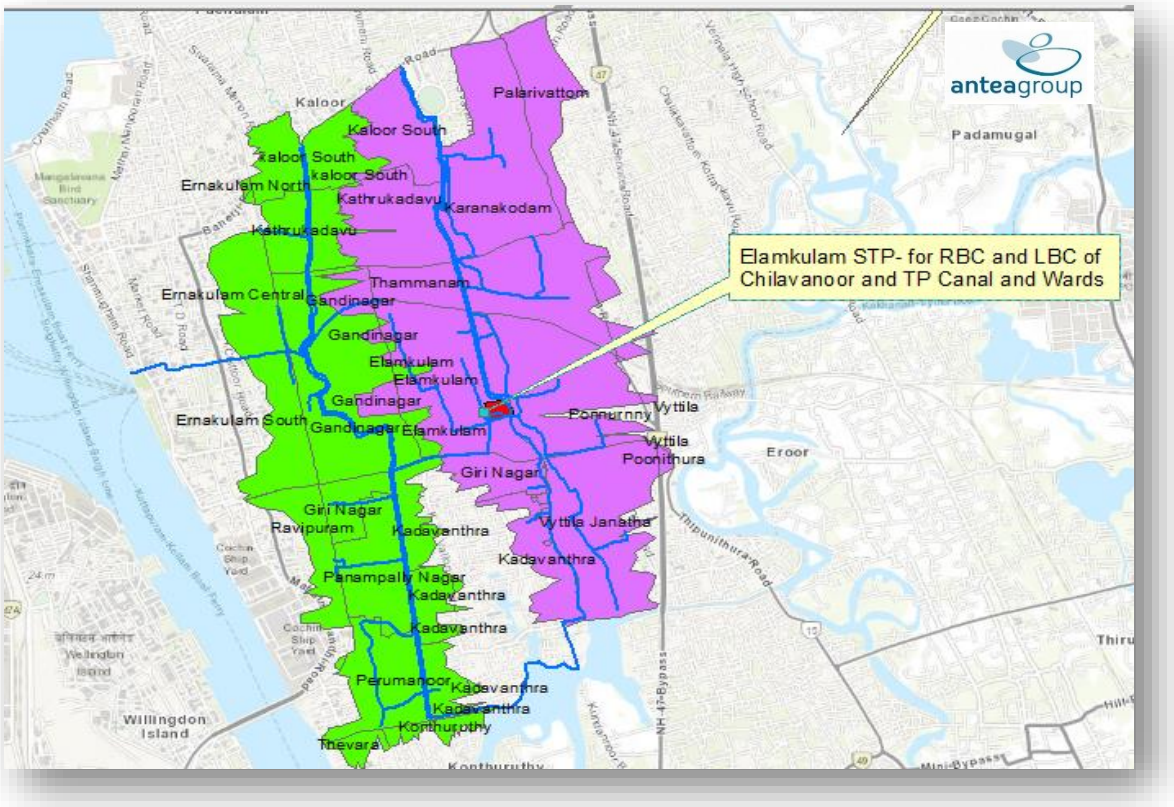


Figure 3B.8: Elamkulam STP – Catchment Area

Table 3B.6: Elamkulam STP – Population Density in Wards

Sl. No.	Zone/Area in Ha	Average Population Density				Population Projection			
		Average Population Density (2021)	Average Population Density (2031)	Average Population Density (2041)	Average Population Density (2051)	Population Projection (2021)	Population Projection (2031)	Population Projection (2041)	Population Projection (2051)
1	623.51	88.09	90.46	91.33	89.42	54925.	56406	56944	55756
2	866.87	76.99	79.06	78.61	78.15	66737.	68536	68141	67746
	1490.38					121662.	124941	125085	123502

Table 3B.7: Elamkulam STP –Sewerage Load Calculations

Sewage (2021) in MLD	Sewage (2031) In MLD	Sewage (2041) in MLD	Sewage (2051) in MLD
13.5	13.8	13.9	13.7

2. **Vennala STP:** The sewer from 34 wards in Edappally canal catchment on the southern side of NH 544, has a shape area of 1338.21ha. The total sewer network length estimated is 17.21Km for both sides of the canal. The catchment area map to be treated is as given in **Figure 3B.9**. The total projected population for the year 2051 is 83692nos (**Table 3B.8**). The total sewer load to be treated at Vennala is estimated as 9.71 MLD (**Table 3B.9**). Hence an STP of capacity 10MLD is proposed.

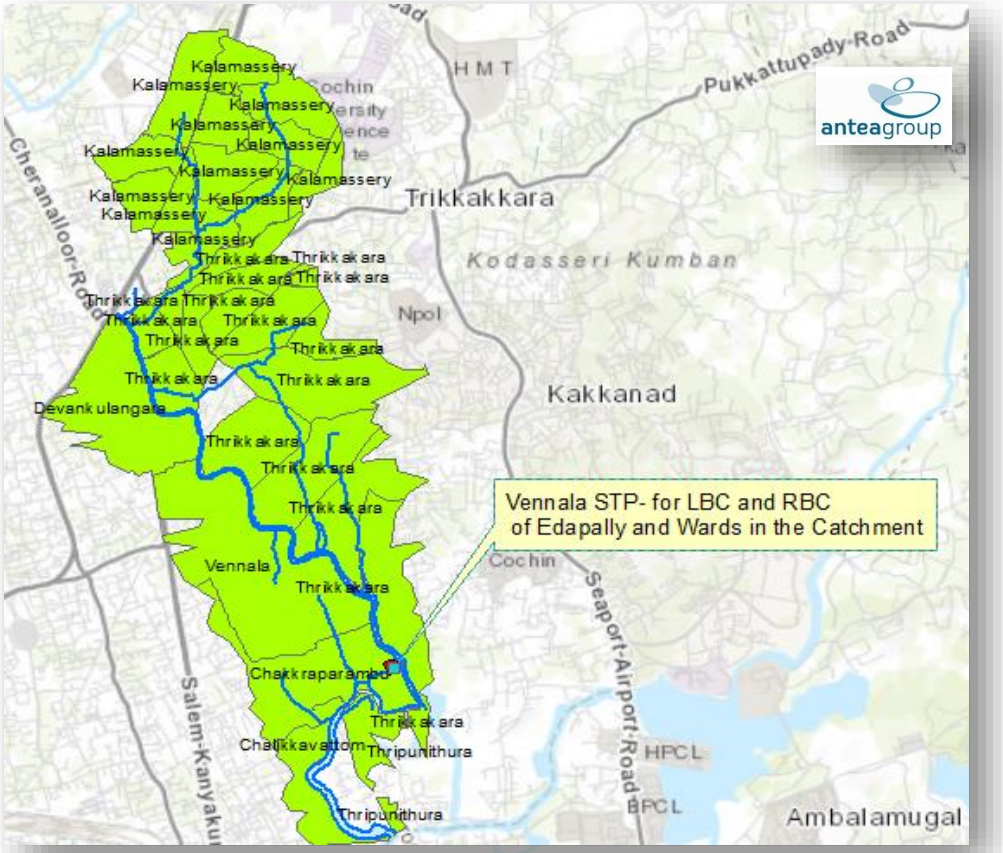


Figure 3B.9: Vennala STP – Catchment Area

Table 3B.8: Vennala STP – Population Density in Wards

Sl. No.	Zone/Area in Ha	Average Population Density				Population Projection			
		Average Population Density (2021)	Average Population Density (2031)	Average Population Density (2041)	Average Population Density (2051)	Population Projection (2021)	Population Projection (2031)	Population Projection (2041)	Population Projection (2051)
1	1338.209	61.60598	63.26542	62.90272	62.54002	82442	84662	84177	83692
	1338.209					82442	84662	84177	83692

Table 3B.9: Vennala STP –Sewerage Load Calculations

Sewage (2021) in MLD	Sewage (2031) In MLD	Sewage (2041) in MLD	Sewage (2051) in MLD
9.13	9.38	9.33	9.27

3B.3.2 Northern side Catchments

3. **Perandoor STP**: The sewer load from 9 wards in Thevara-Perandoor canal catchment on the northern side of NH 544, is estimated. The shape area of catchment is 449.39 ha. The total sewer network length estimated is 3.81 Km for both sides of the canal. The catchment area map to be treated is as given in **Figure 3B.10**. The total project population for the year 2051 is 39829 nos. (**Table 3B.10**). The total sewer load to be treated at Perandoor STP is estimated as 4.41 MLD (**Table 3B.11**). There are several flats wherein they have their own treatment facility. Hence an STP of capacity 4 MLD is proposed.

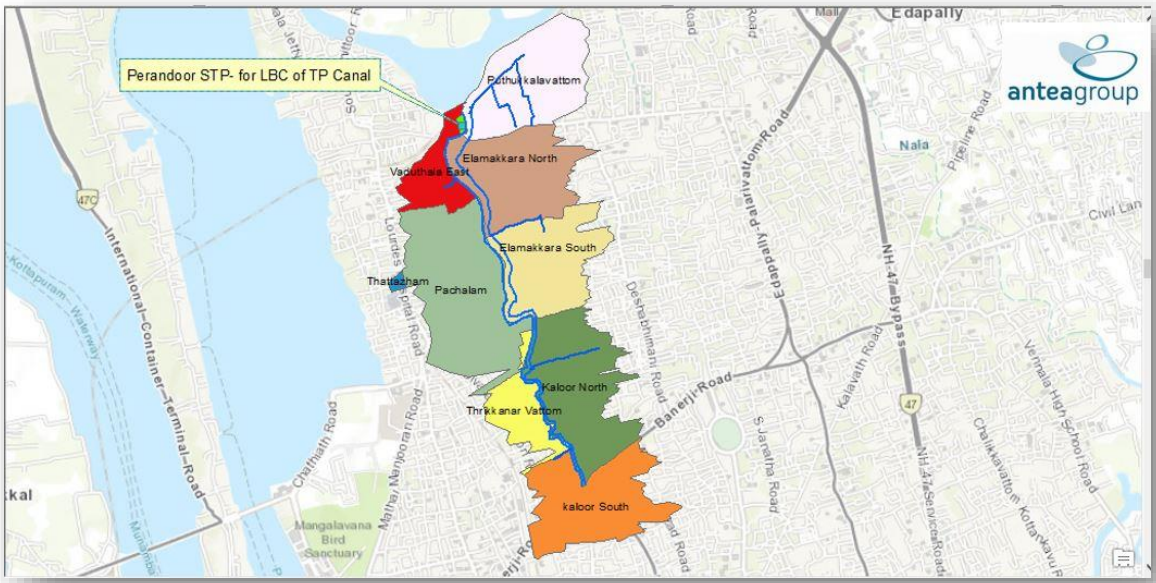


Figure 3B.10: Perandoor STP– Catchment Area

Table 3B.10: Perandoor STP– Population Density in Wards

Sl. No.	Zone/Area in Ha	Average Population Density				Population Projection			
		Average Population Density (2021)	Average Population Density (2031)	Average Population Density (2041)	Average Population Density (2051)	Population Projection (2021)	Population Projection (2031)	Population Projection (2041)	Population Projection (2051)
1	245.53	88.09	90.46	91.33	89.42	21629	22212	22424	21956
2	199.86	88.09	90.46	91.33	89.42	17606	18081	18253	17872
	445.398					39235	40293	40678	39829

Table 3B.11: Perandoor STP– Sewerage Load Calculations

Sewage (2021) in MLD	Sewage (2031) In MLD	Sewage (2041) in MLD	Sewage (2051) in MLD
4.35	4.46	4.51	4.41

4. **Puthukkalavattom STP:** The sewer load from 9 wards in Chilavanoor canal catchment on the northern side of NH 544, is estimated. The shape area of catchment is 415.52ha. The total sewer network length estimated is 8.30 Km for both sides of the canal. The catchment area map to be treated is as given in **Figure 3B.11**. The total projected population for the year 2051 is 50896nos (**Table 3B.12**).The total sewer load to be treated at Puthukkalavattom STP is estimated as 5.64 MLD (**Table 3B.13**). There are several flats in this belt wherein, they have their own treatment facility. Hence an STP of capacity 5 MLD is proposed.

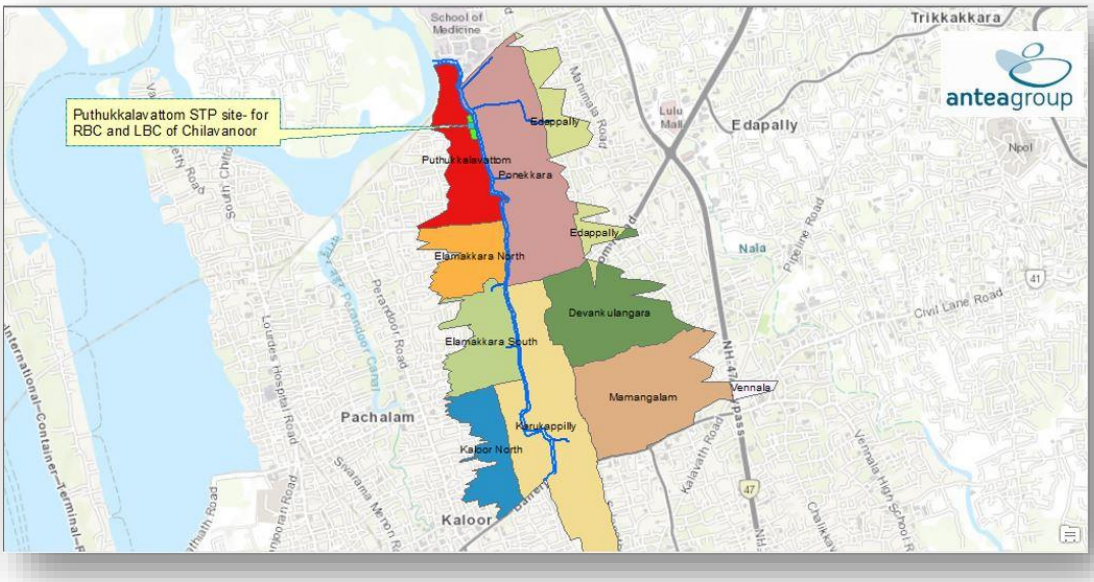


Figure 3B.11: Puthukkalavattom STP– Catchment Area

Table 3B.12: Puthukkalavattom STP– Population Density in Wards

Sl. No.	Zone/Area in Ha	Average Population Density				Population Projection			
		Average Population Density (2021)	Average Population Density (2031)	Average Population Density (2041)	Average Population Density (2051)	Population Projection (2021)	Population Projection (2031)	Population Projection (2041)	Population Projection (2051)
1	153.64	88.09	90.46	91.33	89.42	13534	13899	14032	13739
2	415.52	88.09	90.46	91.33	89.42	36603	37590	37948	37157
	569.15					50137	51489	51980	50896

Table 3B.13: Puthukkalavattom STP– Sewerage Load Calculations

Sewage (2021) in MLD	Sewage (2031) In MLD	Sewage (2041) in MLD	Sewage (2051) in MLD
5.56	5.70	5.76	5.64

5. **Muttar STP:** The sewer load from 9 wards in Edappally canal catchment on the northern side of NH 544, is estimated. The shape area of catchment is 351.62ha. The total sewer network length estimated is 10.81 Km for both sides of the canal. The catchment area map to be treated is as given in **Figure 3B.12**. The total projected population for the year 2051 is 40678 nos. (**Table 3B.14**). The total sewer load to be treated at Muttar STP is estimated as 2.44 MLD (**Table 3B.15**). There are several flats in this belt wherein, they have their own treatment facility. Hence an STP of capacity 2 MLD is proposed.

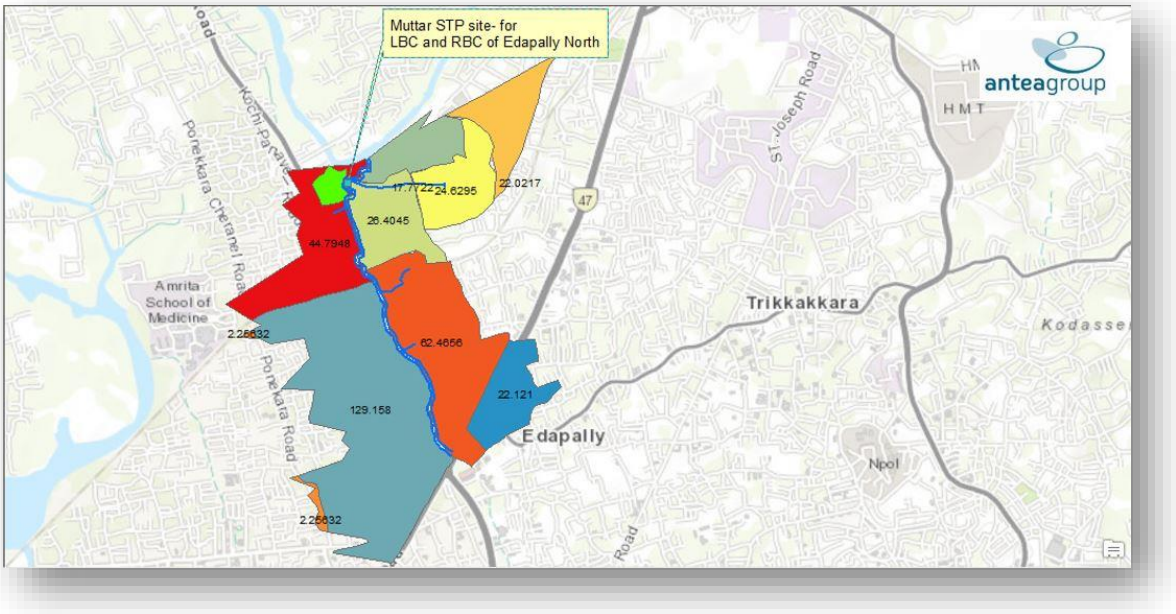


Figure 3B.12: Muttar STP – Catchment Area

Table 3B.14: Muttar STP –Population Density in Wards

Sl. No.	Zone/Area in Ha	Average Population Density				Population Projection			
		Average Population Density (2021)	Average Population Density (2031)	Average Population Density (2041)	Average Population Density (2051)	Population Projection (2021)	Population Projection (2031)	Population Projection (2041)	Population Projection (2051)
1	351.62	61.61	63.27	62.90	62.54	21662	22246	22118	21991
	351.6236					21662	22246	22118	21991

Table 3B.15: Muttar STP – Sewerage Load Calculations

Sewage (2021) in MLD	Sewage (2031) In MLD	Sewage (2041) in MLD	Sewage (2051) in MLD
2.40	2.46	2.45	2.44

The summary of sewer load to be treated based on the sewer load calculated in the 5 STPs is given in Table **3B.16**.

Table 3B.16: Summary of Sewerage Flow/Sewage- New Plan

Sl. No.	STPs	Sewerage Flow			
		Sewage (2021) in MLD	Sewage (2031) In MLD	Sewage (2041) in MLD	Sewage (2051) in MLD
1	Elamkulam STP - Chilavanoor & TP south	13.48	13.84	13.86	13.68
2	Vennala STP - Edappally south	9.13	9.38	9.33	9.27
3	Muttar STP-Edappally north	2.40	2.46	2.45	2.44
4	Puthukkalavattom STP - Chilavanoor north	5.56	5.70	5.76	5.64
5	Perandoor STP - TP north	4.35	4.46	4.51	4.41
	Total	**34.92**	**35.86**	**35.90**	**35.45**

3B.3.3 Fixing alignment of sewer lines

The sewer load is proposed to be conveyed by sewer pipes by a combination of gravity and pumping commonly called the pressurized mode. The sewer alignment for laying of sewer lines is done by estimating the slope of the existing ground from the LIDAR DEM, AutoCAD drawings, spot levels and contour map generated from LiDAR data. The slope for laying the sewer lines from the origin to the STP site is worked out and the optimal depth at which the lift pumping stations are to be located is identified.

The engineering aspects for design of the sewer networks based on the sewer loads calculated for individual canals of project catchment are addressed in **Chapter 4** (Engineering Design).

3B.4 Sewage Treatment Plant

3B.4.1 Selection of appropriate technology

Many experts working on STPs agree that the choice of the STP technology will be dependent on the location, topography, and nature of locality. As per the request from Govt. Of India, a study was undertaken by experts from a group of 7 IITs in India (2010). The findings of the team of professors from

the 7 IITs brings out a clear understanding of the different STP technologies in vogue and how a technology can be leveraged to achieve competitive advantage based on site specific conditions.

One of the most challenging aspects of a sustainable sewage treatment system design is the analysis and selection of the treatment processes and technologies capable of meeting the requirements. The process is to be selected based on required quality of treated water. While treatment costs are important, other factors should also be given due consideration. A general sewage treatment process selection consideration is as given in **Table 3B.17**. The effluent quality, process complexity, process reliability, environmental issues and land requirements should be evaluated and weighted against cost considerations.

Table 3B.17: Consideration for sewage treatment process selection

Consideration	Goal
Quality of Treated Sewage	Production of treated water of stipulated quality without interruption
Power requirement	Reduce energy consumption
Land required	Minimize land requirement
Capital Cost of Plant	Optimum utilization of capital
Operation & Maintenance costs	Lower recurring expenditure
Maintenance requirement	Simple and reliable
Operator attention	Easy to understand procedures
Reliability	Consistent delivery of treated sewage
Resource Recovery	Production of quality water and manure
Load Fluctuations	Withstand variations in organic and hydraulic loads

The following factors are also to be considered while evaluating different treatment processes:

a) Capability of the plant to give desired performance.
b) Availability of land.
c) Overall costs both capital as well as recurring.
d) Energy input - There are two aspects, minimum power or energy requirements and the effect of its dependability on the process.
e) Ease of operation.
f) Manpower requirement both skilled and unskilled.
g) Bearing on local conditions such as climate.

h) Ultimate use or disposal of treated effluent.

i) Use of greener technologies.

3B.4.2 Process overview

Sewage can be treated close to where it is created (in septic tanks, biofilters or aerobic treatment systems), or collected and transported via a network of pipes and pump stations to a municipal treatment plant. Sewage collection and treatment is typically subject to local, state, and national regulations and standards. Industrial sources of wastewater often require specialized treatment processes (see Industrial wastewater treatment). Conventional sewage treatment may involve three stages, called primary, secondary, and tertiary treatment.

Primary treatment consists of temporarily holding the sewage in a quiescent basin where heavy solids can settle to the bottom while oil, grease, and lighter solids float to the surface. The settled and floating materials are removed, and the remaining liquid may be discharged or subjected to secondary treatment. All sewage treatment plants should follow a process chain depending upon the technology chosen and the treatment capacity. In general, treatment is to be done in three stages. Specifications and treatment objectives at each stage of treatment are as follows.

The preliminary treatment follows:

a) Three Stage Screening: -
   - 25 mm bar racks (before pumping)
   - 12 mm bar racks
   - 5 mm mesh (< 2 mm mesh for Membrane Bio Reactor, MBR)

b) Aerated Grit Chamber if following unit operation is aerobic and Normal Grit Chamber if following unit operation is anaerobic.

Expected effluent quality after preliminary treatment:

- No floating materials including polythene bags, small pouches, etc.
- Proper collection and disposal of screening and grit.

Secondary treatment removes dissolved and suspended biological matter. Secondary treatment may require a separation process to remove the micro-organisms from the treated water prior to discharge or tertiary treatment.

Tertiary treatment is sometimes defined as anything more than primary and secondary treatment. Treated water is sometimes disinfected chemically or physically by microfiltration prior to discharge into

a stream, river, bay, lagoon, or wetland, or it can be used for the irrigation of a golf course, green way, or park. If it is sufficiently clean, it can also be used for groundwater recharge or agricultural purposes.

3B.4.3 Technological options for sewage treatment plant

The following technologies of sewage treatment have been considered for evaluation of performance characteristics, like land requirement, energy input, equipment requirement and operational characteristics:

1) Membrane Biological Reactor Process.
2) FAB/MBBR technology.
3) Sequential Batch Reactor (SBR).
4) Extended Aeration.
5) Activated sludge process.

3B.4.4 Life Cycle Cost

Life Cycle Costing (LCC) is used as decision-making tool while constructing STPs. The performance evaluation is not alone enough for the comparison of different sewage treatment technologies and life LCC analysis has been largely applied as a tool to evaluate the best cost-effective alternative among various alternatives to achieve the lowest long-term cost of ownership. Life Cycle Cost analysis includes the initial cost comprising of construction cost and equipment setup, land required and its cost, net operation and maintenance cost including electricity charges, replacement works. A comparison was undertaken by Yamuna Pollution Control Unit (YPCU), U.P. Jal Nigam, Govt. of Uttar Pradesh, Ghaziabad, (2016) and the life cycle cost of six technologies presently being used in India is given in **Table 3B.18**.

Table 3B.18: Life cycle cost comparison of different technologies

Sl. No.	Assessment of Parameter/Technology	ASP	MBBR	SBR	UASB+ ASP	MBR	WSP
	Overall HRT (Through the entire Plant)	16-20 h	8-10 h	16-18 h	16-18h	8-12h	8-15h
1	Performance parameter						
	Effluent BOD mg/L	<20	<30	<10	<20	<5	<40
	Effluent SS mg/L	<30	<30	<20	<30	<5	<100
	Fecal Coliform log Unit	up to 3 <4	up to 2 <3	up to 3 <4	up to 2 <3	up to 5 <6	up to 2 <3
	T-N Removal Efficiency	10 - 20	10 - 20	10 - 20	10 - 20	10 - 20	10 - 20

Sl. No.	Assessment of Parameter/Technology	ASP	MBBR	SBR	UASB+ ASP	MBR	WSP
2	Average Capital Cost Rs. Lacs/MLD						
	Civil works % of capital costs	60	40	30	65	20	90
	E & M Works % of capital costs	40	60	70	35	80	10
3	Average Area Requirement m2/MLD	800	400	400	800	200	6000
4	Operation and Maintenance Costs						
(i)	Energy Costs						
	Avg Technology Power requirements kWh/d/MLD	180	200	170	120	300	2
	Avg. Nontechnology Power requirements kWh/d/MLD	4	2.5	2.5	4.5	2.5	2.5
	Total Daily Power Requirement, kWh/d/MLD (avg)	184	202.5	172.5	124.5	302.5	4.5
	Daily power cost, (@Rs 4.0/ kWr), Rs/MLD/hr.	31	34	29	21	50	0.75
	Yearly power costs, Rs Lacs PA/MLD	2.65	2.92	2.48	1.79	4.36	0.06
(ii)	Repair Cost						
	Civil works per annum, as % of civil works cost	1	1	1	2		1
	E&M works, as % of E&M work cost	3	3	2.5	3.5		3
	Civil works maintenance, Rs Lacs PA/MLD	0.8	0.8	0.34	1.6		0.3
	E&M works maintenance, Rs Lacs	2.4	2.4	2	2.8		0.9
	Annual Repair costs, Rs Lacs	3.2	3.2	2.34	4.4		1.2
(iii)	Recurring cost, (Chemicals etc.), Rs Lacs PA/MLD	0.3	0.4	0.2	0.5		0.2
(iv)	Manpower O&M cost						
	Manager, Rs Lacs PA	4.8	4.8	4.8	4.8		4.8
	Chemist/Engineer, Rs Lacs PA	2.4	2.4	2.4	2.4		2.4
	Operators, Rs Lacs PA	1.44	1.44	1.44	1.44		1.44
	Skilled Technicians, Rs Lacs PA	1.08	1.08	1.08	1.08		1.08
	Unskilled Technicians, Rs Lacs PA	0.96	0.96	0.96	0.96		0.96

Sl. No.	Assessment of Parameter/Technology	ASP	MBBR	SBR	UASB+ ASP	MBR	WSP
	Manpower required & their costs, Rs Lacs PA/MLD	9.96	8.12	8.03	9.96	50	5.88
(v)	Total annual O&M Costs, Rs Lacs PA/MLD	16.11	14.64	13.05	16.65	50	7.67
	Avg Land Cost Assumed Rs. Lacs/m2	0.01	0.01	0.01	0.01	0.01	0.01
	Unit Land Cost Rs. Lacs/MLD	8	4	4	8	2	60
	Unit Capital Cost including land cost, Rs. Lacs/MLD	88	84	84	88	402	90
	Rate of compounded interest(adopted), % per year	10	10	10	10	10	10
5	Treatment Cost	7.3	6.89	6.46	7.44	28.1	3.18
6	**Unit Life cycle cost for 15v years, Rs. Lacs/MLD**	210.53	195.35	**183.27**	214.66	214.66	148.33

As per the **Table 3B.18** above it is seen that when all the parameters are analyzed in a holistic manner life cycle cost of SBR technology is the best option for this project, The SBR is a true batch treatment process reactor having ability to act as an equilibrium basin, aeration basin and clarifier basin within a single batch reactor. The SBR is operated in a batch reactor mode this eliminates all the inefficiencies of the continuous processes. The complete process takes place in a single reactor, within which all biological treatment steps take place sequentially. The optimum effluent quality is obtained during each cycle in SBR. The SBR process is often preferred over continuous flow process (CFP) due to reduction in energy consumption and enhancement in the selective pressures for BOD, nutrient removal, and control of filamentous bacteria. Due to these reasons, SBR process is gaining immense popularity in the recent years. A schematic flow diagram of a sequential batch reactor is a given in **Figure 3B.13** and the technical details given in **Table 3B.19**.

The benefits envisaged include:

- 50 % Reduction in power consumption.
- 50 % Reduction in land requirement.
- Fully automatic, Computerized (PLC/ SCADA).
- Much higher plant life due to excellent material.
- Low maintenance cost.
- Treated effluent can be used for Horticulture/ Industrial purposes.

As the SBR process can be effectively automated, it is known to save more than 60% of the operating expenses required for a conventional ASP and is able to achieve high effluent quality in a very short aeration time. Considering the density of population in project command, SBR is being considered as a preferable technology due to its low requirement of area, land cost, energy efficiency as well as manpower for operation.

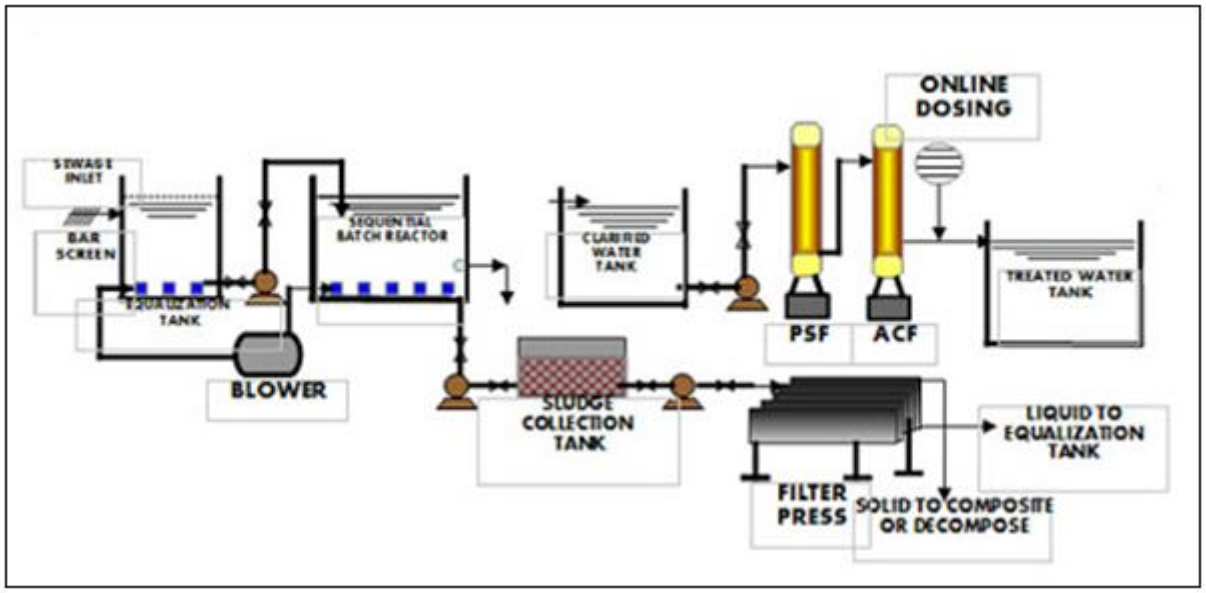


Figure 3B.13: SBR technology process

3B.4.5 Treated effluent standards

When compared to the guidelines of Kerala State pollution Control Board treated effluent standards the quality achieved by SBR is much lesser. The technical details of treated effluent of SBR technology is given in **Table 3B.19**.

Table 3B.19: Technical details of SBR technology

Parameters			**Details**	
Raw Water Source			Sewage, Bathing water, Kitchen/Canteen wash water and Laundry Effluent	
Quality of Raw Effluent (mg/lit.)	COD ≤ 800	SS ≤ 500	BOD ≤ 500	pH - 4 to 9
Treated water standard achieved by the process (mg/lit.)	COD ≤ 100	SS ≤ 20	BOD ≤ 20	pH - 7 to 8

Based on the life cycle cost undertaken by the group of IIT professors and by Yamuna pollution control unit, (YPCU), SBR technology is found to have the competitive advantage of other technologies when the

parameters analyzed are considered in a holistic manner. As shown from studies, the life cycle cost in **Table 3B.18** for SBR technology is found to be minimum when considered in a holistic manner.

3B.4.6 STP identified sites

A explained in detail under section 3B.2.3, 5 STP plants are proposed. The present proposal is to upgrade the existing plant constructed in 1971 to a 10 MLD plant. The sewer load from Thevara-Perandoor and Chilavanoor south catchments will be treated at this plant. Out of the total area of 7.48 acres available at Elamkulam STP site, the land area occupied by the existing plant is 3.33 acres .A new 5MLD plant is being constructed under AMRUT scheme which will occupy an area 1.94 acres. The north side catchments of Thevara-Perandoor will be treated at Perandoor STP, and Chilavanoor north side catchment at Puthukkalavattom STP. The sewage load of the Edappally southern side catchment will be treated at Vennala, and Edappally north side catchment will be treated at Muttar. The land required for the 4 new STPs sites is being acquired as a part of the land acquisition process in progress. The details of the 5 sites are given in **Figure 3B.14**. The **Table 3B.20** gives the details in a consolidated form.

Table 3B.20: STP identified sites

Sl. No	STP location	Proposed STP (MLD)
1	Elamkulam STP - Chilavanoor & TP south	10
2	Vennala STP - Edappally south	10
3	Muttar STP-Edappally north	2
4	Puthukkalavattom STP - Chilavanoor north	5
5	Perandoor STP - TP north	4
	Total MLD	**31**

STP proposed area at Elamkulam

STP proposed area at Vennala

STP proposed area at Muttar

STP proposed area at Perandoor

STP proposed area at Puthukkalavattom

Figure 3B.14: STP site proposed locations

The Engineering design aspects are explained in **Chapter 4** (Engineering Design) of this DPR.

3B.5 Sanitation facilities

In this revised DPR, sewer system facilitates for the inhabitants of project catchment in a holistic manner. Sewer mains are proposed all along both the banks of the 5 canals to collect the sewage generated and transport the same to the sewage treatment plant for treatment. There is a possibility that after the laying of the sewer networks, a few low-income group colonies/ individual houses which due the location issues cannot be connected to the sewer systems. So, provision for providing sanitation facilities for these individual houses are provided by means of community toilets. During the construction phase of the sewer network laying process difficulties are expected to be encountered due to improper sanitation facilities. This issue is proposed to be overcome by providing bio-toilets at very 500 m interval along all the 5 canals and provision for same has been included.

3B.6 Solid waste management

3B.6.1 Existing Situation

Collection, transportation, and safe disposal are the three pillars of waste collection, treatment, and final disposal (only in designated sites). It is widely recognized that segregation enabled collection systems reduce both risks and costs, while it is necessary for rendering specific treatments to the different kinds of wastes generated under urban conditions. Encapsulation of wastes before and after disposal, is the universal method. The degree and nature of risks of the type of waste determines the kind of encapsulation adopted for final disposal. All wastes require compaction before final disposal. Power driven decentralized compactors are a common sight within the cities. The principles apply in the case of Kochi, too.

The State Policy on Solid Waste Management Rules 2018 was framed and published under G.O. (P) No 65/2018/LSGD on 13 September 2018, as postulated under the Solid Waste Management Rule 2016.

Compilation from various studies indicate that in Kerala, by weight 49%, 36%, 15% MSW is generated from households, institutes, and waysides and public places, respectively.

77% is putrescible waste, 18% is bio-non-degradable and the remaining 5% is inert waste, also by weight.

As per the law, throwing, burning, and burying of solid waste is prohibited. The law also necessitates waste generators to dispose of bi-degradable waste through composting or bio-methanation within the premises as far as possible.

Source: G.O date 13 September 2018, stated above.

Box 3B-1: Outline of the MSW management strategy for Kerala

The current approach is minimization of waste. Bio-degradable waste is to be disposed of within the premises of its production, as far as possible, as outlined in **Box 3B.1**. A very successful implementation of the strategy has been experienced in Alappuzha municipality. The MSW system has undergone a complete change, and across several fronts, simultaneously– systemic, socio-behavioral, management approach, personnel engagement etc. Twin bin with lid for solid waste collection in each household will be promoted in the project catchment.

That, waste collection demand is not met by the collection system in place, is evident upon reconnaissance of Kochi. The fact is well documented through various studies conducted earlier. Under the Smart City Mission (SCM), a comprehensive waste management scheme is under the process of implementation. The comprehensive scheme will address the various issues through collection, transportation, segregation, isolation (hazardous and medical wastes) and respective encapsulation for safe disposal including incineration and waste to energy conversion (which are amongst the latest innovations of urban waste management).

Municipal Solid Waste (MSW) management comes under the operational purview of ULBs. However, the SCM is a Centre-State-ULB joint-initiative. This project is focused along five canals that run within the municipal area of the Kochi Municipal Corporation (KMC). The canals were under severe abuse due to incidence of direct littering and dumping of solid waste into its waters.

Control Solid Waste Dumping in Kochi Canals

The severity of the problems arising out of inadequacies of waste management has had to be addressed through a recent specific state level government order (G.O.(Rt)No.823/2020/LSGD Dated, Thiruvananthapuram, 04/05/2020). The order is issued through the Local Self Government Department. It is in direct response to the communication from KMRL aimed at prevention of littering or/and dumping solid waste in the five canals under the project. The order reminds citizens and general public that dumping of waste and garbage into the canals and thodu is prosecutable under law. It has stated the many laws including the IPC supporting prosecution in case of violation of the laws. Under the SCM, surveillance using modern tolls like CCTV coverage is envisaged, to aid real time monitoring. Use of technology can be effective in achieving the desired turn around required from the critique on the current status (which would change), as given in **Table 3B.21**.

Table 3B.21: Status on general compliance for MSW management in Kochi

MSW Rules 2016	KMC Act, 1994 and Amendments	Present Status
Storage at source	Section 327 (1): All premises to provide receptacle of size specified by Secretary for the purpose of storage at source.	• Storage at source is getting increasingly accepted by community. • No notifications issued. • Effort by way of undertaking a phased program for creating awareness and facilitation is almost nil.
Segregation of Waste at Source Schedule II (2); Municipal Authority shall organize awareness program for segregation of waste Schedule II (1-3): It shall be the responsibility of generator of waste to ensure delivery of waste in accordance with collection and segregation system notified by the Municipal Authority.	Section 327 (2A): The MC Secretary by public notice direct owner or occupier of any premises to segregate waste for easy collection and disposal of such waste.	• Action is taken by KMC to enforce compliance is not visible.
Primary Collection of Municipal Solid Waste Schedule II (i to vi): arrange for door to door collection of segregated solid waste from all households including slums and informal settlements, commercial, institutional, and other nonresidential premises. From multi-	Section 329: The Secretary may with the sanction of Council introduce doorstep collection either by municipal employees or by contract.	• Primary collection of waste from doorstep has been initiated to some extent.

MSW Rules 2016	KMC Act, 1994 and Amendments	Present Status
storage buildings, large commercial complexes, malls, housing complexes, etc., this may be collected from the entry gate or any other designated location.		
Street Sweeping	Section 326 (a): Regular sweeping, cleaning of streets and removal of sweepings there-from.	• Need based schedule is almost absent. Sweepings are openly heaped, and removal of heaps not being done simultaneously.
Secondary Storage of Waste Schedule II (3): Storage facilities are to be set up and shall be so designed that waste stored are not exposed open and shall be aesthetically acceptable and user friendly. Facility should take into account waste generated in a given area. Abolish all open waste storage sites/bins and provide closed containers for the storage of waste so that waste is not exposed to open atmosphere. Manual Handling of waste shall be prohibited.	Section 326 (d-i & iv): Municipality to make adequate arrangements – depots, receptacles, and places for temporary deposit of waste.	• Majority of the storage facilities are still open points or topless bins. • Manual & Multiple handling is to be abolished.
Transportation Schedule II (4): Vehicle used for transportation of waste shall be covered. Storage facilities set up are to be attended daily and cleaned before overflowing. Transport vehicle are to be designed such that multiple handling of waste is avoided. Ensure	Section 326 (d-ii): Municipality to make adequate arrangements for covered vehicles for removal of waste.	• Transportation vehicles are mainly truck and tractors, seldom covered. • Manual loading and multiple handling is common.

MSW Rules 2016	KMC Act, 1994 and Amendments	Present Status
transportation of waste in closed vehicles on a day to day basis synchronizing with secondary storage system and avoiding multiple and manual handling of waste.		
Processing of Waste Schedule II (5): The biodegradable wastes shall be processed by composting, vermicomposting, anaerobic digestion, or another appropriate bio-logical processing for stabilization of waste. Incineration with or without energy recovery including palletization can also be used for processing waste in special cases.	Section 332: The Municipality may for the purpose of recycling, treating, processing, or converting such waste into compost or any other matter construct, acquire or operate and manage any establishment and run it on a commercial basis or may contract out such facility. Section 331 (3): Municipality to make arrangements for preparation of compost and the disposal of it by sale.	• Processing is expected to start with the initiatives from KMC. • New WTE project at Brahmapuram is awarded and work in progress.
Disposal of Waste Schedule II (6): Land filling shall be restricted to non-biodegradable, inert waste and other waste that are not suitable either for recycling or for biological processing.	Section 331: Every Municipality shall identify and notify suitable lands within or outside municipal area for the purpose of final disposal of waste.	• Sanitary landfill is being developed at Brahmapuram.

MSW Rules 2016	KMC Act, 1994 and Amendments	Present Status
Prohibition of Littering and Penalty for Littering Schedule II (1): Prohibit littering of waste in urban areas.	Section 340: No person shall put or cause to be put any rubbish or filth or debris into any public place not intended for deposit of waste. Section 340 (2): The Secretary or an officer authorized for the purpose shall, on being satisfied that any person shall put or cause to be put any rubbish or filth or debris into any public place not intended for deposit of waste impose a fine on the spot that may not exceed Rs.250. Secretary shall initiate prosecution against the person if he fails to pay the fine imposed.	• Imposition of penalty is marginal. • Awareness campaigns are required to change the public attitude towards this aspect with the enforcement by officials.
Legal framework Frame bye-laws incorporating the provisions of these rules within one year from the date of notification of these rules and ensure timely implementation.		Not framed.
Direct waste generators not to litter i.e., throw or dispose of any waste, or burn or burry waste on streets, open public spaces, drains, waste bodies and to segregate the waste at source as prescribed under these rules and hand over the segregated waste to authorized the waste pickers or		Not done.

MSW Rules 2016	KMC Act, 1994 and Amendments	Present Status
waste collectors authorized by the local body.		
Material recovery setup material recovery facilities or secondary storage facilities with sufficient space for sorting of recyclable materials to enable informal or authorized waste pickers and waste collectors to separate recyclables from the waste and provide easy access to waste pickers and recyclers for collection of segregated recyclable waste.		Partially Done.

Continuous walkways along the canal banks (on either side) are envisaged, which would be 2.0 m wide (with 15.0 m wide pedestrian promenades in 4 km stretch of Edappally canal is dealt separately in Canal Beautification). The walks are interspersed with public leisure activity areas/zones (being designed and developed under the project) mainly in the form of new or recreated existing parks (currently in dilapidation) with a finite amount of vending. It is also designing the development of small boat based water transport (as feeder to the rail and water metro), for which jetties are being created at 30 locations. Existing road bridges and pedestrian bridges are being re-designed for replacement allowing sufficient clearway for the boats to pass below them. Many new pedestrian bridges with the same criterion are also being developed. Approach roads to jetties are being reconstructed. Approach roads to road bridges are being redesigned for grade adjustments in order to match with the higher than current clearances available permitting boat movement in the canal water below them.

Human response to waste dumping and handling its menace post implementation of this project is an important task. There are locations centered around transit and leisure recreational corridors with activity nodes which are important focal points where necessary infrastructure for waste collection is proposed. Hazardous (including domestic) waste generation is not expected to be occurring on the waterfronts. Where there are any chances, the management of the same can be guided to prevent such wastes from being discarded into receptacles towards the waterfront side. Further, aided by the overhauled municipalized waste transportation system along with the CCTV monitoring system

(monitored in a central command and control Centre), this project can actually achieve complete prevention of the skewed and unscientific practices which were existing over the past.

Social Fencing to Solid Waste Management

Combining such surveillance technology with social fencing strategies, awareness generation among residents, participation of residents in monitoring the solid waste dumping, segregation of waste at household levels and formation of Ward Committees and Ward Commissioners, can promote the required social change and prevent prosecution. Appropriate provision for display and communication will play an important role to create awareness among users and thus promote their participation in solid waste management. This is proposed to be implemented in all the canals including tributaries to prevent throwing waste and garbage into the canal. Consumer redressal mechanism can also be set up in line with MSW guidelines and facilitate the its implementation.

3B.6.2 Solid waste collection

This project opens the canal banks to renewed activities of tourism and transport. Therefore, the generation of solid waste is inevitable. Waste collection is to be facilitated by setting up primary collection system with the development proposals in mind with adequate provision. The quantification in terms of length or number of the proposed development proposals along the five canals under the project, based on which the number of locations have been worked out for primary collection bins is stated in **Table 3B.22**.

Table 3B.22: Development proposals requiring solid waste collection

Canal		Edappally	Thevara-Perandoor	Thevara	Chilavanoor	Market	Total
Total length (km)		11.23	9.88	1.41	11.15	0.66	34.33
Development proposals							
1	Twin-bins for Households	15000					**15000**
2	Reconstructed roads along canal (length)	0	3181.1	2818.9	0	0	**6000**
3	Reconstructed road bridges (nos.)	11	23	2	13	3	**52**
4	Reconstructed foot bridges (nos.)	1	13	0	16	1	**31**
5	New foot bridges (nos.)	9	8	4	4	1	**26**

Canal		Edappally	Thevara-Perandoor	Thevara	Chilavanoor	Market	Total
6	Reconstructed access roads to bridges, up to 250m on either side (length, m)	5500	11500	1000	6500	1500	**26000**
7	Jetties and jetty/terminal building(s) (no.)	9	10	2	9	0	**30**
8	SPV office with testing lab along with jetty (no.)	1	0	0	0	0	**1**
9	Operational Control Centre with CCTV along with jetty (no.)	1	1	1	0	**3**	
10	Access roads to jetties and terminals (length, m)	2014.32	995.76		2014.32	0	**5024.4**

Provision of Twin Bins at Household level

The Honorable High Court has banned for providing bins in the streets and a recent order issued from the Local Self Government Department to prevent littering or/and dumping solid waste in the five canals under the project. Thus, it is proposed that each household should arrange twin bin with lid for solid waste collection. It is assumed that all households cannot afford to invest the amount for such bins, thus it is proposed that the project will provide twin bins to about 25% households (15,000 HH of total 60,000 HH) and the green parks in the project catchment. This will inculcate a habit among the households to keep its segregated waste in twin bins and allow its collection from its points. This provision will prevent throwing waste in the sub drains / canals and sensitize them towards their responsibility to the clean environment.

The spacing between each primary collection point, which is to be kept within the 50.0 m to 75.0 m limiting distance specified under the CPHEEO Manual 2016. Thus, maintaining this criterion in this project is eminently feasible.

3B.6.2.1 Requirement of primary collection bins

The requirement of the provision of primary collection bins at 1918 locations have been determined based on the following criteria of interspacing between bin locations (**Table 3B.23)**.

1. Provide twin bins to about 25% households i.e., 15,000 HH of total 60,000 HH and the green parks in the project catchment.
2. 50 m interspace is maintained along both sides of the reconstructed roads along the canal banks of Thevara and Thevara-Perandoor canal.
3. 75 m inter-distance has been provided on the reconstructed roads leading to the reconstructed road bridges along 250 m of the road on either side of the 52 bridges, or 26 km.
4. Approximately 5.025 km of upgraded access roads to jetties and terminals are provided with inter-spacing of 50 m.

Responding to the varying requirements among vehicular versus foot bridges, jetties and the regenerated access roads to jetties, approach roads to vehicular cum foot bridges, only foot bridges, etc., five types of primary waste collection bins are proposed to meet the demand. The type of bins and their capacities are given in **Figure 3B.15** with representative pictures only.

240L capacity standalone HDPE bins with lid mounted on metal frame anchored to ground

120L capacity free standing wheel mounted HDPE bins with lid.

60L x 3 free standing FRP tri-bin set with openable lid

80L x 2 standalone HDPE twin bin set with fixed/openable lid mounted on metal frame anchored to ground

100L to 120L all-weather smart bins including onboard garbage level sensor, garbage compactor, weight sensor with scale, with mobile internet communication capability along with requisite hardware and software

Figure 3B.15: Type of bins with their capacities

Table 3B.23: Number of primary collection bins required to cover the project area

Sl. No	Canal	Edappally	Thevara-Peran-door	Thevara	Chilavanoor	Market	Total	Type of bin
	Total length (km)	11.23	11.15	1.41	9.88	0.66	**34.33**	
	Development proposal							
1	Twin bins with lid for Households	15,000						Twin bin with lid

Sl. No	Canal	Edappally	Thevara-Peran-door	Thevara	Chilavanoor	Market	Total	Type of bin
	Total length (km)	11.23	11.15	1.41	9.88	0.66	**34.33**	
	Development proposal							
2	Reconstructed roads along canal	0	127	113	0	0	240	Two bin system 80 L each
3	Reconstructed road bridges	22	46	4	26	6	104	240L fixed
4	Reconstructed foot bridges	4	52	0	64	4	124	120L wheelie-bin with lid
5	New foot bridges	36	32	16	16	4	104	-do-
6	Reconstructed access roads to bridges, up to 250m on either side	125	261	23	147	34	589	Two bin system 80L each
7	Jetties and jetty/terminal building(s)	9	10	2	9	0	30	Three bin system, 60L each
7.i	Parking area (Category I)	5					5	Smart bin, solar powered, self-compacting, IoT enabled, 100L
7.ii	Parking area (Category II)	10					10	-do-
7.iii	Parking area (Category III)	8					8	-do-
7.iv	Parking area (Category V)	1					1	-do-
8	SPV office with testing lab along with jetty	1	0	0	0	0	1	Three bin system, 60L each
8.i	Parking area	1	0	0	0	0	1	Smart bin, solar powered, self-compacting, IoT enabled, 100L
9	Operations Control Centre	1	1		1	0	3	Three bin system, 60L each

Sl. No	Canal	Edappally	Thevara-Peran-door	Thevara	Chilavanoor	Market	Total	Type of bin
	Total length (km)	11.23	11.15	1.41	9.88	0.66	**34.33**	
	Development proposal							
	with CCTV along with jetty							
9.i	Parking area	1	1		1	0	3	Smart bin, solar powered, self-compacting, IoT enabled, 100L
10	Access roads to jetties and terminals	40	20		40	0	100	-do-
						Total	**1919**	

3B.7 Sewer network for the catchment

Kochi Municipal Corporation has a total area of 94.88 Sq.km and the IURWTS project command covers an area of 30.91 Sq.km of the corporation and an area of 11.34 Sq.km of 3 municipalities (Kalamassery, Thrikkakkara and Thripunithura). The sewer network is proposed in the entire catchment by providing individual household connections to the inhabitants and there are no uncovered areas in the project command. The sewage load is proposed to be treated in 5 STPs as explained in **sec 3B.3** above. The total sewer load generated in this project command based for a projected population of 3.07 lakhs for the year 2051 is 35.45 MLD.

Background

Kochi municipal corporation has 74 wards with 7 administrative zones. Sewerage coverage is limited to parts of central business district of Kochi and along the marine drive. As per the study conducted as part of the city sanitation plan (2011), it is reported that less than 5% of the city is covered by sewer network.

About 95% of households in Kochi depend on the Periyar river for drinking water needs water which is distributed after treatment by Kerala Water Authority from Aluva, a nearby town.

An area of 2.5 Sq. Km. in the heart of the city i.e. General Hospital area and 1.50 Sq. Km in Gandhi Nagar areas of this project catchment are covered by the existing sewerage system at Elamkulam. There is at present a proposal under AMRUT scheme which is in the execution stage for a new 5 MLD plant in the

existing Elamkulam plant premises. This plant will be mainly treating a part of the load of the project catchment. Hence the total load to be treated at the 5 STPs proposed in this report is only for 31MLD situated at the either ends of the 3 major canal systems as detailed in **Section 3B.3.**1 of this chapter.

3B.7.1 Existing sewage zones of the project catchment

The sewage zones have been demarcated by KWA and grouped under 7 sewage zones for development purpose as shown in **Figure 3B.16**. The divisions that are covered under this project catchment include 54, 58, 53, 61, 64, 65, 62, 63, 67(part), 68, 70, 69, 33, 34, 35, 37, 38, 39, 40, 41, 42(part), 43, 44, 45(part), 46(part), 47(part, 48(part), 49(part), 50, 51, 52, 53(part), 54, 55 (part), 56(part), 58, 59 (part). The ward map will be superimposed on to the sewage zone map to show the coverage of sewer network based on wards during the detailed design and estimation stage.

3B.7.2 Climatic data on temp and rainfall

The average temperature and rainfall for different months of the year (1982-2012) is as given in **Table 3B.24**.

Table 3B.24: Kochi Weather: Monthly Average (Year 1982-2012)

	January	February	March	April	May	June	July	August	September	October	November	December
Avg. Temperature (°C)	27	27.7	28.7	29.1	28.4	26.5	25.9	26.2	26.5	26.8	27.3	27
Min. Temperature (°C)	22.2	23.2	24.7	25.5	25.1	23.8	23.1	23.7	23.7	23.6	23.7	22.6
Max. Temperature (°C)	31.8	32.2	32.7	32.8	31.8	29.3	28.7	28.7	29.3	30.1	30.9	31.5
Avg. Temperature (°F)	80.6	81.9	83.7	84.4	83.1	79.7	78.6	79.2	79.7	80.2	81.1	80.6
Min. Temperature (°F)	72.0	73.8	76.5	77.9	77.2	74.8	73.6	74.7	74.7	74.5	74.7	72.7
Max. Temperature (°F)	89.2	90.0	90.9	91.0	89.2	84.7	83.7	83.7	84.7	86.2	87.6	88.7
Precipitation / Rainfall (mm)	19	33	49	139	386	728	708	375	304	303	162	48

Data: 1982 - 2012

Source: https://en.climate-data.org/asia/india/kerala/kochi-764250/#climate-table

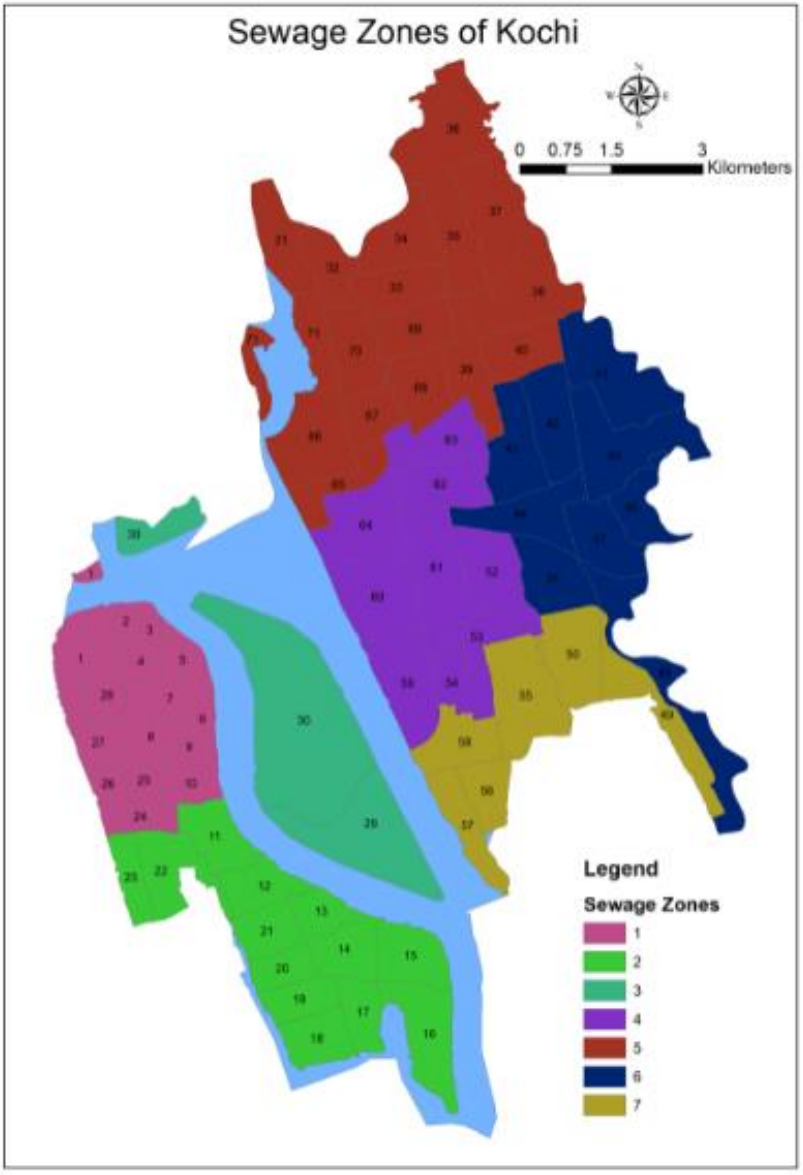


Figure 3B.16: Sewage Zones of Kochi

Looking to the **Table 3B.24**, it is clear that mid of the March was the driest month and the right time to know the water quality status of the dry weather flow. As a part of the investigations by Antea Group, water quality analysis was undertaken in the catchment canals and the results are given in **Table 3B.25** for Chilavanoor canal**, Table 3B.26** for Thevara Perandoor canal and **Table 3B.27**for Edappally canal and the detailed report included as **Appendix Vol 3**.

Chilavanoor Canal: Water Quality

Biochemical Oxygen Demand of all three location chosen for this canal is between 20 to 25, whereas Chemical Oxygen Demand varies from 59 to 157. Total suspended solid are between 34.6 to 39.2, and nitrogen is more than 36.2. The treated standards for Biochemical Oxygen Demand is 5 mg / l, Chemical

Oxygen Demand is 50 mg / l. Total Suspended solids 5 mg/l, Total Nitrogen 10 mg/l, Total Phosphorous 2 mg/l.

Table 3B.25: Water Quality status for Chilavanoor canal

Water - Quality - Chilavanoor Canal				
Test Parameter	Units	Location		
		Near Elamkulam	Near Amrita	Behind KSEB
pH	---	7.3	7.75	7.17
Total Dissolved Solids	mg/L	3107	8970	569
Total Hardness (as CaCO3)	mg/L	495	1535	123
Nitrate (as NO3)	mg/L	13.1	14.4	23.2
Nitrite (as NO2)	mg/L	0.05	0.02	0.02
Total Solids	mg/L	3202	9038	659
Total Suspended Solids	mg/L	34.6	34	39.2
Dissolved Oxygen	mg/L	0.71	0.2	0.02
Biochemical Oxygen Demand (3 days at 27 OC)	mg/L	20.2	24.2	24.9
Chemical Oxygen Demand	mg/L	59	157	126
Salinity	mg/L	2.59	8.31	0.15
Sodium as Na	mg/L	568	2225	58.9
Total Nitrogen	mg/L	42.2	36.5	72.7
Phosphates	mg/L	2.66	2.62	3.22
Total Coliform	---	Present/100 ml	Present/100 ml	Present/100 ml
Feacal Coliform	MPN/100ml	26	21	22

Thevara Perandoor Canal : Water Quality

Biochemical Oxygen Demand Near Perandoor is 92.1, followed by Near P &T Colony 24.5, and Near Jal Vayu Vihar is 24.2. Chemical Oxygen Demand at Perandoor is 315, followed by Jal Vayu Vihar 128 and P &T Colony is 108. Total suspended solid lies between 18 to 42, and nitrogen varies between 29.4 to 49.7. This canal also had Feacal Coliform and total Coliform count. The treated standards for Biochemical Oxygen Demand are 5 mg / l, Chemical Oxygen Demand is 50 mg / l. Total Suspended solids 5 mg/l, Total Nitrogen 10 mg/l, Total Phosphorous 2 mg/l.

Table 3B.26: Water Quality status for Thevara Perandoor canal

Water - Quality - TP Canal				
Test Parameter	Units	Location		
		Near Mini Perandoor	Near P &T Colony	Near Jal Vayu Vihar
pH	---	8.13	6.84	7.04
Total Dissolved Solids	mg/L	12324	6498	2698
Total Hardness (as CaCO3)	mg/L	1931	95	446
Nitrate (as NO3)	mg/L	13.1	7.23	8.05
Nitrite (as NO2)	mg/L	0.06	0.04	0.08
Total Solids	mg/L	12392	6549	2766
Total Suspended Solids	mg/L	18	42	28.5
Dissolved Oxygen	mg/L	0.2	1.2	0.2
Biochemical Oxygen Demand (3 days at 27 OC)	mg/L	92.1	24.5	24.2
Chemical Oxygen Demand	mg/L	315	108	128
Salinity	mg/L	11.3	0.61	2.23
Sodium as Na	mg/L	2825	33.9	402
Total Nitrogen	mg/L	29.4	43.7	49.7
Phosphates	mg/L	1.44	2.98	3.42
Total Coliform	---	Present/100 ml	Present/100 ml	Present/100 ml
Feacal Coliform	MPN/100 ml	17	33	27

Edappally Canal : Water Quality results

Biochemical Oxygen Demand Near Proposed STP is 41.8, followed by Railway location 12.1. The BOD level at the Lulu Mall location is a better level of 0.2 mg/l. Chemical Oxygen Demand Near Proposed STP is 238, and other two location are in the safer limit. Total suspended solid are between 14 to 26, and nitrogen varies between 21.4 to 37.1. This canal also have Feacal Coliform and total Coliform present in the water body. The treated standards for Biochemical Oxygen Demand is 5 mg / l, Chemical Oxygen Demand is 50 mg / l. Total Suspended solids 5 mg/l, Total Nitrogen 10 mg/l, Total Phosphorous 2mg/l.

Table 3B.27: Water Quality status for Edappally canal

Water - Quality - Edappally Canal				
Test Parameter	Units	Location		
		Near Proposed STP	Near Lulu Mall	Near Railway
pH	---	6.84	6.56	6.85
Total Dissolved Solids	mg/L	2529	400	2581
Total Hardness (as CaCO3)	mg/L	446	63.4	345
Nitrate (as NO3)	mg/L	6.19	12.4	4.49
Nitrite (as NO2)	mg/L	0.12	<0.02	0.09
Total Solids	mg/L	2574	481	2648
Total Suspended Solids	mg/L	14.6	26.4	26
Dissolved Oxygen	mg/L	< 0.20	<0.20	< 0.20
Biochemical Oxygen Demand (3 days at 27 OC)	mg/L	41.8	0.20	12.1
Chemical Oxygen Demand	mg/L	238	49	39.3
Salinity	mg/L	1.83	0.1	1.97
Sodium as Na	mg/L	481	30.9	568
Total Nitrogen	mg/L	31	37.1	21.4
Phosphates	mg/L	3.5	0.84	0.18
Total Coliform	---	Present/100 ml	Present/100 ml	Present/100 ml
Feacal Coliform	MPN/100ml	40	13	14

The results of the water quality report confirm that the incoming wastewater quality at the STPs have abnormally low BOD levels, possibly due to seepage/dilution with ground water.

Survey data

LiDAR survey for an AOI of 125m has been undertaken as part of the project investigation. The Spot levels and contours for this stretch has been generated. The planning at this stage has been based only on topography maps and satellite Imageries. Hence the topographic survey /LiDAR study needs to be extended for the whole catchment for detailed information on the topography and for inclusion of all roads and lanes before the detailed design and estimation is undertaken.

3B.7.3 Objectives for extending the sewer network to individual house holds

1) To achieve a hygienic environment within the entire area of the command bound within the Corporation and for portion coming under 3 municipalities (Kalamassery, Thrikkakkara, and Thripunithura) on the eastern side of the catchment.
2) Conservation of project canals barring sewage flow into the canals
3) Convey the wastewater collected from the entire project command to the 5 STPs proposed and generate safe effluent that will be acceptable to the public for disposal to the adjoining water bodies or for any other uses.
4) Ensure that the entire population of the project command enjoy sewer line connected to their households and safe disposal of black wastewater.

3B.7.4 Length of Interceptor Conduits

The length of interceptor of primary main for Edappally canal is 23.14 km followed by Chilavanoor canal 22.3 km, followed by TP canal 19.76 Km. The total length of interceptor of primary main is 65.2 km. The total length of Interceptor-Secondary Main shall be 66.44 Km as shown in **Table 3B.28**.

Table 3B.28: Length of Interceptor Conduits

Name of the Canal	Interceptor- Primary Main in KM	Interceptor-Secondary Main in Km
Chilavanoor Canal	22.3	11.15
Thevara Perandoor Canal	19.76	10.84
Edappally Canal	23.14	11.23
Total Length	**65.2**	**66.44**

3B.7.5 Proposal for the Extension of sewerage network into project catchment

The household unit connection is proposed to be conveyed to the secondary networks. The secondary line will in turn get connected to the primary networks. The extension of sewerage network into the project catchment can be extended till the household sewerage collection.

Looking to all aspects, the network can be extended to a level of interception of secondary main. This shall bring additional sewerage network laying of 66.44 Km, and it will ingress more into the canal catchment. This will require household survey, topographic survey, and additional detailed design.

The **Figure 3B.17** shows the network plan for the Elamkulam STP, where the TP south and Chilavanoor south are feeding to Elamkulam plant by the primary main interceptors.

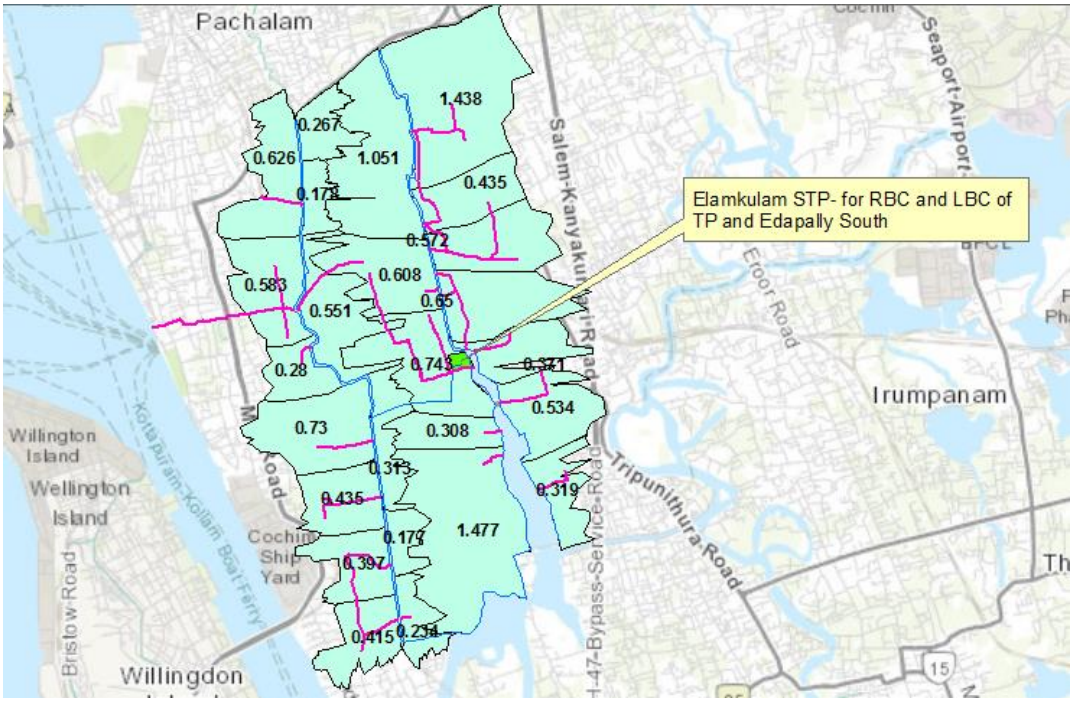


Figure 3B.17: Network plan for Elamkulam STP

The **Figure 3B.18** shows the Extension of sewerage network into the IURWTS Canal catchment, extending additional 66.44 Km of interceptor main in the catchment.

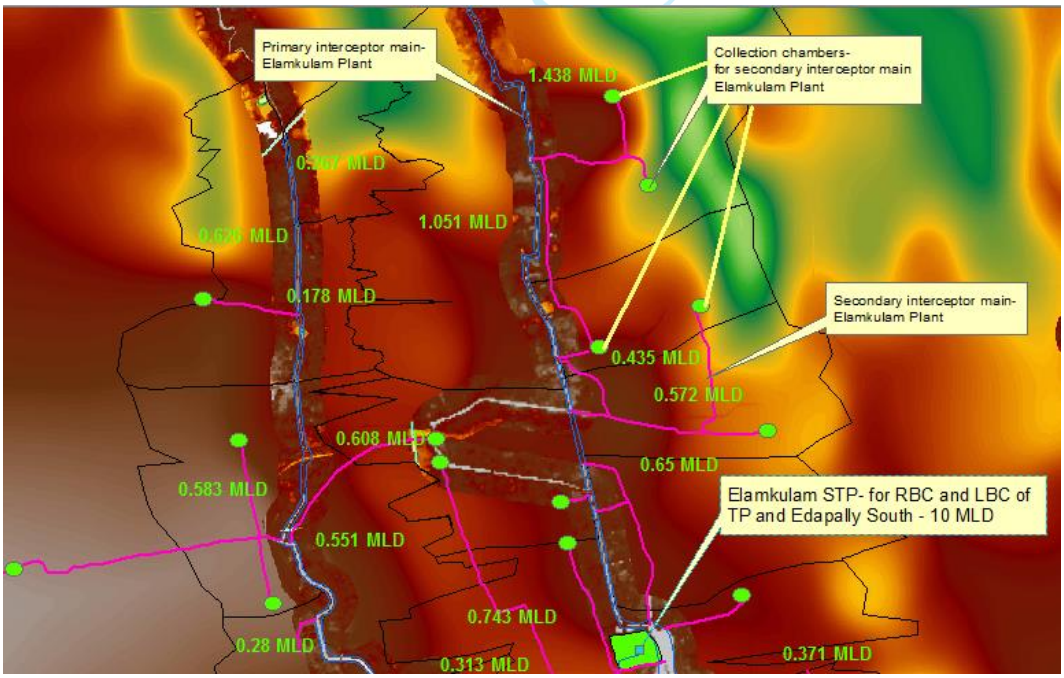


Figure 3B.18: Extension of sewerage network into IURWTS catchment

All the green highlighted circles shall be planned after detailed household survey and topographical survey of the entire project catchment. The pink color lines are the subdrains, and sewerage lines shall be laid both side of the sub drains as a secondary interceptor. (**Figure 3B.19**)

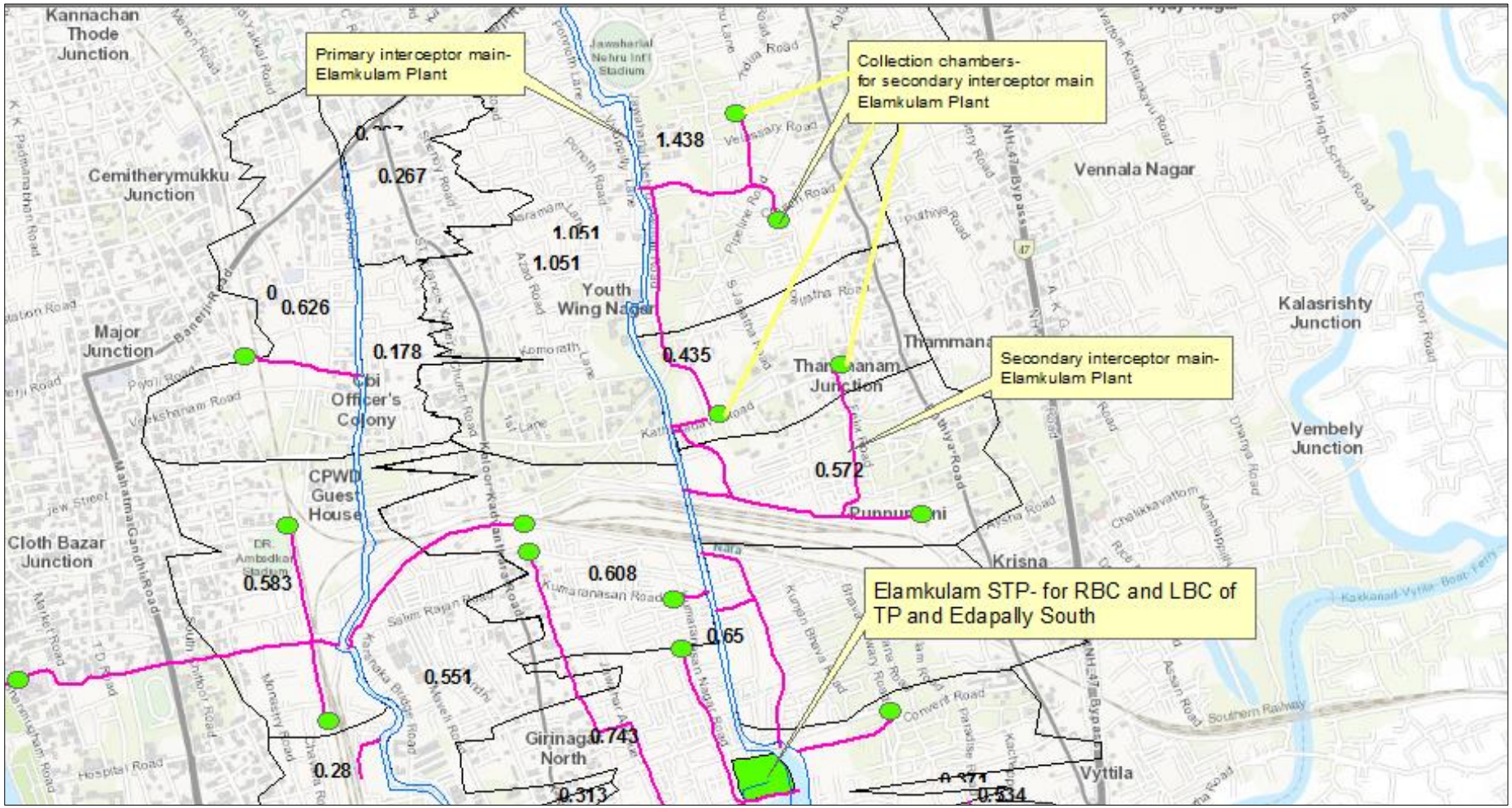


Figure 3B.19: Primary and secondary interceptor mains with collection chambers

3B.7.6 Project catchment

There are 5 canals in the project catchment. Out of which 4 canals Edappally canal, Chilavanoor canal, and Thevara -Perandoor (which includes Thevara canal) are treated as 3 catchments for design of sewer system based on the catchment characteristics.

The original scope of the project for GC was to cover sewer network only along the canal with an Area of Interest (AoI) of 250m on either side of the canal. Later as per the direction of SPV the scope of sewer network was extended to the entire catchment such that each individual house in the catchment is provided with sewer connection facility.

Based on the reconnaissance survey undertaken, the entire catchment was physically surveyed and all the sub canals reaching the main canal were segregated and brought into the catchment area map of the 3 canals. The details given in **Table 3B.29**.

Table 3B.29: Details of sub canals

Sl. No	Canal	Total length (Km)	Catchment area Ha.	Wards	No. of Sub drains (nos.)	Length of sub drains (Km)	Population projected 2051	Sewage load estimated (MLD)
1	Chilavanoor	11.15	1436.0	24	24	11.72	90605	23.73
2	Thevara Perandoor + Thevara	9.88	1008.60	22	20	10.84	108016	
3	Edappally Kochi Corporation Municipalities Thrikkakkara Kalamassery Thripunithura	11.23	1780.0		21 19 19 2	15.30	108460	11.72
	Total	**32.26**	**4225 (42.25 Sq.Km)**		**65(KMC)**	**37.86**	**3,07,181**	**35.45**

3B.7.7 Design of sewer network

Collection and transport of wastewater from each home/building is proposed to be conveyed through secondary and primary riders to the 5 STPs located in the project catchment. The general arrangement for house connection is given in **Figure 3B.20**. The individual households will be connected to an interceptor in the individuals plot. The same connected to a manhole which is designed to accommodate 6 household connections. The manholes are connected by sewer lines to the secondary riders. From the secondary riders laid along the subdrains on either side, it is connected to the primary rider. From the primary rider the sewage is transported to the sewage treatment plant.

The entire catchment is divided into two parts with the NH cutting across the catchment into 2 parts. The sewage generated on the northern side of the 3 canals is proposed to be treated at 3 separate STPs one at Perandoor for T-P canal, Puthukkalavattom for Chilavanoor and Muttar for Edappally canal.

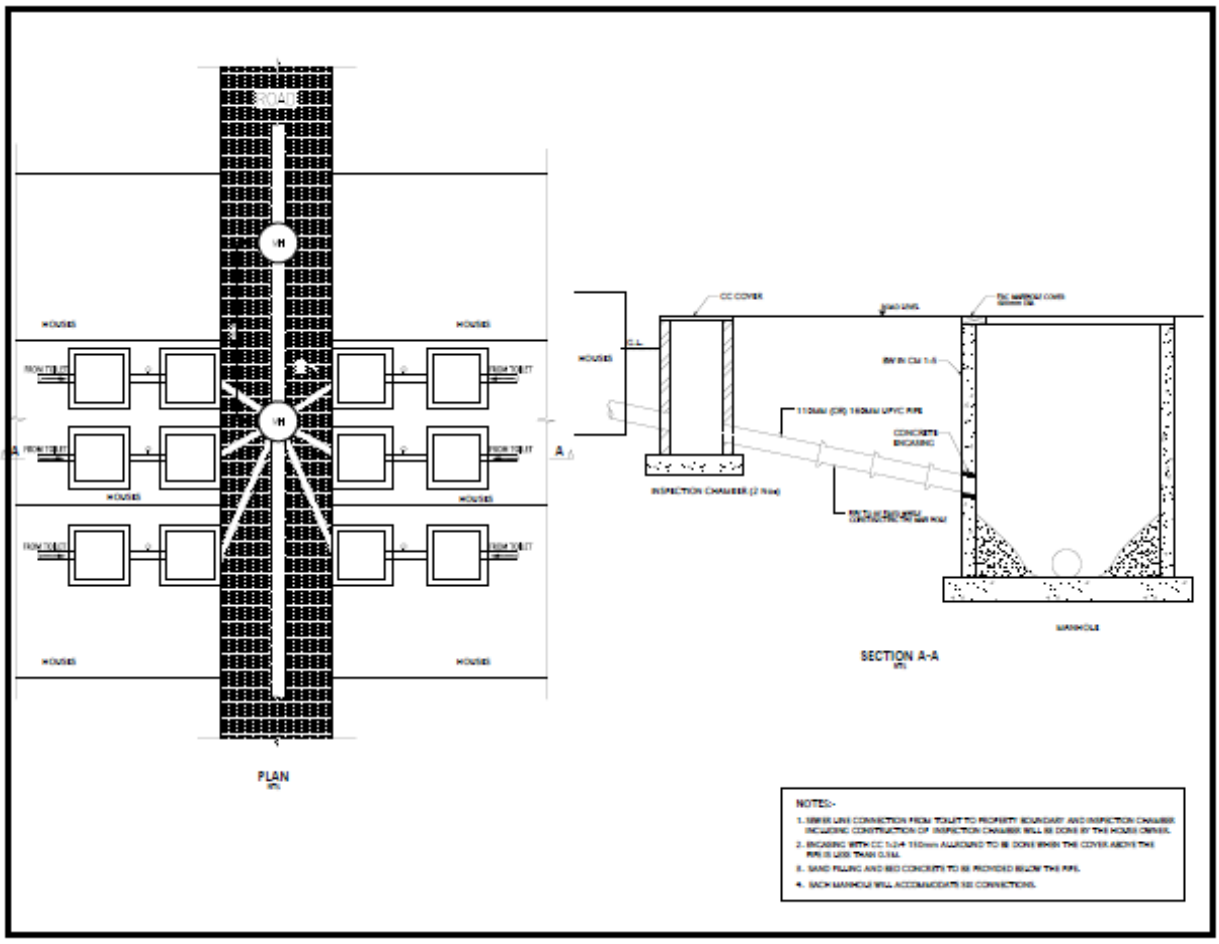


Figure 3B.20: General arrangement for house connection

CHAPTER 4 ENGINEERING DESIGN

4A. CANAL ORIENTED DEVELOPMENT

4A. CANAL ORIENTED DEVELOPMENT

Introduction

The basic engineering design principles followed for Canal oriented development is to preserve the original canal features and functions. As part of the preservation process, stakeholder participation was initiated by Antea Group and based on the views expressed by the community, ecological goals that need to be adopted, the missing or altered original features of the 5 canals were identified.

Chapter 3A (Functional Design) of this DPR has already dealt with the functional design aspects of the activities that are taken up. This chapter brings out the engineering design aspects of the activities. The engineering design has been prepared in accordance with applicable Indian Standards codes as well as International codes and procedures wherever required.

4A.1 Canal Cleaning

Canal cleaning mainly aims at the removal of weed and floating materials lying in the 5 project canals. The fresh and saline water exposed to sunlight of the project canals and surrounding water bodies provide an ideal ecological environment for algal growth. Floating weeds or aquatic plants have leaves floating on water surface either singly or in groups. They have true roots, leaves and flowering parts above the water surface. Some of them are free floating, while the roots of few are anchored in mud in the bottom of water body. These plants rise and fall with the level of water in the water body. They flower very rapidly and some of them which are the most troublesome belong to the genera Eichhornia, Pistia, Lemna, Salvinia, Nymphea, Brasenia spirodella etc.

From an environmental angle, clearing of weed growth, if not timely addressed, can lead to the following issues:

1. Mismanaging vegetative growth like water hyacinth and invasive species can lead to limited access for inspection, create blockages, provide habitat for burrowing animals, and contribute to the likelihood of failures of navigation system.
2. Aquatic weeds create situations which are ideal for mosquito growth. The mosquitoes are sheltered and protected from their predators by aquatic weed roots and leafy growth and are responsible for the spread of Malaria, Yellow fever, River blindness and Encephalitis.
3. Once the roots of the weeds get foothold to the canal bottom, accumulation of sediments is noticed. This creates a sandbar and encourages more aquatic and emergent vegetation growth and causes blocks to the navigation of vessels.

4. Invasive plants like hydrilla is said to grow an inch a day. Water hyacinth can form dense mats and double in size in less than two weeks under favorable conditions.

4A.1.1 Measures adopted for cleaning

Control (both physical and mechanical) measures are proposed to be undertaken for cleaning of the project canals. The advantages of mechanical methods include utilization of available manpower resources, environmentally friendly and target specific, yields immediate results, and provides fewer chances of permitting ecological shifts in aquatic flora. Mechanical methods often reduce massive nutrient load of eutrophic water bodies, helping indirectly in diminishing the future weed population.

In this DPR, as the growth of water hyacinth in the canals is a seasonal process, provision has been included for periodic cleaning all throughout the implementation period. The waste materials dumped will be cleaned during the deepening and widening process of the canal improvement.

The type of machineries to be used during the start of the project canals' cleaning processes and during the post implementation stage are different. There are modern machineries available at present, to undertake the surface cleaning process in small canals and a glimpse of the machineries generally used is given in **Figure 4A.1**.

The cleaning process commences with the removal of water hyacinth and dumped solid waste in the canal. Both this process can be taken up concurrently with the machineries available in the market. **Figure 4A.1(a)** shows a grabber machine equipped with a forked bucket which is fitted to a boat in water. The grabber end can be opened and closed on command and thereby the dumped waste is pulled out from the canals. Water hyacinth removal from the canals during the start can only be undertaken by the conventional method with a Hitachi machine fitted on pontoons (see **Figure 4A.1(b)).** The size of the pontoon and machinery can be adjusted according to the existing width of the canal.

Mowing of weeds: Different types and size of weed harvesters suitable for operation for varying widths of the canals are available in the market. A conventional type is as shown in **Figure 4A.1(c)** and **Figure 4A.1(d)**.

This machine operated water harvester fitted to a boat works like a in water lawn mower. It clears all types of vegetation including dumped floating matters in the canal.

An advanced version of the water harvester is the one with conveyor belts. In this type a conveyor belt is fixed at the front of the machine and when lowered underwater the harvester cuts the vegetation in the water. By means of the conveyor belt it collects and stores the weeds on the board of the boat. Once full,

the harvester is moved to the shore and the conveyor belt helps in clearing the weeds to the shore as given in **Figure 4A.1(e)** and **4A.1(f)**. These types are desirable for cleaning the canals during the post implementation stage of the project.

Figure 4A.1(a) Grabbers mounted on pontoon to remove dumped solid waste

Figure 4A.1(b) Conventional method of Hitachi mounted on pontoon

Figure 4A.1(c) Aquatic weed harvester (cleaning process)

Figure 4A.1(d) Aquatic weed harvester (weeding and disposal)

Figure 4A.1(e) Water hyacinth the floating materials harvester with conveyor belts (Large)

Figure 4A.1(f) Water hyacinth the floating materials harvester with conveyor belts (Small)

Figure 4A.1(g) Floating bicycle to scoop out plastic matter from canal

Figure 4A.1(h) Floating bicycle scooping out plastic waste

Figure 4A.1(i) Specialized boot strap cleaners at canal mouths

Figure 4A.1(j) Plastics and weeds gets collected in the trap

Figure 4A.1 Different machineries for canal cleaning

On an international perspective **Figure 4A.1(e)** and **4A.1(f)** shows a floating bicycle to scoop out plastic matter during the post implementation cleaning process in canals. There are no specific codes or manuals for the cleaning process. Hence in the case of this project we propose to use the above machineries as shown in **Figure 4A.1(a) to 4A.1(f)** based on the canal width available at different stretches of the canals during the implementation stage. **Figure 4A.1(g)-4A.1(j)** is proposed to be used during the post implementation stage of the project.

4A.2 Deepening and Widening the Canals

The project canals are proposed to be restored to the original width of the canal as per village record and meeting the requirement for flood mitigation and navigation of vessels. The deepening process is vital to maintain the usefulness of canals for various purposes, including watercraft navigation and flood control. Deepening a canal involves the removal of varying levels of sediment, mud, trash, and other debris at the

bottom of the canal. The dredge level has been established based on the minimum navigation depth to be maintained during low tide water level in the canal. The detailed calculations carried out by Antea Group is detailed in **Chapter 3A** (Functional design).

The soil conditions have also been taken into consideration for fixing the dredge level. A selected number of secondary data on the geotechnical bore log details by the side of the project canals was provided by SPV. Two typical bore logs of the top layer extracted for Chilavanoor canal are shown in **Figure 4A.2(a)** and for Thevara – Perandoor canal in **Figure 4A.2(b)** respectively.

The dredge level fixed for the project canals is 2.25m below the ground level. As per the tables given in **Figure 4A.2**, it can be seen that the depth of deepening is within the "moorum" layer (i.e. the layer having soft sandy and loose sand). The depth of deepening fixed has not crossed into the dense layers and hence the hydrogeological impact for saltwater intrusion is ruled out. Hydro- geological studies are in progress to ascertain the impact of the deepening proposed before the detailed estimates are finalized.

Economic benefits of restoring the canals include creation of jobs as well as increased leisure and tourism. Social benefits can include sense of community through campaigning and volunteering for a local project as well as benefits to health through increased opportunities for cycling and walking. Environmental benefits include creating habitats to increase biodiversity of wildlife.

The aim behind the deepening and widening the canals is 1) to preserve the original state of the project canals as per revenue records, and 2) for free discharge of the storm waters and maintaining a minimum depth for movement of vessels.

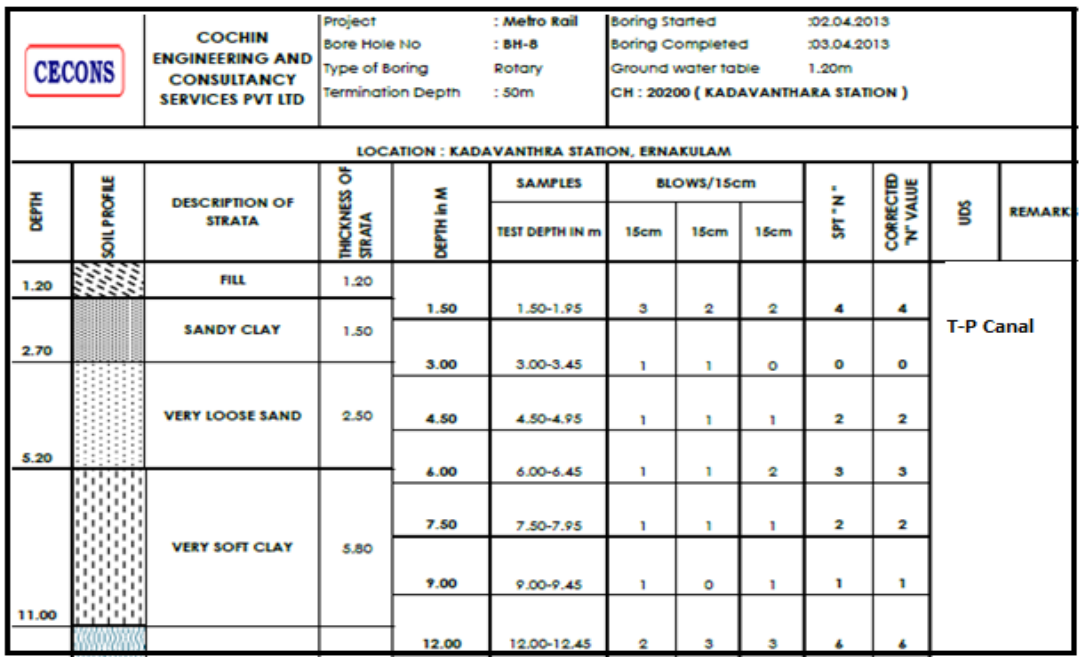
CECONS — COCHIN ENGINEERING AND CONSULTANCY SERVICES PVT LTD

Project : Metro Rail
Bore Hole No : BH-6
Type of Boring : Rotary
Termination Depth : 50m
Boring Started :25.02.2013
Boring Completed :27.02.2013
Ground water table 0.35m
CH : 19300 (ERNAKULAM SOUTH RAILWAY STATION)

LOCATION : SOUTH RAILWAY STATION, ERNAKULAM

DEPTH	SOIL PROFILE	DESCRIPTION OF STRATA	THICKNESS OF STRATA	SAMPLES DEPTH in M	SAMPLES TEST DEPTH IN m	BLOWS/15cm 15cm	15cm	15cm	SPT "N"	CORRECTED "N" VALUE	UDS	REMARKS
0.60		FILL	0.60									
2.10		VERY SOFT SANDY CLAY	1.50	1.50	1.50-1.95	1	0	1	1	1		Chilavanoor canal
3.70		VERY LOOSE SAND	1.60	3.00	3.00-3.45	1	0	2	2	2		
5.10		DENSE SAND	1.40	4.50	4.50-4.95	16	19	14	33	24		
				6.00	6.00-6.45	1	0	1	1	1		

Figure 4A.2(a) Geotechnical Bore log details for Chilavanoor canal



CECONS	COCHIN ENGINEERING AND CONSULTANCY SERVICES PVT LTD	Project : Metro Rail Bore Hole No : BH-8 Type of Boring : Rotary Termination Depth : 50m	Boring Started :02.04.2013 Boring Completed :03.04.2013 Ground water table 1.20m CH : 20200 (KADAVANTHARA STATION)

LOCATION : KADAVANTHRA STATION, ERNAKULAM

DEPTH	SOIL PROFILE	DESCRIPTION OF STRATA	THICKNESS OF STRATA	DEPTH in M	SAMPLES TEST DEPTH IN m	BLOWS/15cm 15cm	15cm	15cm	SPT "N"	CORRECTED "N" VALUE	UDS	REMARKS
1.20		FILL	1.20	1.50	1.50-1.95	3	2	2	4	4		
2.70		SANDY CLAY	1.50	3.00	3.00-3.45	1	1	0	0	0		T-P Canal
5.20		VERY LOOSE SAND	2.50	4.50	4.50-4.95	1	1	1	2	2		
				6.00	6.00-6.45	1	1	2	3	3		
		VERY SOFT CLAY	5.80	7.50	7.50-7.95	1	1	1	2	2		
				9.00	9.00-9.45	1	0	1	1	1		
11.00				12.00	12.00-12.45	2	3	3	6	6		

Figure 4A.2(b) Geotechnical Bore log details for Thevara-Perandoor canal

Figure 4A.2: Geotechnical bore log details

The procedures involved in the deepening and widening of the canals are site specific. A broad idea on the mechanical machineries to be used in this project is essential and the different machineries that are conventionally engaged and innovative latest trends in undertaking the deepening and widening are shown in **Figures 4A.3(a)** to **4A.3 (f)**.

In the conventional procedures adopted, mechanical deepening is conducted using a barge-mounted clamshell crane or backhoe. The excavated materials are deposited on the shore further conveyed by lorries to the dumping sites as given in **Figures 4A.3(a)** & **4A.3(b)**. In modern methods the excavated material is loaded into the waiting barges, which are then towed to disposal areas as given in **Figures 4A.3(c)** to **4A.3(e)**.

For deepening and widening activities in the project, deepening is completely an underwater excavation activity. On the other hand, widening is done both above and under the water level of the canal. Mechanical deepening costs typically include the hiring costs of floating platform with a barge mounted crane or excavator, tugboat, disposal scows, and the labor to operate the dredging equipment. The cost for conveyance of the dredged excavated earth includes the distance the material must be disposed, either through barges in water or by lorries on land.

Cost estimates for deepening and widening have be undertaken based on Delhi Schedule of Rates (DSR 2019) and detailed in **Chapter 6.**

Figure 4A.3(a) Hitachi fixed on a pontoon for deepening

Figure 4A.3 (b) Long arm deepening Hitachi

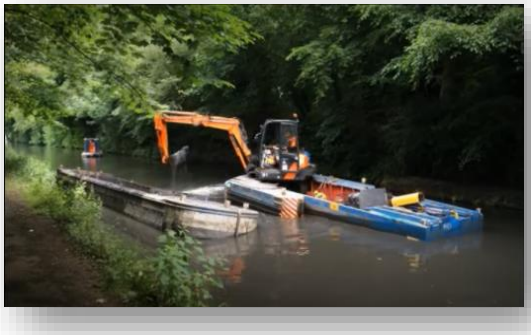


Figure 4A.3(c) Excavated material filled into barge

Figure 4A.3(d) Excavated material conveyed by barge for disposal

Figure 4A.3(e) Machinery for deepening smaller canals

Figure 4A.3(f) Innovative Dino6 dredger used for widening work

Figure 4A.3(g) Dino6 dredger in operation

Figure 4A.3(h) The sucked earth from Dino 6 dredging used to fill geo-synthetic tubes

Figure 4A.3: Different conventional machineries engaged in deepening and widening

The innovative dredger Dino6 available in international markets is used for widening canals with lesser width. This dredger machinery has the capability of cutting the soil with a cutter fixed on the front side. The cut soil is sucked by means of powerful submersible pumps and transported to the shore in slurry form through a pipe. The end of the pipe is connected to geo-synthetic tubes placed in the shore and the same used for low lying area filling. Hence, the whole process has no negative impact on the ecosystem within the canal and canal banks. The specification for Dino6 dredger is as given in **Table 4A.1**.

Table 4A.1: Specification for Dino6 dredger

Sl. No	Specification	Features	Facilities
1	Working depth	13 ft	Canals of 6’ deep or less
2	Pump performance	1500 GPM	Powerful enough to dredge canal
3	Cutter head	66 Inches	The bottom and sides of the canal
4	Length	22 ft	Transport this dredge to the job site
5	Width	5ft 11 inches	Access to tight spaces
6	Engine	Cummin4 cylinder	Power and efficient engine

4A.3 Shore Protection

As discussed in **Chapter 3A**, **section 3A.3** of this DPR for comparison with other types the design analysis for sheet piles has been undertaken. Based on the pressure distribution on the steel sheet piles, the equation to be solved for estimating the depth is a 4^{th} order equation. Hence estimating the depth can be undertaken only by a trial and error method. Being a cumbersome process, the general practice is to use available software.

All design calculations were carried out using DC-Pit software. The assumptions used for the design are detailed in **Chapter 3A, section 3A.3.1.1** of this DPR. The partial load factors recommended as per BS 5950 and as per Euro code-part -1 is 1.5. However, Indian Standard IS 9527 Part 3 recommendation to use a load factor of 2.0 on Bending moment. Hence, a load factor of 2 has been used in design calculations.

Design inputs to the model are as given in **Figure 4A.4**.

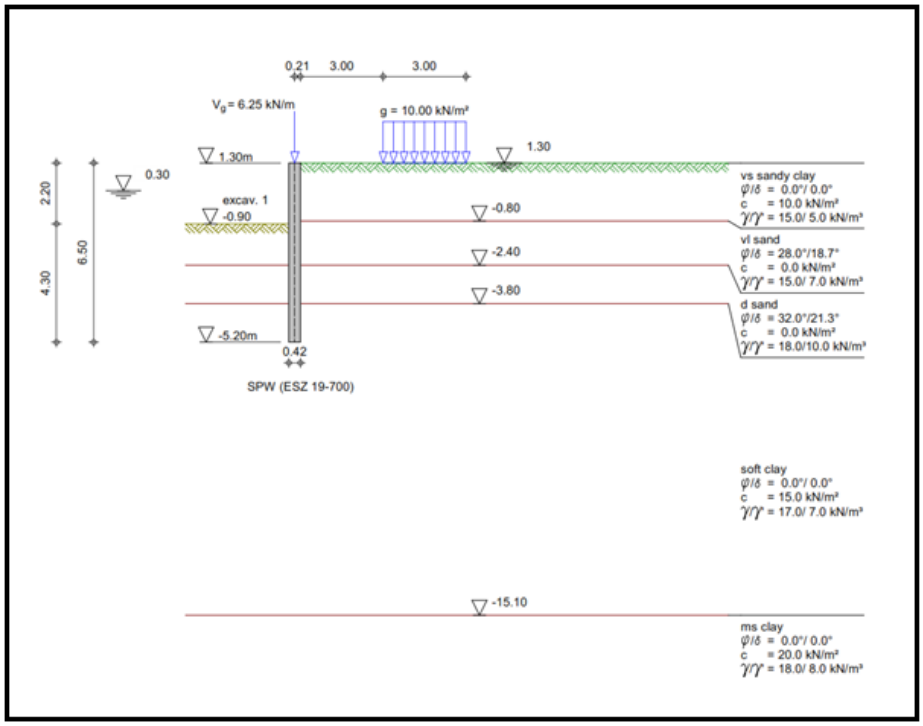


Figure 4A.4: Design assumption of the loads on the steel sheet pile

Note: In **Figure 4A.4,** above LWL is considered on dredge side and high-water table on retention side.

The active and passive pressure diagrams were generated from the software used. The soil parameters taken were based on the inputs of the two geotechnical bore logs (near Chilavanoor and Thevara Perandoor canals) and surcharge loads was assumed as 10 kN/m^2 , as given in **Figures 4A.2(a) and 4A.2(b)** for the soil on the landward side of the sheet piles.

The design drawings details of the sheet pile are given in **Figure 4A.5**.

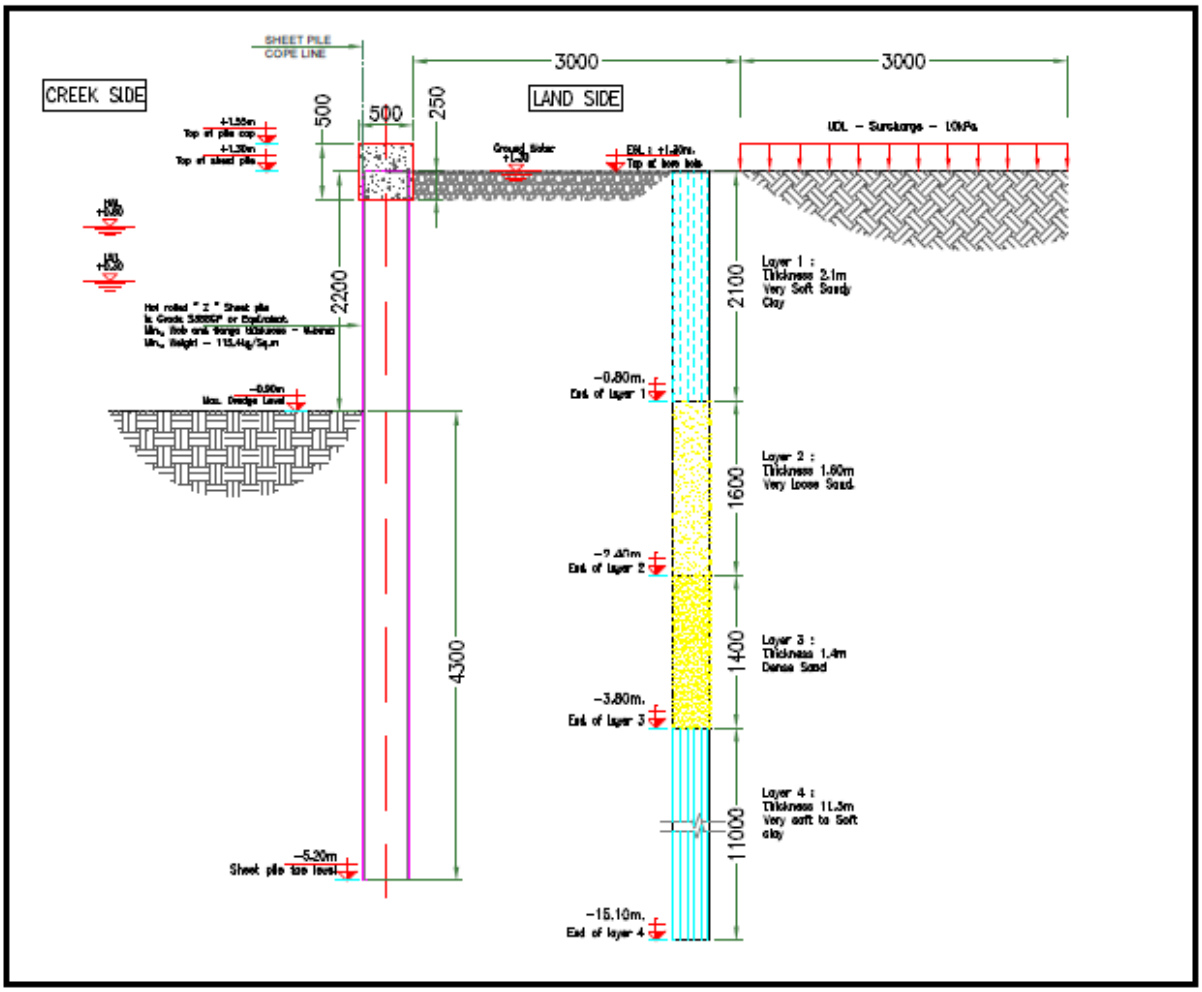


Figure 4A.5: Design drawings details of the sheet pile

The earth, hydraulic and total pressure diagrams - As built condition on sheet piles are as given in **Figure 4A.6**.

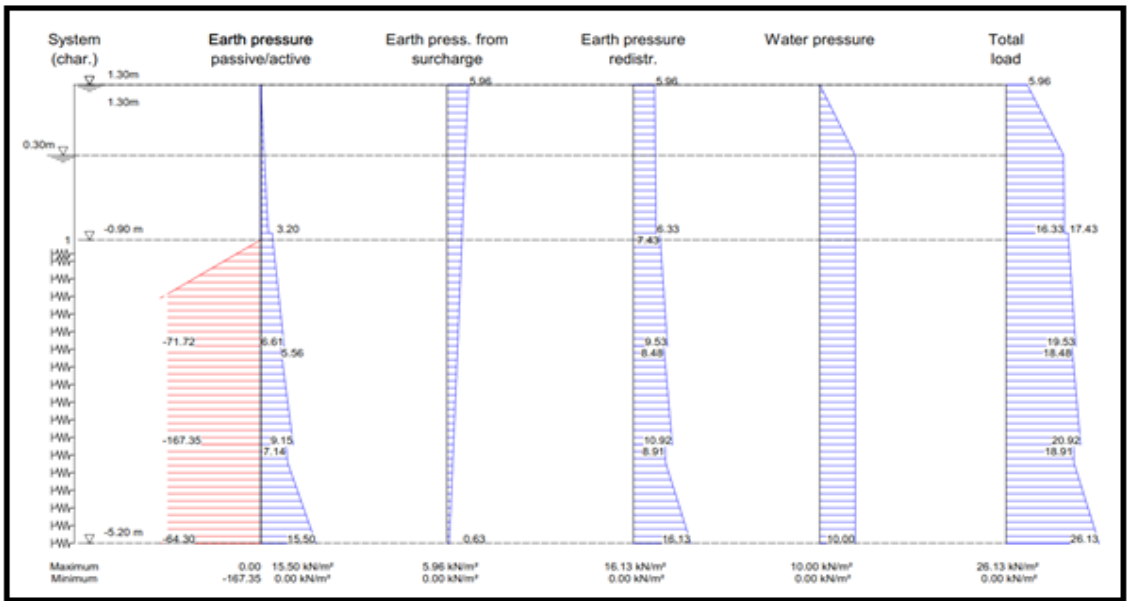


Figure 4A.6: The earth, hydraulic and total pressure diagrams - As built on sheet piles

The structural forces in an as-built condition on the Steel sheet pile as generated from the model are shown in **Figure 4A.7**.

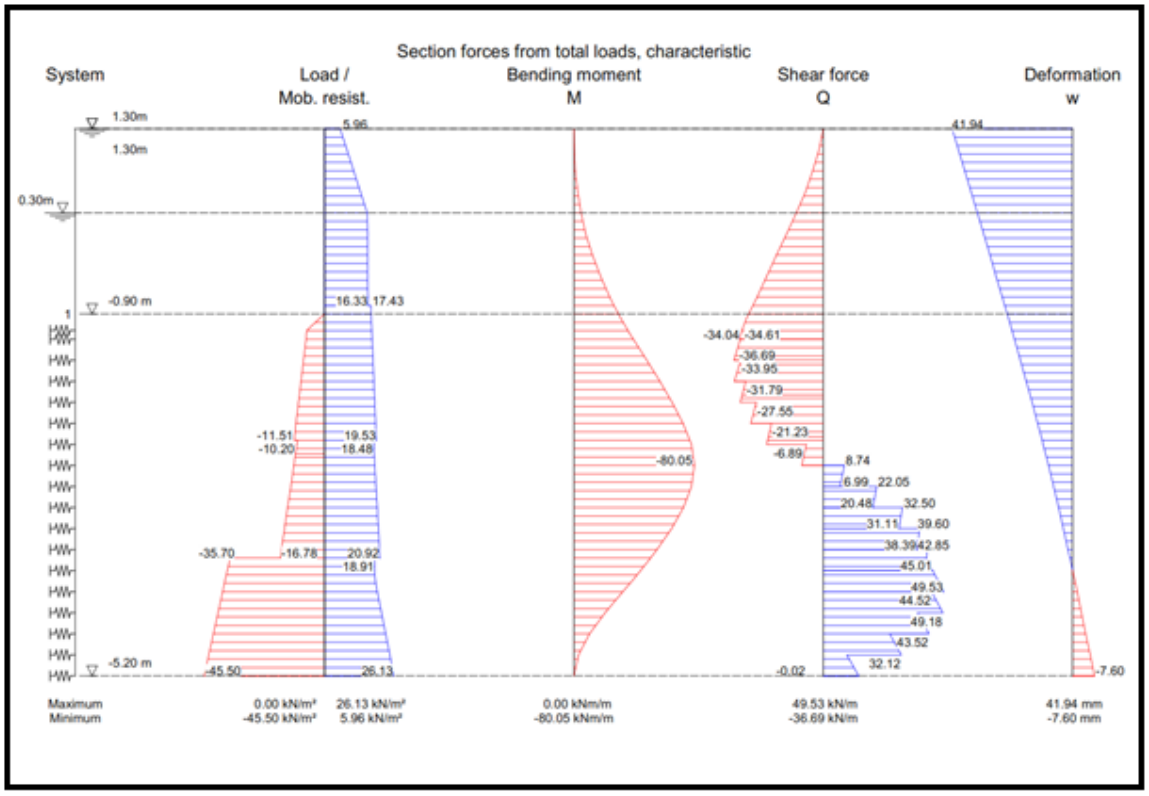


Figure 4A.7: Structural forces – As-built acting on the steel sheet pile

As derived from the bending moment diagram:

Max. unfactored bending moment: -80.05kN-m/m

Max. unfactored shear force: +49.53kN/m

The final as-built design section for the sheet pile under this project shore protection is given in **Figure 4A.8**.

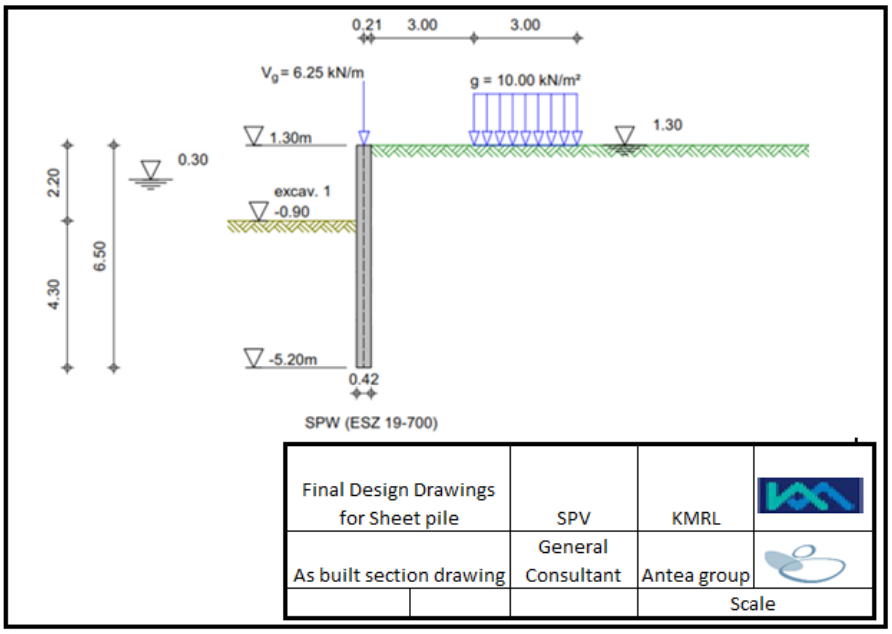


Figure 4A.8: Final As built design section for the sheet pile under IURWTS canals

The recommended minimum sheet pile length is 6.5m to retain a maximum retention height of 2.25m. The summary of the design outputs is as given in **Table 4A.2**.

Table 4A.2: Summary of design outputs

No.	Name	Unit	Data
	Input Data		
1	Top of sheet pile	m	+1.3
2	Ground level	m	+1.3
3	Canal bed level	m	-0.9
4	Depth of excavation	m	2.2
5	Water level land side	m BGL	+1.3
6	Water level canal side	m BGL	+0.3
7	Surcharge	kN/m^2	10
	Sheet pile wall (without corrosion consideration)		
1	Max bending moment	kNm/m	80.05
2	Factor of safety	–	2
3	Factored bending moment	kNm/m	160.1

No.	Name	Unit	Data
4	Type of sheet pile	Z/U	Z shape
5	β Factor	–	1
6	Steel	–	S355 GP
7	Material factor	–	1
8	Factored steel strength	MPa	355
9	Required section modulus of sheet pile	cm^3/m	450.99
10	Proposed section	–	ESZ 19 - 700
11	Moment of inertia	cm^4/m	39420
12	Section modulus	cm^3/m	1875
13	Bending moment capacity	kNm/m	665.625
14	Web thickness	mm	9.5
15	Flange thickness	mm	9.5
16	Length of wall	m	6.5
17	Deformation	mm	41.94
18	Factor of safety (SF)	–	4.16
	Sheet pile wall (with corrosion consideration)		
1	Design working life (years)		50
2	Norm for corrosion rates		EC 1993 - 5
3	Working condition	Front	Common fresh water (river, ship, canal….)
4		Back	Undisturbed natural soils (sand, silt, clay, schist...)
5	Corrosion protection (years)	Front	0
6		Back	0
7	Corrosion loss (mm)	Front	0.9
8		Back	0.6
9		Total	1.5
10	Moment of inertia with corrosion loss	cm^4/m	34578.9
11	Section modulus with corrosion loss	cm^3/m	1648.6
12	Bending moment capacity	kNm/m	585.253
13	Web thickness	mm	8
14	Flange thickness	mm	8
15	Factor of safety (SF)	–	3.66

4A.4 Navigation facilities

4A.4.1 Engineering Vessel design

Design Philosophy for navigation vessels

In any inland waterway system, the two most important aspects to be carefully evaluated are the type of vessels that are expected to ply and the parameters governing the navigation channel. These two aspects are themselves closely related. Since many different sizes of vessels will use the waterway depending upon the type of passenger demand, a typical vessel with limiting dimensions for the channel has to be arrived at. This may be termed as the "Design Vessel". It should be noted that the Design Vessel is a conceptual vessel; it is obvious that vessels smaller than the design vessel will have no difficulty in operation provided the speed and other parameters are limited to the shallow water constraints set by the channel. Vessels larger than the Design Vessel may not be able to operate or may be operated under certain constraints such as operating during high tides or with lower loads. **PIANC guidelines** has been followed in general for arriving at the design vessel. However, these guidelines are made mostly for large ocean-going vessels entering larger canals. Hence some adaptations have been made considering the IURWTS canal capacity and other environmental factors. This design vessel has been dimensioned as big as possible within the constraints. The intent is to reduce the cost per passenger and service more passengers within the capacity of the canal.

Assumptions

The canal's water level is proposed to be maintained with a clear water depth of 1.4m. The dredge level of the canal has been fixed based on Geo-technical consideration and to maintain the minimum draft for navigation purposes. The canal passenger vessel design has been based on the passenger demand. Even with this guaranteed water level, the canal is still considered to be as shallow water. Hence the shallow water effects has been specially considered during the vessel design.

The vertical clearance of the existing bridges and cross structures in the route of the design vessel are currently not to the navigation standards of 4m in line with minimum requirement as per IWAI. Proposal to reconstruct 52 existing road bridges and 31-foot bridges with a canal width of 16.5m and with a vertical clearance of 4m from HFL has been included as part of this DPR. The entire stretch of canals is expected to be open for navigation on completion of the canal reconstruction. In case any of the cross structures / bridges cannot be rebuilt to this standard, the navigable area should be revisited**.** This value suits the design vessel also. Views and feedback from experienced users (pilots, mariners, researchers etc.) of COPT, Kochi has also been sought.

Considerations for dimension fixing

These parameters limit the dimensions of the design vessel:

- The length of the vessel is constrained by two aspects.
  a) The bend radius along the route.
  b) Requirement to turn the vessel at reasonable stretch of navigation in an emergency.
- The breadth is constrained by the channel width i.e. 16.5m, two-way channel and the clearance requirement, slope of the sides of the channel etc.
  - Boat maneuvering – width required to allow for the oscillating track produced by combination of sway and yaw of the vessel.
  - Counteracting crosswinds and cross currents.
  - Counteracting bank suction.
  - Hydrodynamic interaction between meeting and passing vessels in two-way traffic.
  - Other allowance relating to navigation aids, cargo hazards, depth/draft ratio, and channel bed material.
  - PIANC guidelines for safe navigation
  - IS guidelines for safe navigation
- The draft is constrained by the available water depth i.e. 1.4m and its effect on navigation, and speed of vessel.
- Waterway depth is the most important factor.
  - Allowance for trim and squat - Vessel squat depends on several factors like vessel speed, depth of channel, and geometric characteristics of the vessel. Generally, a draft/depth ratio of more than 3 is required to minimize the squat effect.
  - Bottom material allowance. It is the minimum safety margin between the keel of the vessel and the project waterway depth. Loose materials like rocks that are unaccounted in the depth measurement of the waterway pose a safety threat to the movement of vessel. The depth and head room are dependent on the air draft allowance along the routes.
- The speed is constrained by the under keel clearance, wake and wash of vessel, length of the vessel etc.

Considering these constraints and applying the Naval Architecture principles, the following dimensions were chosen for the preliminary design vessel.

Design Vessel

The boats shall follow KIV rules for minimum standards to be fulfilled for safety standards and measures as well as firefighting methods and equipment.

Basic dimensions of the vessel shall be in accordance with Channel width i.e. 16.5m (top & bottom-width). As per guidelines, the length of vessel can be primarily fixed to be a maximum of 75% of channel width i.e. approx. 12m taking into account immediate turning at any point of navigation. Considering PIANC guidelines for 2-way channel movement with sufficient passage clearance on both sides of vessel, breadth of vessel can be taken approx. $1/4^{th}$ to $1/5^{th}$ of Channel width i.e. approx. 3m- 4m depending on the maneuverability of vessel. Draft, for practical consideration cannot exceed a value 0f 0.6m considering shallow water effects.

The optional preliminary vessel dimensions as per above are given in **Table 4A.3**. However, the possibility of achieving full-electric propulsion, desired passenger capacity & other operational requirements will have to be analyzed in detail with given dimensions and the most preferred vessel type shall be adopted.

The preliminary arrangement of design vessel is indicated in **Drawing Annexure 4A – D.1**.

Table 4A.3: Preliminary design options for vessels

Sl. No.	Design parameters	Assumed dimensions	Assumed Dimensions
	Type	**Catamaran**	**Mono-Hull**
1	Length	12m	12m
2	Breadth (overall)	4.0 m	3.5m
3	Draft (approx..)	0.6m	0.6m
4	Speed	5-6 knots (9-11Km/hr.)	5-6 knots (9-11Km/hr.)
5	Propulsion	Electric, Hybrid Electric, with generator	Electric Hybrid, with generator.

Once the pilot projects are done and refined specifications are used for series production, GRP/FRP/Carbon fiber hull also may be considered. The material and the protective coating have to be adaptable to the water quality of the canal.

The traffic study by NATPAC predicted a high traffic demand serviced with faster vessels. However, owing to the shallow water effect, a restricted channel width, turning radius, jetty utilization, considerations of wave making effects due to higher speeds and adherence to PIANC guidelines vessels of slower speeds

were only possible in this canal and adopted. Hence it is important to have the vessel type & size as practical as possible and with maximum possible capacity. The basic dimensions were derived from this.

Mono-hull Vs. Catamaran vessels of better stability and better maneuvering capability due to twin propulsion. However, for the same size the deadweight capacity will be limited. To avoid the interference between hull wakes a separation of minimum 1.5 B (B-demi-hull width) is generally assumed. However, at low speed hull separation can be as low as 1B.

Mono-hull boats will have lesser maneuverability and hence the vessel breadth can only be lower.

Table 4A.4 shows comparison for the selected size of design vessel, with a reduced breadth for Mono-hull vessel to 3.2 m against a Catamaran of 4m breadth.

Table 4A.4: Catamaran Mono-Hull comparison

Sl. No.	Design parameters	Catamaran	Mono-hull
1	Length overall (LoA)	12m	12m
2	Length on the water line (LWL)	11.5	11.5
3	Breadth (overall)	4.0 m	3.2 m
4	Demi Hull	1.3 m	-
5	Draft (approx.)	0.6m	0.6m
6	Block coefficient (Cb)	0.7	0.7
7	Displacement	12.56 t	15.46 t
8	Speed	5 knots	5 knots
9	Predicted propulsion Power	11.2 KW	12.7 KW
10	Lightweight estimation (approx.)	13 t	12.1
11	Deadweight	- 0.44 t	3.6 t
12	Max Passenger Capacity	--	35

With basic assumptions, the lightweight arrived with an Aluminium hull construction and battery powered propulsion, for a catamaran exceeds possible displacement, with the design dimensions. For a mono-hull a deadweight capacity possible for a max passenger capacity of 35 Pax, with strict control of weights.

Thus, a catamaran design is highly unlikely in this case, unless the vessel design adopt very light material like Carbon fiber technology in FRP construction and doing away with additional weight of Battery etc. A mono-hull design would be suitable for maximum passenger carrying capacity of 25 to 35 pax..

Performance of dimensions arrived

Length/Breath ratio

[1]"Larger L/B indicates a slimmer hull. This usually implies less wave-making resistance, and thus more efficient high-speed performance, but also suggests reduced load-carrying ability for a given length. An L/B ratio of more than 12 is required to contain wave making effects at medium speed, which is practical limitation due to narrow channel. However, for speeds below 6 knots the effect is minimal and hence considered the speed a limiting factor.

Typical ranges of L/B are 2 to 4 - Small to mid-size planning powerboats.

M.B. Marsh Design Boat parameters offers a steadily growing range of plans for small watercraft and has been used in the study. PIANC guidelines are for ships and the guidelines are too high when used for small boats.

In the case of boats designed for IURWTS canals the length of the vessel is 12m and breadth id 4m. Hence L/B ratio is estimated as **3** and **hence safe**.

Speed of the boat: in Knots is approx.= 2.43* (l_m)^0.5

Where, "l_m" is the length of the waterline (LWL) in meters.
Permissible speed in Knot is approx. = 6.87 knots.

As the design vessel has a lesser L/B ratio, the speed has been fixed as maximum of 6 knots. Boats shall be designed optimally for a very low power system.

Passenger Space

Relatively low L/B implies a larger, more spacious interior and increased carrying capacity when compared to slimmer competitors of the same length.

Volume displacement (∇∇ or D)

The total volume of water displaced by the boat when the vessel is sitting on its design waterline. Or, equivalently, the below-waterline volume of the hull and appendages.

Displacement = (L*B* T* C)/35

Where, L= length of vessel (m); B= breadth of the vessel (m), T= stands for draught (depth of water) (m)

[1] M.B. Marsh Design Boat parameters for small boats. offers a steadily growing range of plans for small watercraft

and C= Block coefficient, 35= a constant for body objects found in salt water.

Block coefficient = [2]C= 1.23-0.395 (V/L) ^0.5

Where, V= speed of the vessel (Knots) and L= length of vessel.

C= 1.23- 0.395*(6/12) ^0.5= 0.95

Displacement (D)(m) = (0.95*12*4*1.4)/36= 1.3m which is <1.4m the depth.

Hence D/T= 1.3/1.4 = **0.92<1 so safe**.

Free board

Higher length could be advantageous when it comes to propulsion power requirement. The capacity of the vessel was decided based on the available deck area of the design vessel, and to meet the traffic demand considerations. The propulsion will in general be on electric mode with slow charging at night and fast charging during noon break. When the battery storage falls short, the diesel generator will be used for powering. A conservative Free board of 0.6m is given as required by KIV rules is shown in the **Figure 4A.9**. The air draft including margins considering the above freeboard is found to be less than the available value of 4m.

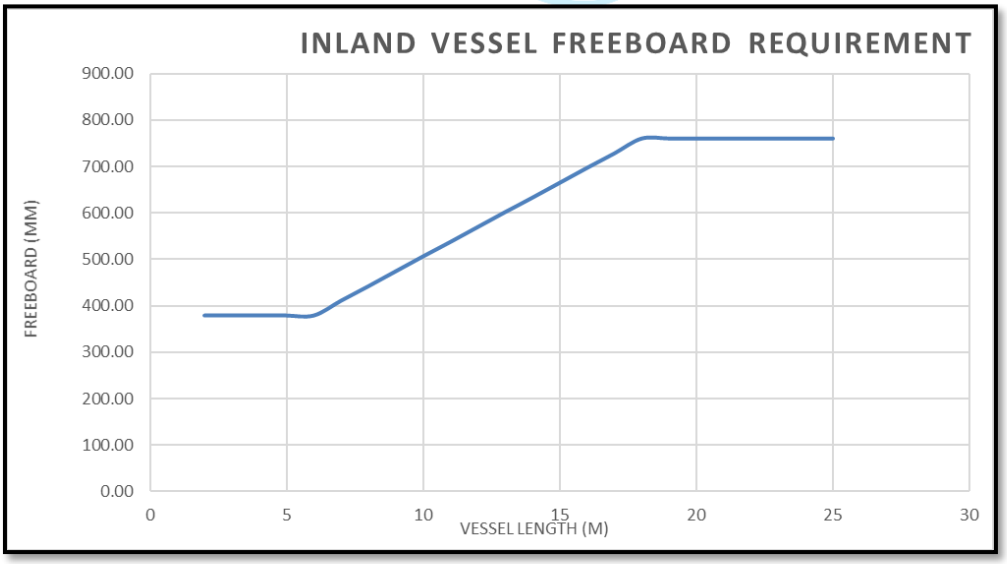


Figure 4A.9: Inland vessel freeboard requirement

2 Molland, A. F., The Maritime Engineering Reference Book, ELSEVIER, 2008.

As per KIV Rules, minimum freeboard requirement to be met corresponding to 12 m is 0.6 m for inland application. This is to be 1.5 times, where the vessel is exposed to sea conditions.

Propulsion

Electric Propulsion:

- Pure electric operation during normal operations.
- Outboard electric propulsion is preferred for operational convenience and better maneuverability at slow speeds.
- Charging infrastructure to be provided at defined intervals.
- Battery requirement may increase the capex and also the vessel weight.
- Charging shall be integrated with solar infrastructure.
- Eco friendly:
    - No emissions to air or water.
    - Silent.

It is suggested to use a hybrid propulsion device. The vessel operation will be environment friendly as it operates on battery. It gives the flexibility in the vessel trips to choose between battery and diesel generator. Also, having the hybrid generators onboard can help reduce the battery requirement which will in turn reduce the capex and improve on the overall weight (lightship) as well as the resistance parameters. The propulsion machinery envisaged is an electric outboard. Azimuth propellers may be considered during detail design phase considering the maneuvering and turning capacity based on the detail design of canal, jetties and turning basins.

Outboard propulsion was chosen considering the following parameters:

Dedicated Design: This generally makes outboard motors more reliable and efficient.
Size and Space: Outboard motors are lighter and does into take up too much of internal space.

Handling: The entire mounting turns which helps the handling of boats especially in reverse mode. It can help turn the boat at low rpms at less power in comparison with rudder assisted boats. This makes low-speed manoeuvring and docking easy. It also easy to handle the engine for maintenance purpose as it is more accessible from outside and portable.

Efficiency: Outboards are unaffected by the hull induced turbulence hence easier to accelerate and provides better fuel efficiency.

Diesel propulsion are cheaper and without range restrictions. There shall be savings in weight, which may be critical at vessel designs

Material

Since the boats are plying in shallow waters, it is important to use light materials. This avoids the chances of grounding and avoid the shallow water effects resulting in higher resistance and wash. In this regard, GRP and aluminum are considered to be more suitable than steel. Aluminum under impact will bend and subsequently crack; GRP could immediately crack. Hence Aluminum is better from a repair point of view. GRP /FRP is moldable and can attain better and efficient hull but is susceptible to fire and environmental costs are high. Carbon fibers offer superior strength and light weight. Combination of materials for Hull and superstructure are also a viable option.

Vessel characteristics

The vessels used can be a tourist or a passenger's type of vessel. The passenger's variant discussed here considers standing passengers with the minimum required passenger space provided. The tourist variant will be completely air-conditioned, meeting high end standards such as quality doors, fire protection, luxurious seats and common spaces, cycle, luggage carriage and pantry. There will be other outfits such as ramp access provision for disabled passengers, the details of which will be decided during detailed design phase. Designs like jet capsule are good options on a tourist angle.

Design considerations

The design vessel must have very good wash characteristics. It is important to study these characteristics as the wash waves could be detrimental to the vessel movement, and also to the integrity of the shores where the sheet piles are not inserted.

4A.4.2 Vessel to Channel Matching

Horizontal dimensions of Channel width

Factors affecting the width of channel are as follows:

1. Basic Maneuverability

   The dynamics of vessels are such that they will follow a swept path, which in absence of any external forces from waves, wind, current etc., will exceed their breadth by some amount.

   The width of the swept path, which is the basic maneuvering lane, will depend on a number of factors, but the key elements are:

   - The inherent maneuverability of the vessel (which will vary from vessel to vessel and with water depth/draught ratio).

- Ability of the vessel-handler.
- Visual cues available to the vessel-handler.
- Overall visibility.

2. Environmental forces

   The channel should have sufficient width to ensure safe navigation allowing for the effects of external forces due to cross winds, currents, and waves.

3. Cross winds

   Cross winds will affect the vessel at all speeds but will have its greatest effect at low vessel speeds. It will cause the vessel to drift sideways or to take an angle of leeway, both of which increase the width required for maneuvering.

   Cross wind effects depend on:

   - Vessel speed.
   - Windage of the vessel (relative to lateral submerged area).
   - Depth/draught ratio (because a vessel's resistance to lateral motion increases as the depth/draught ratio approaches unity since wind causes less drift at small under keel clearances).
   - Wind speed and direction relative to the vessel.

4. Cross currents

   Cross-currents affect a vessel's ability to maintain a course, while longitudinal currents affect its ability to maneuver and stop. the maneuverability of a vessel changes as its depth/draught ratio approaches unity. As a result, its ability to cope with currents will also change as the water depth becomes shallower.

5. Bank clearance

   When a vessel navigates in the vicinity of a channel edge, flow around the vessel's hull varies and becomes laterally asymmetrical with respect to its longitudinal center line. This generates hydrodynamic forces due to the asymmetrical flow. To avoid uncontrollable situations in a channel with underwater banks, additional width outside the maneuvering lane is required.

   Important factors are:

   - Vessel speed.
   - Bank slope or bank structures.
   - Cross-section/symmetry of the channel.

- Under keel clearance (ratio h/T).
- Distance between the vessel and bank.

6. Vessel-Vessel Interaction

   Similar dynamic interaction forces due to asymmetrical flow also act on two vessels when they are transiting close to each other. The vessel-vessel interaction should be considered both for meeting (vessels travelling in opposite directions) and overtaking maneuvers. The additional width requirement to take account of vessel-vessel interaction also depends on the traffic density in the two lanes, as the greater the density, the greater the width that is required.

Overall bottom width (PIANC guidelines)

The overall bottom width W of channel with straight sections is given for a two-way channel by:

$$W = 2W_{BM} + 2\Sigma W_i + W_{BR} + W_{BG} + \Sigma W_p$$

where:

W_{BM} = width of basic maneuvering lane as a multiple of the design vessel's beam B as 1.2B

ΣW_i = additional widths to allow for the effects of wind, current etc. 8 kts ≤ Vs < 12 kts =0.1B

W_{BR} = bank clearance. bank clearance of red and green sides of the canal for slow speed vessel is = 0.5 B

ΣW_P = passing distance, comprising the sum of a separation distance between both maneuvering lanes WM.

To determine additional width for passing distance in two-way traffic ,the beam of the largest passing vessel should be used whether or not it is the design vessel and the value for slow speed = 0.5B.

Above shall depend on the maneuverability of the vessel, and higher factors may be required depending on maneuverability which will be confirmed during the detailed design and estimation stage.

4A.4.3 Design of curved channels and bends

Turning radius and swept path

As per PIANC guidelines, in calm water with no wind, a hard-over turn may be accomplished by a vessel having average to good maneuverability with a turning radius of 2.0 to 3.0 times L_{OA} in deep water, increasing to perhaps 5 or more Loa at h/T = 1.2. The way a vessel turns depends very much on the h/T ratio. The design boat has a h/T ratio of 2.33 which is higher than the threshold value of 1.2, and hence it can be assumed that the vessel will require a small turning radius preferably in the range of 2.0 to 3.0 times L_{OA}. Since the PIANC guidelines are meant for vessels with rudder, and vessels with OBD have much higher maneuverability, it can be safe to say that the lower end of the range, i.e. 2.0 times L_{OA} can be presumed as the required turning circle radius at bends. (**Figure 4A.10**).

Bend radius, R_C = 24 m

Where,

h = Depth of waterway, T = Draft of the design vessel

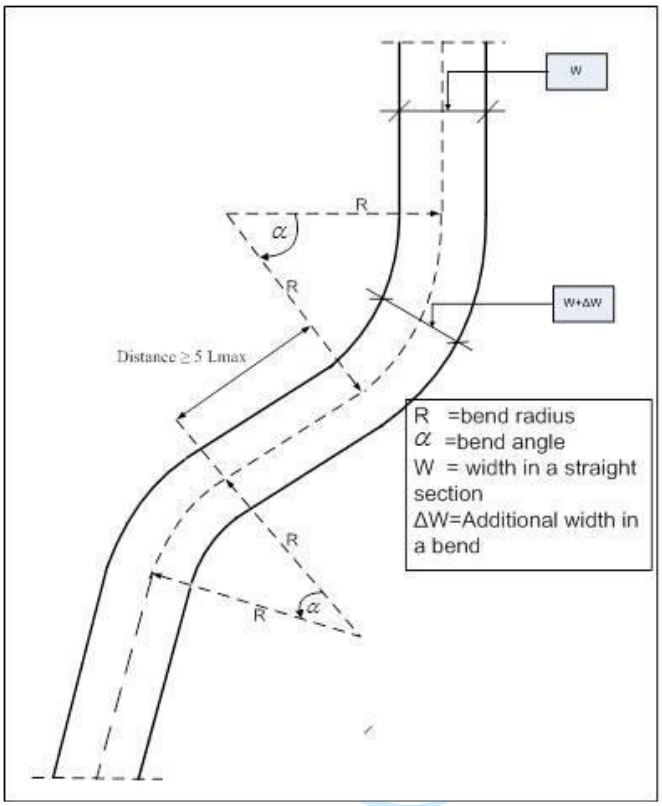


Figure 4A.10: Bend configuration

Additional Widths in Bends

When transiting a bend in the approach channel the width of the swept path will increase. This additional channel width ΔW is necessitated by increases in:

- Drift angle of the vessel.
- Response time from the instant the vessel deviates from the channel axis and the moment when the correction becomes effective.

Thus, the total additional width in a bend due to the swept path ΔW is equal to the sum of the additional width due to these two factors.

Additional Width Due to Drift Angle

The additional width due to the drift angle ΔWDA can be determined by using the simplified formula:

$$\Delta W_{DA} = L^2_{OA} / aR_C$$

Where,

ΔW_{DA} = additional width of the vessel's path swept due to drift angle in a curved channel section

R_C = Bend Radius L_{OA} = Length overall ΔW_{DA} =0.75m

a = factor depending on the vessel type: a = 8 for normal vessels and a = 4.5 for larger displacement vessels with $C_B \geq 0.8$

Additional Width Due to Response Time

An additional width ΔWRT is required in bends to compensate for the time delay of the vessel-handler in responding to a required alteration of course. The following allowance is recommended:

$$\Delta W_{RT} = 0.4B = 1.6m$$

Total additional width required at bend is 2.35 m. No major bends are encountered and hence the additional width will not be required for IURWS canals.

Vertical Dimensions

Vessel related factors are the most important in vertical channel design. Apart from vessel draught T, the vessel factors can be estimated separately for vessel squat, dynamic heel and wave response allowance or combined together. Rather than estimating each one separately, a simpler approach for the concept stage of design is to combine them into one vessel related factor Fs that includes all of these vessel effects. An approximation depends on vessel speed, intensity of wave effects on the design vessel with its maximum draught T and type of channel.

Description	Vessel Speed	Wave Conditions	Channel Bottom	Inner Channel	Outer Channel
Ship Related Factors F_s					
Depth *h*	≤ 10 kts	None		1.10 *T*	
	10 - 15 kts	None		1.12 *T*	
	> 15 kts	None		1.15 *T*	
	All	Low swell (H_s < 1 m)			1.15 *T* to 1.2 *T*
	All	Moderate swell (1 m < H_s < 2 m)			1.2 *T* to 1.3 *T*
	All	Heavy swell (H_s > 2 m)			1.3 *T* to 1.4 *T*
	Add for Channel Bottom Type				
	All	All	Mud	None	None
	All	All	Sand/clay	0.4 m	0.5 m
	All	All	Rock/coral	0.6 m	1.0 m
Air Draught Clearance (ADC)					
ADC	All	All		0.05 H_{st}	0.05 H_{st} + 0.4 *T*

Notes:
1. For Ship Related Factors: Assumes *T* > 10 m. If *T* < 10 m, use value for *T* = 10m
2. Swell means waves with peak periods T_p greater than 10 s
3. For Outer Channel swell values, use lower value for smaller swell wave periods and higher value for larger swell periods
4. Value of significant wave height H_s is dependent on required operation, design ship type, level of accessibility, wave period and relative wave direction
5. H_{st} is the distance from the sea surface to the top of the ship
6. Seawater density assumed for *T*. Additional adjustments required if fresh water.

Table 2.2: Channel depth components and air draught estimates for Concept Design (CD)

Figure 4A.11: Vertical dimension approximation

Based on **Figure 4A.11**, taking the vessel speed as 6 knots and the channel bottom, the required channel depth is **1.26 m** (1.1T+0.6m), which is lower than the currently available depth of 1.4m.

4A.4.4 Wash studies

High speed vessels make waves that hit the canal shores. This will affect the side of the shore, especially where no sheet piles or similar reinforcements are available. Another detrimental effect occurs when the waves are reflected by the shores and subsequently affect the movement of the vessels. The canal, being shallow and having breadth as low as 16m, will need vessels with less wash effects. To account for this, though the design vessel is having a capability of achieving 13Km/hr., the cruising speed is limited to 10Km/hr.

These environment friendly boats not only need to be less polluting and less noisy, but also minimize the impact to the shores of the canal for sustainability of the ecosystem.

The detailed study on the safety and stability aspects will be undertaken during the detailed design and estimation stage of this project.

4A.4.5 Environment Impact

Since the propulsion is going to be mostly on electric mode, the air pollution from engine exhaust, water pollution from oily water discharge, noise pollution from the machinery etc. will not be present. This advantage will not be there while running on generator power. However, the hybrid propulsion mode will be designed to have the propulsion on battery mode only and generator will be kept as an emergency backup. Accidental oil spill which could occur will be limited to and can be contained within the canal and cleaned up as the canal is designed with gates and flow control on the water inside. The accidental spills can be cleared using portable oil skimmers. Other modes of water pollution can come from sewage discharge, solid waste discharge and boat washing. Bio toilets are proposed in the boat so that the black and grey water will not be discharged to the water body. There should be mechanism at the jetties or outside for periodic cleaning of the accumulated waste in boats.

At the end of the life of the boat the major structure, from aluminum can be recycled. The batteries will have to undergo the e-waste recycling methodology. The superstructure GRP and other non-recyclable components have to be treated separately.

The navigation along the canals can be hindered by the growth of mosses/ water hyacinth. This could resist the boat movement and also choke the separation space between the demi hulls if not cleared on

a timely basis. The siltation also needs to be kept in check so that the under keel clearances are not reduced.

4A.4.6 Life cycle cost

The fleet size and types has been estimated based on the passenger demand, service frequency, size of the boats and their capacity etc. The roll out is to be in phases so that the learnings from the former set of fleets can be implemented on the latter. There could be potential reduction in the size of the boat for maneuvering and canal decongestion reason, however, may increase the number of boats to cater for the passenger demand. Smaller the boats the cost per passenger seat will increase. A contingency to account for this has been added in the capital expenditure (CAPEX) for fleet which is given in the **Chapter 8** (Cost Benefit Analysis).

The battery cost weight and technology is so fast changing that we need to account for a 20% cost variation which may lead to a reduction in the number of boats planned for the estimated cost.

With respect to the Operating (OPEX) Lifecycle costs an early estimate on the boat is shown in the **Table 4A.5**.

Table 4A.5: Estimate with respect to Operating (OPEX) Lifecycle costs

	Cost factor	Cumulative	Period
CAPEX			
Design	5%	100%	One time
Electrical System cost	50%		
Material and labour cost	45%		
OPEX			
Operating cost	15%	recurring	yearly
Maintenance	20%	recurring	per 3 years
Depreciation	-15%	recurring	yearly
Disposal charges	15%		one time

4A.4.7 Canal Lock system

The canals will have locks to maintain the water levels in the system. The water depth will be maintained between 1.4 m to 1.9 m by locking the water inside during low tides as well as by opening them for high tides.

4A.5 Jetties and Jetty terminals

4A.5.1 Design consideration for a Jetty

The berthing structures are constructed for the berthing and mooring of vessels to enable loading and unloading of cargo and for embarking and disembarking of passengers, conveyances etc. The project jetties are designed to have a leading platform perpendicular to the land area. Furthermore, 2 embarking platforms with 2 levels are situated along the canal edge. The embarking platforms are designed in a stepped manner based on the water level fluctuation, so that there is no difficulty for passengers to embark from the vessels. The level of the higher platform is kept at +0.9m MSL and the lower level platform at a level of +0.5m above the LTL, both levels are fixed 0.2m above high and low tide levels. The leading and the embarking platforms are designed to rest on piles.

4A.5.2 Location of jetties

The location of jetties as detailed in **Chapter 3A** has been finalized based on a passenger survey undertaken by NATPAC (2018) ensuring the first and last mile connectivity.

4A.5.3 Types of jetties

Classifications of berthing structure are basically Piers and Wharfs:

1) Wharf – A berthing structure which is parallel to shoreline. It is generally adjacent to the shore and may not be very near to shore.

2) Pier - A berthing structure which is project into water that means perpendicular to shore. This structure need not be exactly perpendicular to shore; it may be with some angle to shore. These structures also are like T or L shape.

Required number of berths for vessels: It is recommended to have a fixed berth with two levels to adjust for the tidal level fluctuation.

Longitudinal dimension of berth: The function of the terminal and size of vessel determines the berth length. The berth has a length of 10.4m x 3m.

Required area for berthing: The minimum berthing area needed is determined by the length and the broadness of the biggest size of boat utilizing for the berths (i.e. the Design Vessel, see section 4A.4.1). The length needed for berthing a vessel as well as its surging resulting from waves are generally defined

as: 10% of boats length, subject to at least 15m.The width of the berthing zone ought to be 1.15 B + b, where B is the shaft width of the outline vessel , and b is the width of the attending craft.

Draft maintenance along the berth: The design vessels recommended for project canals needs a minimum draft of 0.5 m. Even under LTL condition the draft available in the canal is 1.2m (see **Figure 4A.12**). As per design condition, 10% in excess is required to be maintained to consider for silting and vertical movement.

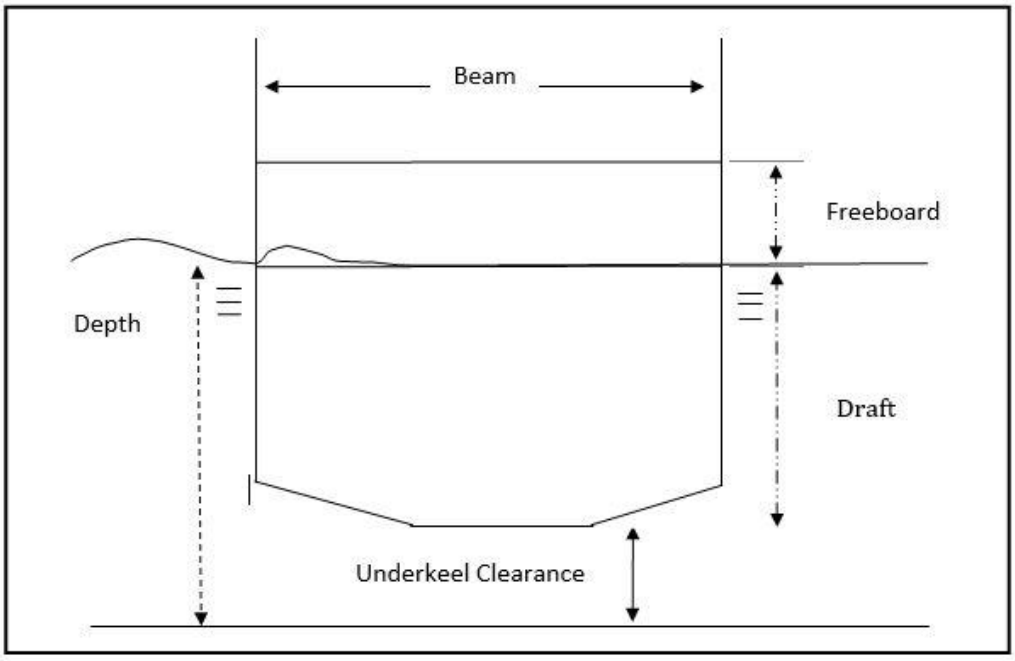


Figure 4A.12: The unchecked clearance available in IURWTS

Width of berthing apron: The apron width is designed based on the facilities provided at the jetty. The platform widths provided is adequate to permit a free unhampered movement of passengers. In the case of the project, only passenger vessels are proposed and hence a minimum width of 2m is required.

Quay: A quay is a general term used to describe a marine structure for the mooring or tying up of vessels, and for loading and unloading of goods and passengers. In areas with a high tidal range, both quays and jetties are often of the floating type.

Vessel Anchorage/Mooring

Adequate facilities is provided at jetties for safe and secure mooring. Mooring arrangements are made based on the size and type of the vessel, local tidal variation, etc. Close liaison is required between all components concerned (such as boat crew, boat master, and jetty operator) to ensure that the mooring is done safely. An adequate watch is kept on the moorings while the vessel is alongside and particularly during passenger transfer. Local conditions may place additional requirements on vessel mooring.

Account needs to be taken of the rise and fall of vessels in relation to the jetty as a result of tides. In addition, the displacement of the vessels in the water will also rise and fall during the embarking disembarking process of the passengers is also be taken into account while designing mooring systems.

Jetty bollards and mooring arrangements are designed to hold the vessels in position once the vessels are docked so that loading/offloading can take place safely. Inadequacies in the mooring arrangements could result in the vessel breaking away from the moorings is accounted.

Turning Circle

Measurements of turning loop are subject to the predominating power of wind, current and the force of tugs accessible for aid. The accompanying criteria may be followed in either case for figuring the radius of the circle:

i. Without tug support: - 1.7 L.
ii. With tug support: - 0.85 L.

For the jetties used in the project tug support will be provided, a minimum turning circle with a width of 10.8m is required. The canals have a minimum width of 16.5m and consequently are safe (see **Figure 4A.13**).

Turning circle: Vessel In the process of turning in the canal

Turning circle: Vessel after turning in the canal

Figure 4A.13: A vessel in Turning circle

4A.5.4 SPV building and control rooms

An institutional mechanism is proposed to look into the post implementation activities of the project catchment. In order to house the Special Purpose Vehicle (SPV) and a testing lab with staff a building of 300 m^2 is proposed in the land identified for the jetty adjacent to, Edappally Lulu mall area. Provision for monitoring all the CCTV installed along the canal will is also conceived in the SPV building. The location of

the jetty terminal housing the SPV buildings and control rooms is proposed in the Jetty near Lulu, Edappally and is given in **Figure 4A.14**.

Figure 4A.14: Edappally Lulu mall jetty SPV office

4A.5.4.1 Materials & cover

Concrete

The grade of concrete shall be of M-40 for substructure and M-40 for superstructure. The grade of concrete is considered the same as for precast structures.

Reinforcement

The grade of Steel shall be - Fe 500D (Confirming IS 1789). The clear cover to outermost reinforcement shall be:

Pile	: 75 mm
Beams	: 50 mm
Slab	: 40 mm

Structural steel

Structural steel used in this design confirms to IS2062 with the following properties:

Yield stress	: 310 Mpa
Ultimate stress	: 430 Mpa

4A.5.4.2 Load data

Dead Load

Dead loads comprise of the weight of all parts of the structure and also the weight of all permanent connections. The DL of a port related marine structure constitutes a relatively less rate of the total burden acting up on the structure.

The dead loads shall be assessed considering following unit weight of materials.

Plain Concrete : 24.0 kN/m^3

Reinforced Concrete : 25.0 kN/m^3

Live Load

A live load of 10kN/m^2 is considered for landing jetty and 10kN/m2 for approach jetty.

Mooring Force

The mooring loads are the lateral loads caused by the mooring lines when they pull the vessel into or along the wharf or hold it against the forces of wind or current. The maximum mooring loads are due to the wind forces on exposed area on the broad side of the ship in light condition.

$$\boldsymbol{F = Cw\, Aw\, P}$$

where,

F : force due to wind in Kg.

Cw : shape factor = 1.3 to 1.6.

Aw : wind age area in m^2.

P : wind age pressure in m2 to be taken in accordance with IS: 875-1964.

The wind age area (*Aw*) can be estimated as follows:

$$\boldsymbol{Aw = 1.175Lp\,(DM - DL)}$$

where,

Lp : length between perpendicular in meter.

*D*M : mould depth in m.

*D*L : average light draft in m.

Take maximum displacement of vessel in tons. As per I.S 4651-part 3, table 4, the bollard shall be found out. Line pull shall be taken in KN.

Berthing Force

Berthing Energy - When an approaching vessel strikes a berth a horizontal force acts on the berth. The magnitude of this force Depends on the kinetic energy that can be absorbed by the rendering system. The reaction force for which the berth is to be designed can be obtained and Deflection-reaction diagrams of the fendering system chosen. These diagrams are obtainable from fender manufacturers the kinetic energy, E, imparted to a fendering system, by a vessel moving with velocity V m/s is given by:

$$E = \frac{W_D V^2}{2g}(C_m)(C_e)(C_s)$$

where,

W_D : displacement tonnage (DT) of the vessel.

V : velocity of vessel in m/s, normal to the berth.

g : acceleration due to gravity in m/s^2.

C_m : mass coefficient.

C_m : eccentricity coefficient.

C_m : soft coefficient.

The load by mooring force and berthing force has to be taken by bollards. Providing bollard on floating jetties are difficult and that is tackled with the help of piles provided at the edges to hold the jetty in position. These piles can be extended above more than the levels of the jetty on which the mooring and the berthing can be done.

Seismic Load

The seismic force has been calculated in accordance with the Earthquake code IS 1893- 2002. The code specifies the earthquake zone for the above work as Zone III and the basic horizontal seismic coefficient is calculated accordingly.

$$\boldsymbol{SF = A_h(DL + ½\,LL)}$$

The horizontal seismic coefficient is as follows,

$$\boldsymbol{A_h = \frac{ZIS_a}{2Rg}}$$

Where,

A_h : Design horizontal seismic coefficient. Z : Zone Factor.

R : Response Factor. I : Importance Factor = 1.5.

$\frac{S_a}{g}$: Average response acceleration co-efficient.

4A.5.4.3 Active Earth pressure and surcharge

Active earth pressure

Active earth pressure and surcharge has been considered as per IS 4651-III

$$\boldsymbol{P_a = K_a \Upsilon h}$$

$$\boldsymbol{K_a = \frac{1 - \sin\varphi}{1 + \sin\varphi}}$$

Where,

Υ	: Unit weight of the soil in kN/m^3.	φ	: Angle of internal friction of the soil.
h	: Depth of the soil above the section.	K_a	: Coefficient of active earth pressure.
C	: Cohesion in kN/m^2.		

Surcharge

$$\boldsymbol{P_a = K_a q}$$

Where, q = Surcharge in k N /m^2.

4A.5.4.4 Load combination

Load combinations for analysis is considered in accordance with IS:4651-Part(IV)1989.The following load combination has been considered in the analysis.

$1.5DL + 1.5LL + 1AEP + 1HP + 1.5BL + 1.5ML$

$1.2DL + 1.2LL + 1AEP + 1.2HP$

$1.2DL + 1.2LL + 1AEP + 1HP + 1.5WL$

$1.2DL + 1.2LL + AEP + 1HP + 1.5SL$

Where,

DL	: Dead Load.
LL	: Live Load.
ML	: Mooring Force.
BL	: Berthing Force.
SL	: Seismic Force.
AEP	: Active earth pressure.
WL	: Wind load.
HP	: Hydrostatic pressure.

4A.5.4.5 Load data for Jetty terminal

Dead load

Dead load of the modelled elements will be taken care by the analysis software. The dead load from other structural elements are calculated as per IS:875 Part-I.

Live load

Suitable Live Load as per IS: 875 Part-2 and data collected from various vendors are considered.

Wind Load

Suitable Wind Load as per IS: 875 Part-3 and wind speed to be considered is 39m/s (3 second gust).

Seismic Load

Earth quake Load as per IS: 1893-2016. Seismic zone-Zone III The seismic force has been calculated in accordance with the Earthquake code IS 1893- 2002 zone III. The code specifies the earthquake zone for the above work as Zone IV and the basic horizontal seismic coefficient is calculated accordingly.

$$\boldsymbol{SF = A_h(DL + ½\, LL)}$$

The horizontal seismic coefficient is as follows:

$$\boldsymbol{A_h = \frac{ZIS_a}{2Rg}}$$

Where,

A_h : Design horizontal seismic coefficient.

Z : Zone Factor.

I : Importance Factor = 1.5.

R : Response Factor.

$\frac{S_a}{g}$: Average response acceleration co-efficient.

4A.5.4.6 Load combination Jetty terminal

The following are the basic load combinations that are considered for the analysis.

Design consideration

$1.5\ DL\ + 1.5LL$

$1.2\ DL\ + 1.2LL + \ 0.6WL$

$1.2\ DL\ + \ 1.2LL + 0.6\ SL$

$1.2\ DL\ + \ 1.2WL + 1.2LL$

$1.2\ DL\ + \ 1.2LL + 1.2\ SL$

$1.5\ DL\ + \ 1.5WL$

$1.5\ DL\ + \ 1.5SL$

$0.9\ DL\ + \ 1.5WL$

$0.9\ DL\ + \ 1.5SL$

Where,

DL : Dead Load.

LL : Live Load.

SL : Seismic Force.

WL : Wind load.

Serviceability consideration

$1.0\ DL\ + \ 1.00\ LL$

$1.0\ DL + 0.80\ LL + \ 0.80\ WL$

$1.0\ DL + 0.80\ LL + \ 0.80\ SL$

$1.0\ DL\ + \ 1.00\ WL$

$1.0\ DL\ + \ 1.00\ SL$

Where,

DL : Dead Load.

LL : Live Load.

SL : Seismic Force.

WL : Wind load.

The 3D elevation of the proposed jetty terminal based on the plan is as given in **Figure 4A.15**.

4A.5.5 Reference Codes followed for design of jetties

The codes applied in the design of the jetties and jetty terminals are given in **Table 4A.6**.

Table 4A.6: Codes followed for the design of jetty and jetty terminal

S. No.	Relevant code	Description
1	IS 456: 2000	Code of Practice for Plain and Reinforced Concrete Code of Practice, 9th revision, Bureau of Indian Standards, New Delhi.
2	SP-16	Design Aids for Reinforced Concrete to IS 456-1978.
3	a) IS: 875 (Part 1) Dead loads, (Part 5) Special loads and combinations, (Part 3) – Wind Loads & (Part 2) Imposed Loads (1987)	Code of Practice for Design Loads (Other than Earthquake) For Buildings and Structures.
4	IS: 1893-1984	Code of Practice Criteria for Earthquake Resistant Design of Structures", 4th Revision.
5	IS 4651 (Part IV): 1989	Code of Practice for General Design Considerations", 2nd Revision.
6	IS: 4851 (Part III) – 1974	Code of Practice for Planning and Design Of Ports and Harbors ", 1st Revision.
7	IS 14238:1995	Code of Practice for Inland vessels – Selection of rubber Fenders for berthing structures, 2nd Revision.
8	IS: 800-2007	Code of Practice for general construction in steel.
9	SP-34	Design aids Code of Practice for general construction in steel.

Jetty - View from the canal

Jetty - Front view

Jetty - interior view

Figure 4A.15: Front view of jetty terminal

4A.6 Cross-structures: Road bridges and Foot bridges

As detailed in Chapter 3A of this report, different types of road bridges have been considered. Parametric analysis was undertaken to decide on the type of bridge to be used. The types of bridges include Suspension bridge, Steel Truss/Girder bridge, RCC bridge, Precast prestressed Girder bridge and Corrugated steel plate bridge and discussed in Chapter 3A of this report. Among the different types, Corrugated steel plate arch bridge was found to be cost effective and aesthetically pleasing for the project canals. Being an innovative type, which is widely used in the market today a preliminary design for cost comparison was undertaken.

Bridge Plate is one of the strongest and deepest corrugated structural plate products in the market today, providing for the economical construction of long span soil-steel structures. Corrugated Structural Plate Structures (CSP) are assembled in the field, using sectional pre-curved plates bolted together and backfilled with compacted, well graded granular material. The engineered backfill provides structural stability and completes the installation of the bridge plate steel shell. The interaction of a well compacted engineered backfill with the superior sectional properties of Bridge Plate ensures a structure capable of supporting high loads with the most economical use of steel. With installation time measured in weeks rather than months, road closure periods are shortened and disruption to environmentally sensitive locations is minimized.

The Ministry of Road Transport and Highways (MORTH), Government of India appointed an Expert Committee (Sept 2015) to make recommendations regarding the best practices /technologies for Indian conditions in respect of material and machinery for economical, durable, speedy, and aesthetic construction of roads, bridges, flyovers, and tunnels. After studying the practices and technologies that are used in selected developed countries of the world, the expert committee has also recommended CSP type of bridges considering the economic and speedy construction.

4A.6.1.1 Typical Specification for Bridge Plate Structure

Scope: This specification covers corrugated steel plate (CSP) typically used in the construction of field assembled corrugated steel bridge structures.

Material specification: The main parts of the specification include approved manufacturers, materials, fabrication, hardware and accessories, and coating.

The plates shall be manufactured so that, when assembled, they shall form the size and shape of structure as shown on the plans. The code used is ASTM A761/A761M – 04 (Reapproved 2009).

Assembly and backfilling, not covered in this specification, shall follow the manufacturer's recommendations.

Manufacturer: The manufacturer of the Corrugated Structural Plate shall be one approved by SPV before issuing the work order to a firm. The manufacturer who is interested in competing for the supply will be asked to submit substantial evidence of having undertaken similar works for review.

Fabrication, hardware, and accessories used, galvanized coating procedures and specifications, dimensions and tolerances, plate thickness (Cross-Section & Dimensions), and workmanship for deep corrugated structural plate shall be formed from materials specified in ASTM A761/A761M – 04 (reapproved 2009).

Corrugations: Corrugations shall form smooth continuous curves and tangents. Corrugations shall form annular rings (complete or partial) about the axis of the structure. The dimensions of the corrugations shall be in accordance with the site-specific orders and a typical cross-section.

Bolt Holes (general): The bolt holes shall be punched so that all plates having like dimensions, curvature, and same size and number of bolts per foot of seam shall be interchangeable as given in Tables of ASTM A761/A761M – 04 (reapproved 2009).

Sampling and Testing: The manufacturer or steel supplier shall make adequate tests and measurements to ensure that the material produced complies with the specification of the contract. Test for zinc coating weight [mass] in accordance with Test Method ASTM A90/A90M, using a specimen with an area of 5 in.2 [3000 mm^2] or greater.
Test for zinc coating weight [mass] using the X-ray fluorescence procedure of Test Method ASTM A754/A754M.

Certification: As specified in the purchase order or contract, a steel manufacturer or supplier's certification or fabricator's certification, or both, shall be furnished to the purchaser stating that samples representing each lot have been tested and inspected in accordance with this specification and have been found to meet the requirements for the material described in the order. When specified in the purchase order or contract, a report of the test results shall be furnished.

Product Marking

Each plate shall be identified by showing the following:

- Name of fabricator.
- Specified zinc-coated plate thickness.

- Specified coating weight [mass].
- Identification showing heat number and coating lot number.
- ASTM designation.
- The marking shall be so placed that when the structure is erected, the identification will appear on the inside.

The sectional view of corrugated steel is as given in **Figure 4A.16**. The important sectional properties of the Corrugated plate of profile 400mmx150mm is as given in **Table 4A.7**.

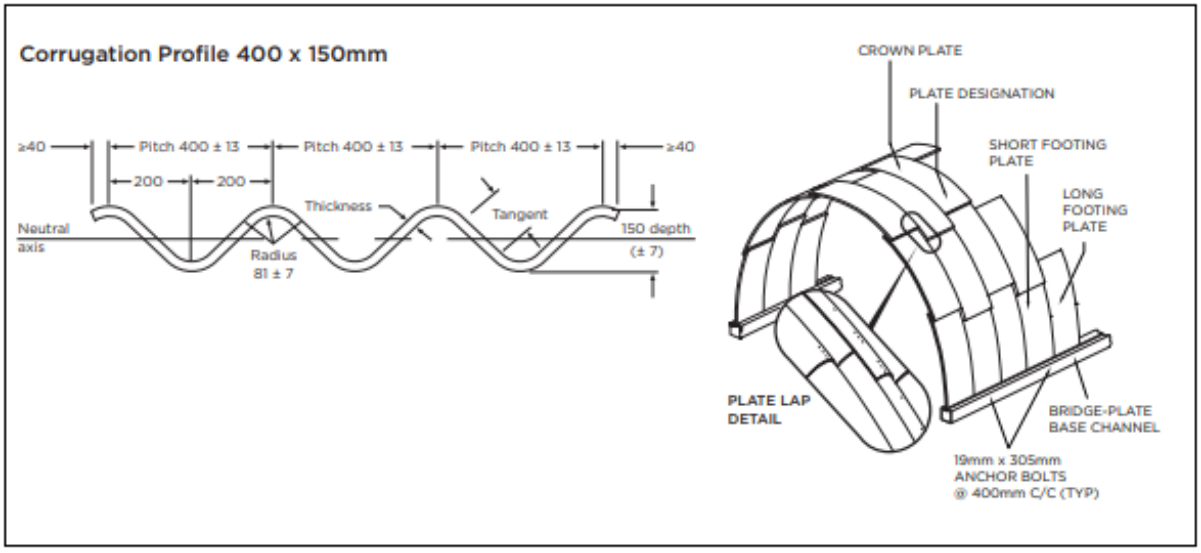


Figure 4A.16: Sectional view of corrugated steel plate structure

Table 4A.7: Sectional properties of CSP

Nominal Thickness	Design Thickness	Tangent Length	Angle Θ	Area of Section	Moment of Inertia	Elastic Section Modulus	Plastic Section Modulus	Radius of Gyration
(mm)	(mm)	(mm)	(degrees)	(mm^2/mm)	(mm^2/mm)	(mm^2/mm)	(mm^2/mm)	(mm)
4.3	4.21	112.41	51.29	5.792	16.187	200.52	273.62	52.86
5.0	4.95	111.42	51.44	6.811	19.060	235.04	321.70	52.90
6.0	6.00	110.00	51.64	8.260	23.154	283.71	390.57	52.95
7.0	7.00	108.63	51.84	9.640	27.071	329.69	456.35	52.99
8.0	7.94	107.33	52.03	10.940	30.759	372.48	518.88	53.04
Bridge Plate is manufactured in an ISO 9001:2008 certified plant and meets CSA Group Standard G401-14								

Footings

Corrugated steel plate arch bridges are typically installed on concrete strip footings. Receiving angles and anchor bolts are suppled complete with detailed layout instruction by the suppliers for casting into the footing. The suppliers will also provide the unfactored footing load values and will also assist with the

preliminary footing sizing depending on the site specific site foundation condition as and design loads. The cross sectional view of the base channel is given in **Figure 4A.17** and the nut and the anchor unit is given in **Figure 4A.18**.

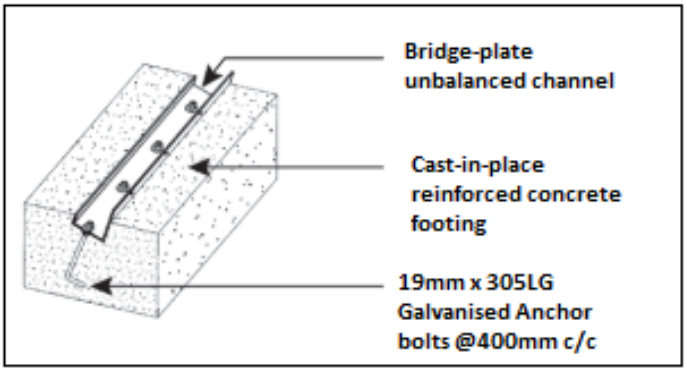


Figure 4A.17: Cross sectional view of the base channel

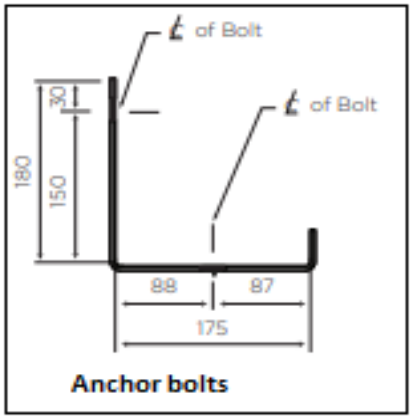


Figure 4A.18: The nut and the anchor unit

End Treatments

A concrete collar around each end of the corrugated steel plate structure at base is recommended. This serves to stiffen the ends, protecting them from localised damage and deformation, while improving their structural integrity. Head wall protection (like Rock face wire mesh with mechanically stablised earth MSE) are provided. Atypical cross section of a completed bridge is shown in **Figure 4A.19**.

Figure 4A.19: Head wall protection (Rock face wire mesh with MSE)

Back fill and compaction

The structural success of Bridge Plate depends on the interaction of the backfill material and the steel shell. The selection, placement, and compaction of the engineered backfill material are the key elements in the performance of a soil-steel structure. As a principle rule for backfilling, approved granular materials should be used to construct an engineered backfill envelope. It should be placed in maximum 200mm lifts to ensure that specified compaction levels are attained. The details of grain size distribution are given in **Figure 4A.20**.

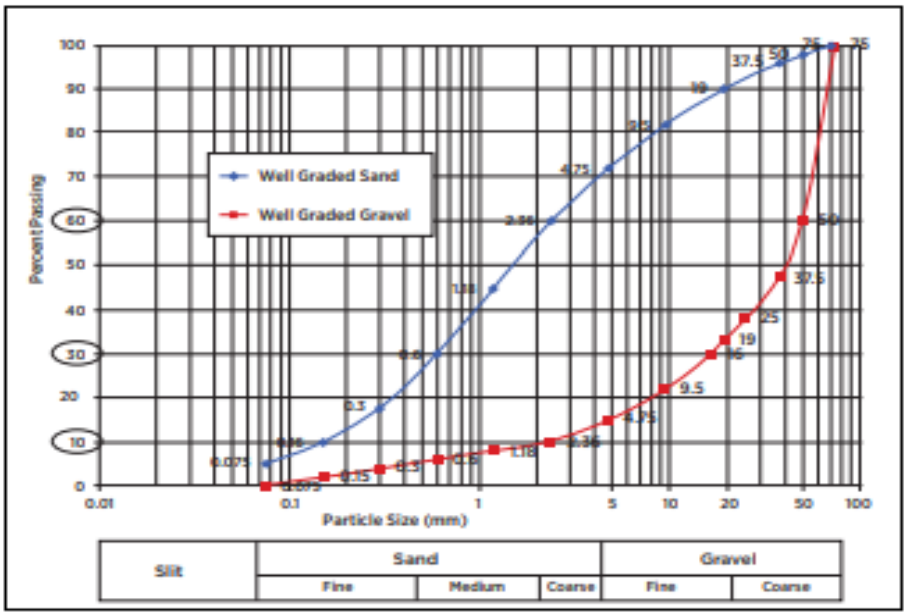


Figure 4A.20: Details of grain size distribution

4A.6.1.2 Advantages of using Corrugated Steel Plate Arch bridges for canals in Kochi

- Increase in free board height – such that passenger boats can ply.
- The gradient of the approach road FRL can be adjusted for smooth alignment with the adjacent roads.
- Width of canal will not be reduced.
- Number & depth of pile can be reduced, resulting in overall saving in project cost.
- Abutments can be avoided, thereby cost of construction can be reduced.
- Services can be rerouted easily / dedicated service ducts can be provided.
- Carbon footprint can be reduced.
- Flow of water during construction will not be blocked.
- Speed in construction.

The photos in the **Figure 4A.21** show the construction of the CSP arch bridge across Thevara-Perandoor canal at Kadavanthara, Kochi (GCDA 2015).

Figure 4A.21: Construction of CSP arch bridge across T-P canal at Kochi

Among the different type of Road bridges envisaged for construction, the final decision on the suitability of each type will be taken in the detailed design and estimation stage of the project.

A typical cost estimate considering all the alternatives is provided in **Chapter 6** of this report.

4A.6.2 Foot over Bridges

Footbridges are needed where a separate pathway needs to be provided for people to cross the canals. Truss type steel bridges are proposed for most locations.

Trusses offer a light and economical form of construction, particularly when the span is large. The members of the truss can be quite slender and this naturally leads to the use of structural hollow sections. Hollow sections have been used for footbridges for over 50 years.

For a simple footway, a minimum clear width of 2.0 m is required by the highway's authorities. To the sides of this footway, parapets are required, which should be 1.15 m high, height measured from the footway surface in both cases. An increased parapet height of 1.5 m may be needed in areas of high prevailing wind and areas prone to vandalism. For footbridges over the canal, the span is determined by the dimensions of the carriageway which has to be maintained at 16.5m (min)

Soil condition and Foundation

Based on preliminary soil investigation data, received from SPV secondary data records, it is recommended to provide friction pile foundation to support vertical column loads. Each pile should have a length of around 10-11 m depending on the soil parameter.

Temperature

Outside temperature for design purpose:

- Maximum temperature : +40 °C
- Minimum temperature : +20 °C

The steel / concrete structures are designed in consideration of temperature variation: +/- 20°C.

Relative Humidity

Relative humidity ranges normally from 70% to 98% with a mean figure of 90%.

Material Properties

Concrete

M30 grade of concrete is proposed for all piles. M25 grade of concrete is proposed for other structural elements.

Unit weight of concrete (in kN/m^3) - 25.00

Steel

1) Structural steel used in this design confirms to IS2062 with the following properties:
   a) Yield stress: 310 Mpa.
   b) Ultimate stress: 430 Mpa.
2) The reinforcement steel proposed is high yield strength deformed bars of grade Fe-500 Conforming to IS:1786-1985
   a) Unit mass of steel (in Kg/m^3): 7850
   b) Modulus of Elasticity (N/mm^2):$2.1x10^5$

Clear cover to reinforcements

By considering the exposure condition a minimum clear cover to outer reinforcement is provided as per IS standards.

Minimum Specifications

Minimum specifications are listed below:

1. Width of footbridge: 2 m.
2. Clearance from center line of the canal: 4 m.

A.5.2.1 Loading and Analysis

Dead load

Dead load of the modeled elements will be taken care by the analysis software. The dead load from other structural elements are calculated as per IS:875 Part-I.

Live load

Suitable Live Load as per IS: 875 Part-2 and data collected from various vendors are considered:

a) **Wind Load**

Suitable Wind Load as per IS: 875 Part-3 and wind speed to be considered is 39 m/s (3 second gust).

b) **Seismic Load**

Earthquake Load as per IS: 1893-2016. Seismic zone-Zone III.

The type of loads and the specification values are given in **Table 4A.8**.

Table 4A.8: Type of loads and the specification values

Sl. No	Type of Load in IURWTS foot bridges	Specifications
1	Total span	16.5 m
2	Live load	5.00 kN/m^2
3	Weight of RCC slab	0.15x25= 3.75 kN/m^2
4	Total load	8.75kN/m2= say 10kN/m^2
5	Dead load (safety)	1.5 kN/m^2
6	Final load	1.5 kN/m^2

4A.6.2.1 Analysis and Design Methodology

Structural Components of a foot over bridges are classified into Steel & RCC categories.

Structural Steel Components

a) Steel Bridge system consisting of (i) Main truss (ii) Secondary Beam (iii) Decking sheets. A schematic sketch of a foot bridge is given in **Figure 4A.22**.

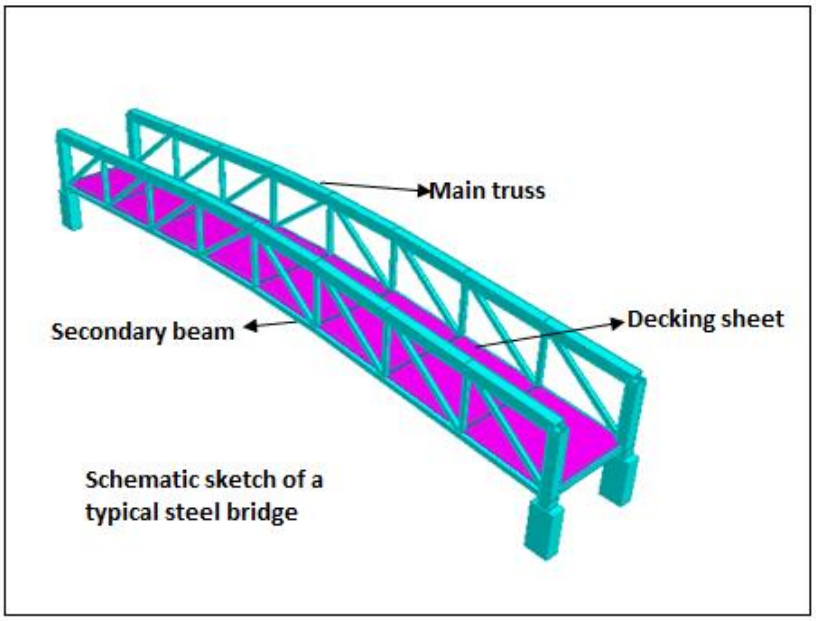


Figure 4A.22: Schematic sketch of a foot bridge

RCC Components

(a) Piles (b) Pile cap (c) Retaining Wall/Pedestal

Load transferred from decking slab to secondary beam and then to main truss. Load transferred from main truss to Retaining wall/Pedestal through anchor bolts (pinned base support) and further to Pile cap and Pile. Decking floor plate will act as the "bracing" to the bottom chords, to carry the lateral shear (mainly wind forces) back to the supports. If a non-participating form of floor is used, cross bracing in the plane of the bottom chord, to resist lateral forces, must be considered.

The structure is modeled and analyzed in STAAD-pro software. The support conditions of the main truss is assumed as pinned and resting on the abutment. Analysis is performed for the worst load combinations as per the provisions given in IS Codes. Forces obtained from the critical combination of loads from the analysis model is taken as the input for the design. Limit state Design is carried out for RC & Steel members as per relevant Indian Codes.

4A.6.3 Codes and Standards

The following **Table 4A.9** shows the Codes and Standards are used in the analysis and design of the foot over bridge structure:

Table 4A.9: Codes and Standards referred

S. No.	Indian standard code	Area of application
1	IS: 875 -1987 Part I to part V	Code of practice for Design loads (other than earthquake)
2	IS: 456-2000	Code of practice for plain reinforced concrete
3	SP:34	Handbook on concrete reinforcement and detailing
4	IS: 1893-P1-2002	Criteria for earthquake resistant design of structures, Part 1-General provisions and buildings AMD.1

The drawings for Foot over bridge layout and details, foundation details are given in **Drawing Annexure 4A D.2 and D.3,** respectively. The cost estimate is provided in **Chapter 6** of this report.

4A.7 Development of Konthuruthy Canal (Additional work)

Preliminary investigation of Konthuruthy canal was conducted Antea group. Detailed engineering and estimation will be done after all the surveys and the investigation are carried out. The preliminary investigation proposed the following development activities for the initial stages.

Deepening and widening

The existing width of the canal varies from 5m to 70m and the width is nearly 300m near the joining point with Konthuruthy kayal. It is proposed to widen the canal to a width of 40 m for stretches with width less than 40m. Deepening of the canal is also proposed to a uniform dredge depth of (-)0.90m. The engineering part of this will be similar to the section **4A.2**.

Shore Protection

Shore protection using structural sheet pile is also proposed for the stretch of the canal with width less than 40m. Detailed design for this stretch will be done after further investigation and the engineering aspect will comply as section **4A.3.**

Reconstruction of road bridge and foot bridges

It is proposed to reconstruct the existing road bridge and 2 footbridges complying the functional requirement such as length, width, air draught of minimum 4m etc. The design aspect will be complied as per the section **4A.6.**

Other miscellaneous activities

Other miscellaneous activities include demolition of the existing structures, fencing to prevent further encroachments etc.

CHAPTER 4. ENGINEERING DESIGN

4B. URBAN REGENARATION

(sewer, sewage treatment, sanitation, and solid waste)

4B. URBAN REGENARATION

Introduction

A proper Sewerage System is an important infrastructure for urban needs. The different technology options in the design of sewerage network system include gravity sewer system, vacuum sewer system, and pressure sewer system. The different techniques for implementation of the above systems are open cut excavation, trenchless technology, etc. The various types of construction material generally used include metallic, concrete, plastic pipes, and prefabricated RCC & FRP manholes.

The choice among the different technologies and alternative material are site specific. Hence, before going for the implementation of the sewerage system we should always consider both the techno (Design) and the economical (Cost) feasibility of the system with due consideration of various technology options available for sewerage system. Often, the planners use a combination of different approaches in different circumstances to save money, control development, and protect public health and the environment.

The major roles of a sewer system are listed as follows:

1. Improvement in the environment by removing the sewage as it originates.
2. Prevention of inundation of low-lying areas that may be otherwise caused by not providing sewers.
3. Prevention of vector propagation by sewage stagnations.
4. Avoidance of cross-connections with freshwater sources by seepage.

The various categories of Sewerage System are:

1. Conventional gravity sewerage system.
2. Small-bore gravity sewerage.
3. Vacuum sewerage system.
4. Pressurized sewerage system.

The design principle of each of the above systems is as follows:

1. Conventional Gravity Sewerage System

Design Principle: Large networks of underground pipes, mostly in urban areas, collect black water, brown water, greywater, and storm water. Wastewater is transported to a centralized treatment facility by gravity. Depending on topography, sewer pumping stations is necessary. The lines are at a depth of 1.5

to 3 m and manholes provide access for maintenance. It must be designed to maintain "self-cleansing" velocity that no particles accumulate.

Costs: Initial costs are high because excavation and refilling of trenches to lay the pipes, requires specialized engineers, operators and maintenance costs are high compared to decentralized systems. Extension of the system can be difficult and costly.

Applicability: Suitable for urban areas that have the resources such a system. These systems only make sense if a centralized treatment system exists which can handle big loads of waste- and storm water. Enough water as a transport medium needs to be available. A professional management system must be in place.

2. Solid free /Small bore sewerage system

Design Principle: Solids-free sewer systems are like conventional systems. However, the wastewater is pre-settled, and solids are removed before entering the system, e.g. Septic tanks, Biogas settlers and Anaerobic baffled reactor. The recommended pipe diameter is 75 to 100 mm and a depth of at least 300 mm. If well maintained, there is little risk of clogging, thus there is no need of self-cleansing velocity, i.e. shallow depths, small or even ineffective gradients, fewer inspection points, can follow topography more closely. This results in significantly lower investment costs due to the simplified design.

Costs: Solids-free sewers can be built for 20% to 50% less costs than conventional sewerage. Repairs and removal of as well as costs for emptying the pre-settling unit must be considered. Applicability: Well suited for areas where leaching fields/soak pits are inappropriate due to sensitive groundwater or lack of space for on-site infiltration in growing communities. In areas with a high willingness to pay (for the operation and maintenance) and with locally available expertise and resources. Users should receive some basic training.

3. Vacuum sewer systems

Design Principle: A central vacuum source conveys sewage from individual households to a central collection station. Use of differential air pressure ("negative pressure" or "vacuum") to move the sewage. Gravity line carries wastewater from the source to the collection chamber. When a defined height is reached, the vacuum interface valves open and sucks the wastewater into the vacuum sewer main. At the end of this main it is collected in a big tank. After this tank is filled to a predetermined level, the wastewater is transferred to a treatment plant via a conventional/separate sewer system.

Design Principle-Piping: Narrow and shallow trenches (1.0 to 1.2 m). Inspection points for pressure testing. Small pipe diameter (80 to 250 mm). If a pipe is damaged, risk of leaking is low because of the negative pressure.

Costs: It is a high-tech system; thus, it is costly. But in comparison with a conventional sewer system, it is cheaper. Large amounts of flushing water can be saved. A permanent source of electrical power can increase the costs.

Applicability: Flat topography: gravity systems demand installation at great depths to maintain adequate flow (pump stations, lift stations). Rock layers, running sand or a high groundwater table makes deep excavation difficult. Areas short of water supply or poor communities that must pay for water but cannot afford great amounts of water necessary for operation of gravity systems. Areas that are ecologically sensitive. Areas where flooding can occur.

4. Pressurized sewage system

Design Principle: This system is not dependent on gravity to move wastewater. Shallow trenches and relatively small pipe diameters. It requires permanent electricity and grinder pumps. Wastewater is collected by gravity in a collection tank. A grinder pump moves it to the sewer; this transfer of wastewater pressurizes the sewer. Various pumps along the sewer line move the wastewater progressively. Generally, prefabricated products are used. The components include: a collection tank, a grinder and pump, and a non-return valve (prevents back flow from the pressure sewer). The grinding allows small pipe diameters of 600mm. It is wired to the household power supply and regulated by a control panel. The alternative to this unit can be a septic tank situated outside on the ground or in the basement. Effluent flows into an underground holding tank containing a pump and control devices from where it is then pumped into the pressurized sewer.

Costs: Costs can be divided into two major components: On-lot costs: pump, basin, controls, building sewer, lateral piping, electrical service, installation. And collection network costs includes all the piping in the utility easements that directs the sewage to the treatment facility.

Operation & Maintenance: Regular service is important for all system components. Electricity needs to be available all the time. Pumps should be checked regularly. Pipe connections should be controlled for leakages. Applicability basically, pressurized sewer systems have the same advantages as vacuum sewers. Therefore, they are used in surroundings. such as flat or hilly topography: gravity systems demand installation at great depths to maintain adequate flow or requires pumping and lift stations. Rock layers,

running sand or a high groundwater table makes deep excavation difficult. High groundwater table. Densely populated areas.

Project Catchment

In the IURWTS Project area (**Figure 4B.1**) a considerable portion of the toilet waste is treated by individual septic tanks. However, the treatment efficiency of the septic tanks is not sufficient due to their insufficient maintenance. Hence, the treatment efficiency of septic tanks is ignored to determine the domestic wastewater quality and quantity. The wastewater discharge is defined as wastewater consisting of both toilet waste and gray water.

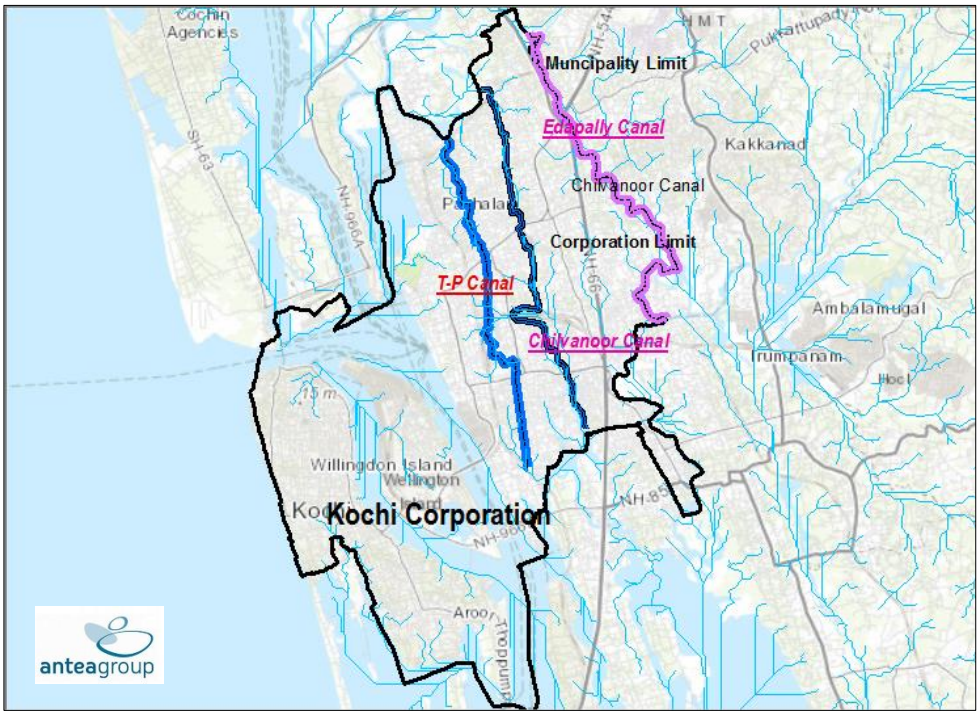


Figure 4B.1: IURWTS Project area

All project canals carry the entire dry weather flow and contribute to the canals. To rejuvenate the canal, it is prerequisite to have a zero dry weather flow discharge to the canals through interceptor sewerage planning in both sides of the canal.

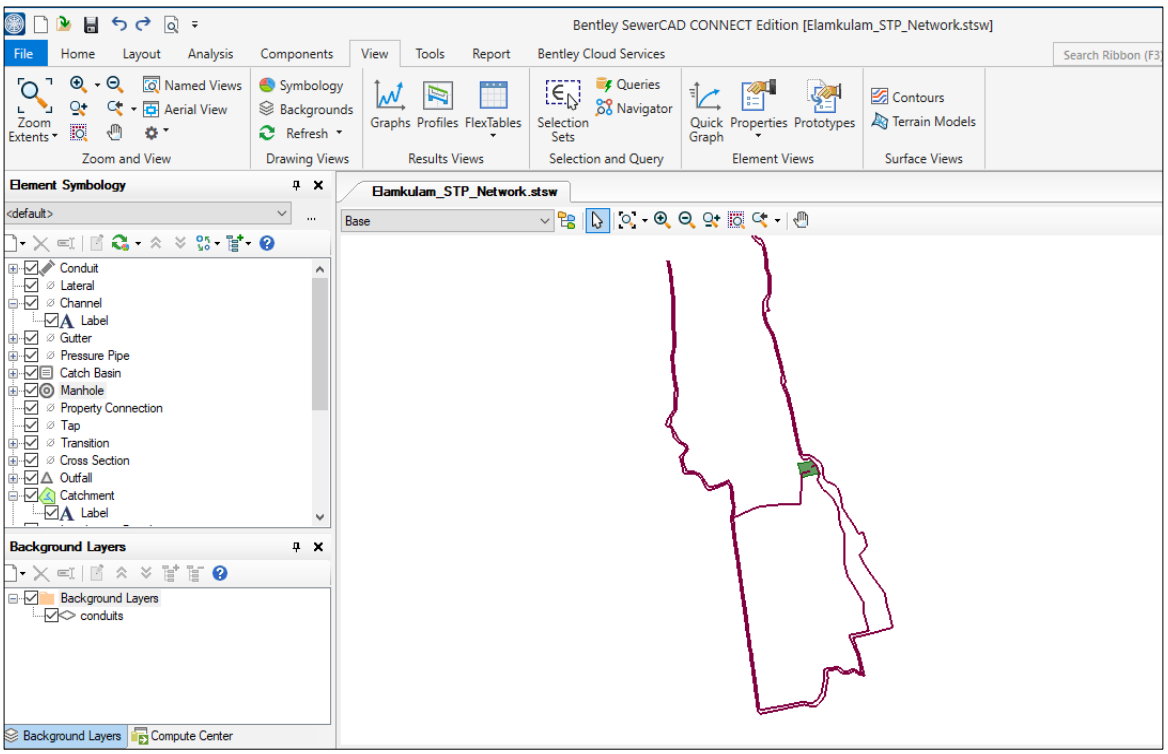
4B.1 Interceptor sewer

An interceptor sewer, also known as an interceptor, is a component of a sewer network that helps to control its flow. It receives the flow from trunk sewer lines and sometimes from storm water runoff and directs it to the wastewater treatment plant. It is among the larger lines of a sewer system.

A drain interceptor is a tank installed within pipework to collect and hold contaminants, allowing the remaining wastewater to be discharged safely into the main sewerage system. Drainage interceptors are referred to by other names, including interceptor traps, interceptor tanks, and filter tanks.

4B.1.1 Interceptor Main Sewer – Modelling by Gravity and Pumping

A snapshot of the software output using sewer CAD for Elamkulam catchment interceptor main sewer for modelling using gravity and pumping method is given in **Figure 4B.2**.



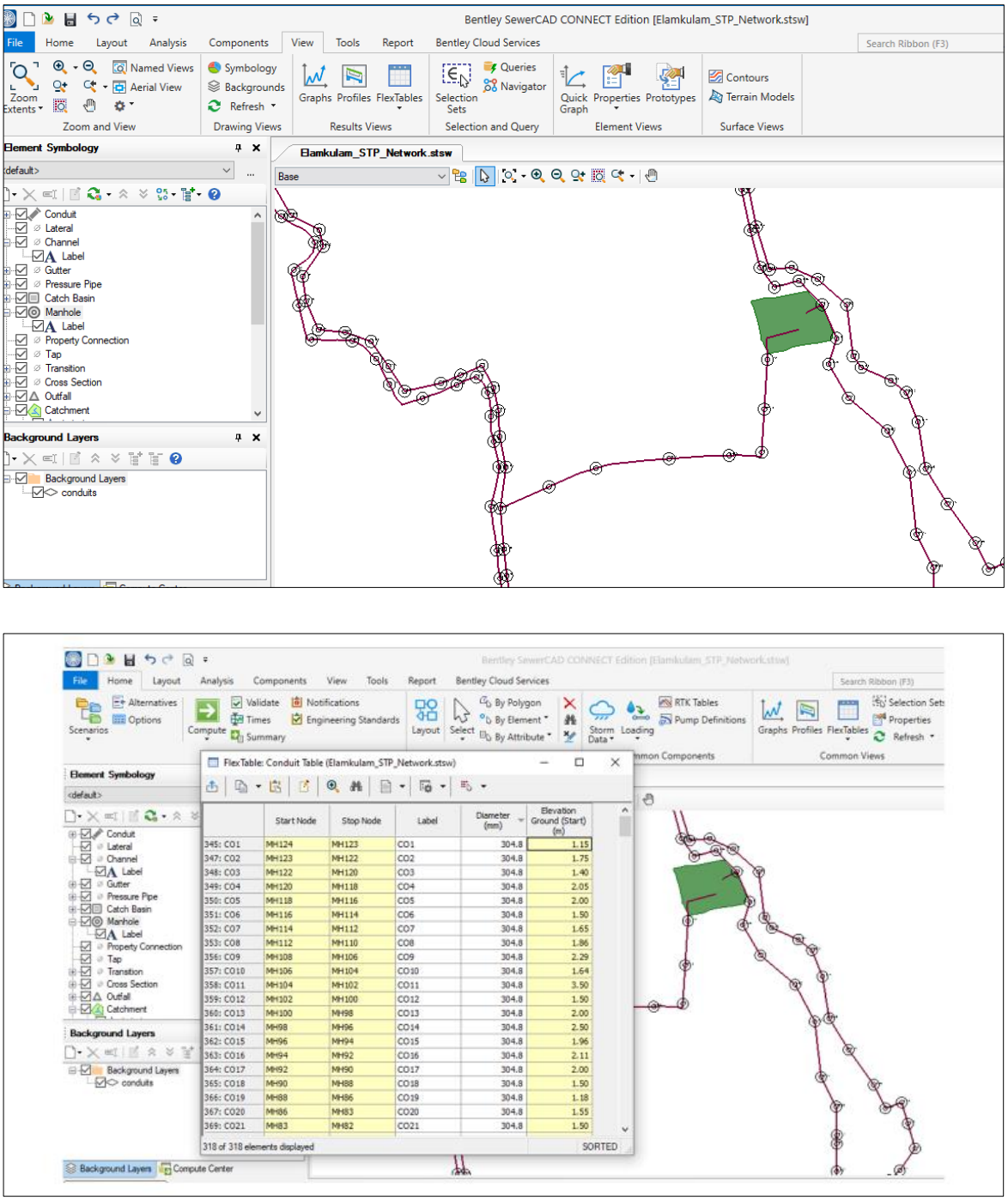


Figure 4B.2: Interceptor Main Sewer for Elamkulam STP

4B.1.2 Planning Concept and Design Criteria

1. Target Year to be designed: 2051
2. Design criteria: see **Table 4B.1**.

Table 4B.1: Design criteria for IURWTS sewer systems

Pipe material	RCC NP3
Unit Wastewater Discharge	-----Liter/per capita/day (consisting of domestic, commercial, institutional, and home industrial wastewater)
Design Flow	Hourly maximum flow (1.4 times of daily average dry weather flow in year 2020) plus groundwater infiltration (10% of daily average dry weather flow)
Flow system	Gravitation
Flow equation	Manning equation
Minimum velocity	0.7 m /s

The design criteria to be followed for design of sewage collection, transportation and treatment system for the project are based on the recommendations laid down in the CPHEEO Manual of Sewerage and Sewage Treatment (Ministry of Urban Development, Government of India, 2013) and as per provisions laid down in the relevant I.S. codes and Consultants' past experience in related field. The various design considerations and norms are described in **Table 4B.2**.

Table 4B.2: Recommended design period for sewage components

Sl. No.	Component	Recommended Design Period (in years)	Remarks/ Clarification
1	Sewer Network (Gravity Collection System)	30	The system will be designed for the prospective population of 30 years, as its replacement is not possible during its use.
2	Pumping Stations (Civil Works)	30	Duplicating machinery within the Pumping Station would be easier/ cost of Civil Works would be economical if executed once for full design period.
3	Pumping Machinery	15	Life of Pumping Machinery is considered as 15 years as per practice/ guidelines.

Sl. No.	Component	Recommended Design Period (in years)	Remarks/ Clarification
4	Conveyance System	30	Provision will be kept for the entire design period, as its' phasing/ replacement is not possible during its use.
5	Sewage Treatment Plant	30	The plant will be designed in modules for immediate stage and ultimate phase.
6	Effluent Disposal System	30	Provision of design capacities in the initial stage is economical.
7	Land Acquisition	30	Land requirement will be worked out for the ultimate stage.

4B.1.3 Per Capita Sewage Flow

CPHEEO Manual on Sewerage and Sewage Treatment (2013) recommends a sewage generation of 80 - 90% of water supply.

4B.1.3.1 Peak Factor

The peak factor, i.e. the ratio of maximum to average hourly flow, depends on the water use habit of the population of the project area and the contributing population. The quantity of water used in a day varies during the hours of the day due to habits of people.

Though the sewerage system will receive flow throughout the day, there will be some duration in which maximum sewage will be generated. Peak factors for domestic flow as per guidelines given in the CPHEEO Manual are as follows:

Contributing Population	Peak Factor
Up to 20,000	3.00
From 20,000 to 50,000	2.50
50,000 – 750,000	2.25
Above 750,000	2.00

4B.1.3.2 Infiltration

The infiltration into sewerage system shall be considered during flow estimation. Estimation of the flow in sanitary sewer includes flows due to infiltration of water through the joints of pipes and through manholes. The quantity is contingent on the workmanship in laying of sewers and the depth of ground water table in the area. Sewers are designed for the peak discharges and provision for ground water infiltration is to be made for worst condition and conservative design. With better standards of workmanship and availability of watertight joints for pipes, these values may be kept at minimum.

During most periods in the year, no ground infiltration is expected due to the absence of rains. Furthermore, due to the use of better pipe materials and construction techniques, the infiltration will be minimal. Provision for infiltration shall be made in the designs of sewer network in the scheme as per recommendations of CPHEEO manual, **Table 4B.3**.

Table 4B.3: Recommended Infiltration rate

Norm	Minimum	Maximum
Liters/ha/day	5,000	50,000
Liters/km of sewer/day	500	5,000
Liters/day/manhole	250	500

The infiltration into sewer may occur through pipes, pipe joints, and manholes. With improved construction practices, the rate of infiltration will tend to be on the minimum, rather than on the maximum. The water table in Kochi is relatively high ((Source: Soil Investigation Report, 2009): it varies from 1.5 to 3 meters. Thus, for the purpose of this study, an infiltration rate of 5% of the per capita sewage flow as suggested by CPHEEO has been adopted in the design.

4B.1.4 Sewage Collection System

The various components of the proposed network are given below:

4B.1.4.1 Sanitary Sewer Lines

Sewers are provided to convey wastewater from one location to another under gravity and therefore are normally laid deep enough to receive incoming flows from the contributing areas. Sewers must resist erosion and corrosion and its structural strength must be sufficient to withstand the backfill, impact, and live loads satisfactorily. The size and slope of sewer must be adequate for the flow to be carried and

sufficient to prevent deposition of solids. Ease and economy of maintenance, safety to the personnel and the public, during its life as well as during construction period must be given due consideration.

In the design of sewerage system, the important decisions to be taken are location, size, slope, and depth of sewer, material of sewer lines and appurtenances to be added such as manholes, junctions, vent pipes and other structures to minimize turbulence, save head loss and prevent deposits and obnoxious gases.

The aim of design is not only to make the sewer system functional, but also to build the system at low competitive costs.

Generally, the total available energy is utilized to maintain proper flow velocities in the sewers with minimum head loss. Hence, the sewerage system design is limited on one hand by hydraulic losses, which must be within the available limit, and on the other on maintaining self-cleansing velocities in sewers. Often, it is difficult to meet both conditions simultaneously due to wide variation in rate of flow.

Where differences in elevations are insufficient to permit gravity flow, pumping may be required. The cost of construction, operation and maintenance of pumping stations are compared with the cost of construction and maintenance of gravity sewers. Apart from the cost considerations, the consequences of mechanical and electrical failures at pumping stations may also be considered, which may necessitate a gravity system even at a higher cost. In the current context, requirement of an intermediate SPS is not expected because of availability of enough natural ground slopes.

The sewerage system layout involves the following steps:

- Selection of an outlet or disposal point.
- Location and alignment of Trunk and Main Sewers and laterals.
- Location of Pumping Stations.
- Location of sewage treatment plant.

In general, the sewers will slope in the same direction as the roads, drains or natural ground surface and will be connected to trunk sewers. The discharge point may be a treatment plant, a pumping station, a watercourse, a trunk, or an intercepting sewer. In this case, disposal point will be a treatment plant.

Sewers are to be laid away from existing water supply and other utility lines as far as possible. When such situations are unavoidable, sewers are to be encased in concrete or provided with sleeve pipes. Tees, wyes, chambers will be provided on sewer lines in order to avoid breaking the sewer for future connections.

4B.1.4.2 Minimum Size of Sewer Line

Minimum diameter for public sewer shall not be less than 150 mm (internal) except for sharply falling gradients. A minimum sewer size of 150 mm is therefore proposed to be adopted as per CPHEEO norms.

4B.1.4.3 Capacity of Sewer

All sewers will be designed to flow up to a maximum depth of 0.80 times (i.e. 80 %) the internal diameter of sewer at ultimate peak flow (As per the CPHEEO Sewerage Manual) in order to ensure proper ventilation in sewers. However, such provision will be simultaneously checked for self-cleansing velocity in present peak flow condition.

4B.1.4.4 Velocity in Sewer

It is required to maintain minimum velocity through the sewer to ensure that suspended solids do not deposit and cause choking. Hence, it is mandatory to maintain "self-cleansing velocity" in sewer lines. As per Govt. of India stipulations:

The minimum self-cleansing velocity required is 0.6 m/sec at present peak flow to prevent 0.09 mm sand particles of sp. gr. 2.65 from settling.

The maximum scouring velocity is limited to less than 3.0 m/sec to safeguard the sewer against abrasion and erosion by sand and other gritty material and also against possible sulphide corrosion (as a result of release of hydrogen sulphide gas due to turbulence).

At certain stretches, viz. the tail ends of laterals, branches and even on the main sewer, minimum velocity for design flow is likely to be less than minimum self-cleansing velocity. At certain stretches, where velocity corresponding to peak flow condition is high, manholes and sewers will be flushed out during peak flow in removing silt, which got deposited during minimum flow period, especially during night hours. Adopting lower values of velocities through lesser gradients will help in avoiding deep excavations for sewer laying. In developing a particular sewer collection network, this point shall be given due consideration prior to design of sewers.

4B.1.4.5 Sewer Transition

Sewer transition is defined as an event or point at which there is change in diameter of sewer or its alignment, junction of two or more sewer lines, etc. These changes can occur singly or as a combination

of two or more factors. The preparation of hydraulic design of sewers has to take into account the changes in hydraulic profile of sewers due to such transitions. Usually, the diameter of the sewer increases progressively.

4B.1.5 Hydraulic Design Formula

4B.1.5.1 Gravity Flow

For open channel flow, Manning's formula is used for designing slope and diameter of the sewer line to carry the design flow at stated velocity. The value of Manning's co-efficient ('n' value) for uPVC / HDPE pipe is 0.011, for DI pipe (cement mortar lined) is 0.011, for RCC pipe is 0.011 (for rubber gasket jointed pipes) and for stoneware pipe is 0.012.

Pressure Flow

Hazen-Williams and the modified Hazen William's Formula are used for closed conduits and pressure flow (e.g. pumping main).

4B.1.5.2 Manholes

Sewer transitions occur wherever conduits of different characteristics are connected. The difference may be in flow, size, grade and alignment, material of conduit, with a combination of one or all characteristics. Manholes have been located at all such transitions with CI/PVC footrest for access. The types of manholes shall be provided as per following standard given in CPHEEO Manual:

(a) Rectangular manholes shall be provided for depth up to 2.5 m:

For depths of manholes less than 0.90 m	-	900 x 800 mm
For depths of manholes from 0.9 m and up to 2.5 m	-	1200 x 900 mm

(b) Arch Type manholes shall be provided for depth above 2.5 m:

For depths from 2.3 m up to 9 m	-	1400 x 900 mm

The size of the access cover should be of 560 mm clear opening. Since the manholes are to be located on roads with trucks plying on them, steel fibre reinforced concrete covers (SFRC) of heavy-duty HD-35 designation and conforming to IS: 12592 have been proposed.

For straight sections, the interval at manholes on sewers, which are to be cleaned manually and cannot be entered for cleaning or inspection, the maximum distance between manholes should be kept at 30 m. However, for economical consideration a manhole spacing of 50 m C/C shall be provided for all trunk sewers having diameter more than 600 mm.

4B.1.6 Materials of Pipeline

The pipe material to be adopted is selected through a techno-economic comparison of the available materials and based on the following factors as well as the Life Cycle Analysis:

- Type of flow (Gravity / Pumping)
- Characteristics of flow
- Availability of sizes
- Soil conditions and bedding requirement
- Strength
- Jointing Methods
- Durability
- Cost

Based on the above factors, different types of pipe materials used for sewer are as follows:

For Gravity Sewer:

- Stoneware pipes.
- HDPE pipes.
- Spun RCC pipes and
- PVC pipes

HDPE and Stoneware (SW) pipes shall be utilized for sizes from 150 to 300 mm diameter in gravity collection systems for depths up to 3.00 m.

Spun RCC pipes used in gravity collection systems for depths greater than 3.00 m and for diameters greater than 300 mm. These pipes are easily available in diameters from 200 mm to 3,000 mm in general and are economic for sixes above 300 mm dia when compared to SW pipes.

- Stoneware pipes are proposed for sewers of 150 to 300 mm diameter in general.
- RCC Spun pipes are proposed for sewers of > 300 mm diameter in general
- HDPE pipes are proposed for sewers of 150 to 300 mm diameter in a small pilot area in zone 3 (in wards 27, 28 and 29).

4B.1.7 Comparison of pipe material – Gravity sewers

A comparison of gravity sewers is indicated in **Table 4B.4**.

Table 4B.4: Comparison of Gravity Sewers

No.	Parameters	Gravity Sewer		
		Stoneware	**RCC & Spun RCC**	**PVC Pipes**
1	Available sizes (mm)	100-300	NP 2: 200-1000, NP 3 & NP 4; 200-1000	90 OD to 315 OD
2	Length (m)	0.6	2.5	3m, 6m
3	Applicable IS	651-1971 4127	458; 783; 3597	3076: 1985
4	Weight	Medium	Medium-Heavy	Light flexible
5	Flexibility	Rigid	Rigid	
6	Tensile strength	-	2.5 N / mm2	
7	Impact strength	Fair	Good	Fair
8	C-value of pipe material	100 –120	120-150	
9	Manning coefficient of roughness	0.012	0.013	0.011
10	Corrosion Resistance	Good corrosion resistant	Good corrosion resistant	Very Good corrosion resistance
11	Jointing Methods	S/S jointed with yarn and cement mortar.	S/S with rubber rings conforming to type IS / cement mortar	Bell and plain ends jointed with solvent cement or push on joint with rubber ring
12	General Availability	Easily available in India	Easily available in India	Not being used for sewer lines in India. But widely used worldwide.

No.	Parameters	Gravity Sewer		
		Stoneware	RCC & Spun RCC	PVC Pipes
13	Availability of Plant & Skilled Manpower for Manufacturing Laying and Maintenance	Easily Available	Easily Available	Easily available
14	Corrosion Control Techniques	Glazing is done to the exposed surface	Manufactured with sulphate resistant cement. Sacrificial coating with high alumina cement if necessary	Pipes are corrosion resistant
15	Jointing Materials	Tarred Yarn and cement mortar	Tarred Yarn and cement mortar	Rubber rings, solvent cement
16	Special Bedding requirement	Granular / Concrete	Granular / Concrete	Granular / Concrete
17	Laying speed	Fair	Good	Very fast
18	Pipe Performance Experience	Good	Very Good	Largely used in Australia since 1975
19	Recommendation	Yes, up to 3.50m depth	Suitable for all depths	Yes, up to 200 mm diameter for house sewer connections and laterals

4B.1.8 For Pumping Mains

Cast Iron, Ductile Iron, Pre-Stressed Concrete and Glass Fibre Reinforced Plastic (GRP) Pipes are to be considered for pumping mains and crossing of river channels, roads, and railways at shallow depth. The brief characteristics of CI, DI, PSC and MS Pipes are given below.

4B.1.8.1 Cast Iron Pipes

CI pipes are easily available in class LA, A and B and size from 100 mm up to 750 mm diameter. However, considering corrosion effects due to sulphide, CI are not preferred.

4B.1.8.2 Ductile Iron Pipes

DI pipes are preferred because of better strength properties and surge withstanding capacity of DI pipes. DI pipes with internal cement lining and bituminous coating are preferred over CI pipes for pumping mains, with sizes up to 500mm.

4B.1.8.3 PSC Pipes

PSC pipes are proposed for pumping mains, with diameters above 500 mm and less than 1000 mm.

4B.1.8.4 GRP Pipes

GRP Pipes are proposed for pumping mains, with diameters greater than 1,000 mm.

4B.1.9 Comparison of pipe material – Pumping / Force mains

A comparison of pipe materials for pump mains is indicated in the **Table 4B.5**.

Table 4B.5: Comparison of pipe materials for pump mains

No.	Parameters	Pumping Main Material			
		Cast Iron	**Ductile Iron**	**GRP**	**HDPE**
1	Available sizes (mm)	100 – 1,000 mm	100 –1,000 mm	200 – 1500mm	20 -1,000 mm
2	Length (m)	5.50	6.00 m	6.0 to 12.0m	6m – 12 m
3	Applicable IS for manufacture, laying and jointing, fittings etc	1536,1537, 1538, 6263,7181, 3114	3589; 5822		4984
4	Weight	Heavy	Medium	Light	Very light

No.	Parameters	Pumping Main Material			
		Cast Iron	Ductile Iron	GRP	HDPE
5	Flexibility	Rigid	Medium	Flexible	Flexible
6	Available working pressure range Kg/m2	6-12 class LA, A, B	As required	Up to 10ksc	2.5 – 16 kg/cm2
7	Tensile strength Kgf/mm2	15	40		
8	Impact strength	Good	Very Good	Good	Good
9	C-value of pipe material	100	140	150	150
10	Corrosion resistance	Low in corrosive soils & water	Good with internal lining & outside coating	Good	Very Good
11	Jointing methods	Spigot & sockets joint with rubber ring / flanged joint	Spigot & sockets joint with rubber ring / flanged joint	S/S with push on joint with rubber ring	Butt welding using parent material
12	General availability	Freely Available in India	Limited Availability in India	Now available in India	Widely mfd. In India
13	Availability of tools & plant and skilled manpower for laying and maintenance	Freely Available	Easily Available	Available	Available – requires initial training of personnel

No.	Parameters	Pumping Main Material			
		Cast Iron	Ductile Iron	GRP	HDPE
14	Availability of Corrosion Control Techniques	Mortar lining on the inner surface required for corrosive wastewater	Cement Mortar lining on the inner surface for corrosion resistance	Corrosion resistant	Corrosion resistant
15	Laying speed	Fast	Fast	Fast	Fast
16	Pipe Performance & Experience	Very good	Good with Cement or Glass-lining	Limited experience in India	Good; Repairs are difficult.
17	Recommendation	Not recommended	Yes (for sizes up to 500 mm)	Yes (for sizes greater than 750 mm)	Yes (for sizes up to 1000 mm)

The following pipes have been considered in the design of pumping mains:

- Up to 300 mm diameter gravity pipes – HDPE pipes have been recommended.
- More than 300 mm diameter gravity pipes – RCC NP3 s/s pipes have been recommended.
- For pumping main in Treatment plant, HDPE pipes have been recommended.

4B.1.10 Laying & Jointing of Gravity Sewers/ Pressure Mains

DI sewer pipes of push-on joint are proposed to be utilized. The sewer lines will be laid and jointed in accordance with standard norms of manufacturer and requirements of relevant standards codes. Sewers will be encased in concrete where the required cover is not available. Special protection to sewer lines will be provided at locations of road crossing, drain/ nalla crossings, and crossings near potable water lines.

4B.1.11 Minimum Cover and Maximum Depth of Sewer

The gravity sewer lines, and pressure mains will be laid with minimum earth cover of 1.0 m above the top of the sewer in order to protect the pipes from bearing loads. Depth of excavation increases the cost of

lying of sewer lines substantially and also makes future maintenance difficult. Hence, efforts shall be made to optimize the design of collection system with regard to maximum depth of sewer and this shall be restricted to 6.0 m for all proposed lines.

4B.1.12 Type of Bedding

The type of bedding provided for pipes will be selected from three types of bedding namely, type "B" i.e. shaped bottom or compacted granular bedding with carefully compacted backfill, type "Ab" i.e. concrete cradle-plain concrete with carefully tamped backfill and "Ac" i.e. concrete cradle RCC with 0.4 % reinforcement. They are described as:

Special compact granular bedding

The pipe shall be bedded in compacted granular material placed on a fresh trench bottom of the granular bedding shall have minimum thickness of one fourth the outside diameter of pipe but not less than 10 cm and shall extend halfway up the pipe barrel at the sides.

Concrete Cradles

The pipe be bedded in a monolith cradle of plain or reinforce concrete 1:2:4 as specified having minimum thickness of one fourth the outside diameter of the pipe but not less than 10 cm and shall extend halfway up the pipe barrel at the sides and then slopping upward tangential to the top surfaces of the pipe, the coarse aggregate if the cement concrete 1:2:4 shall be of stone chips or gravel 20 mm down.

Concrete Encasement

The pipe shall be bedded in monolith layer of plain or reinforced cement concrete 1:2:4. The coarse aggregate shall be stone chips or/gravel 20 mm down.

The following **Table 4B.6** shows the details of type of bedding below the sewers to be provided depending on the load factor obtained during the design. These are as per the CPHEEO manual.

Table 4B.6: Bedding Details

Load Factor	Class	Bedding Details
0	C	Flat bottom trench
1.1	C	Shaped bottom or compacted granular bedding with lightly compacted backfill

Load Factor	Class	Bedding Details
1.5	B	Shaped bottom or compacted granular bedding with carefully compacted backfill
1.9	Aa	Concrete cradle – plain concrete and lightly tamped backfill
2.2	Ab	Concrete cradle – plain concrete and carefully tamped backfill
2.8	Ac	Concrete cradle – RCC 0.4%
3.4	Ad	Concrete cradle – RCC 1.0%

The location of the above types of bedding and any other types should be decided on site conditions such as type of soil and its extent of water contents, super imposed load etc. Immediately after excavation, the construction of bedding should be taken up. It should be ensured that the trench is not waterlogged. The soil under the bedding shall be well compacted and stabilized.

4B.2 Design Criteria for Sewage Pumping Station

4B.2.1 Design Approach

Sizing of pumping station, its design and selection of pumps for a sewage pumping station involve a team of specialists concerning civil, electrical, and mechanical aspects to obtain a practicable design solution and operation of the pumping station. Different types of pumps have their own merits, demerits, and characteristics. An array of decisions is to be taken while selecting and designing these pumps. The design of pumps broadly follows the following aspects:

- Determine pumping station location and purpose.
- Determine the required flows (average and peak.)
- Determine the required lift, including the variations therein, as well as the transmission distance.
- Determine the type of liquid.
- Determine inflow and outflow conditions.

4B.2.2 Location

Pumping stations are normally located at the lowest point of the area to be served. Selection of location of the pumping station requires a detailed study of the area to be served to ensure that the entire area

can be adequately catered for. The plinth level of pumping station shall be fixed up so that it will not be flooded at any time. The location should also be easily accessible in all weather conditions.

4B.2.3 Determination of Flows

After deciding the location of the pumping station, and segregating its contributory area, the average and peak flows of sewage reaching this location for the present day are estimated. These are normally designed to cater for a 30-year design period.

The basic steps for the calculation of flow are as follows:

- Estimation of population.
- Assessment for development and growth of population for the design year.
- Fixing per capita sewage generation and flow estimation.
- Estimate peak factor.
- Establishing maximum, average, and minimum design flows for various stages.

4B.2.4 Layout

Generally, for fixing up the layout of the pumping station, all the design factors will be taken into account. It can be said that the layout of a pumping station is finalized based on the requirement of space for the mechanical items, with sufficient room to move between machinery/ equipment for erection and maintenance purposes, but without unnecessary spaces either in horizontal or in vertical direction. In principle stretches of flow should be as short as possible and no unnecessary bends should be there in the piping layout. Space is required for the following units:

- Inlet chamber
- Coarse screen chamber
- Main sewage collection sump
- Valve chamber / dry well
- Transformer station
- Electrical panel and DG set room
- Operations Office

The spaces should be well illuminated. Also, outside lighting is required. Proper railings are required along stairs, sump, and chamber or on platforms. Sufficient space should be available for future augmentation of the station if required.

4B.2.5 Pump Sizing

Pump sizing is carried out based on manufacturer's pump data, as these are the most reliable guides. Having determined the duty conditions, the pipe work, sizing, solids handling capacity and basic dimensions will be known.

4B.2.6 Sump Sizing

(a) Wet Well

Capacity of wet well sump is adopted as per guidelines for submersible and horizontal centrifugal type of pumps. A maximum of 5 minutes detention time at peak flow condition shall be considered to size the sump well. The other factors are two basic criteria to be considered.

- Free fall of sewage into the sump well governed by the invert of the incoming sewer pipe.
- Adequate space for pumps within the well to be removed for maintenance (submersibles only)

In addition to these sizing criteria, the well must be self-cleansing and will be provided with a shaped base (benching).

(b) Dry Well/ Valve Chamber

Sizing of dry well (for horizontal centrifugal pumps) or Valve chamber (for submersible pumps) shall take the requirement of pumps spacing, common header diameter, fittings, valves, and equipment, working and operating space into consideration.

4B.2.7 Rising Main Design

Sewage collected at pumping station through gravity lines have to be conveyed to higher elevations through pressure main. The Hazen-Williams formula shall be used for computing the frictional losses. The concept of design of rising main is to meet following requirement:

- The main must be self-cleaning with minimum flows.
- Velocities should not be excessive with design peak flows.
- The techno-economic diameter of rising main is calculated considering capitalized cost of pumps and rising main for 15 years.

The pump capacity together with rising main diameter should be calculated considering pump cost, rising main cost, rate of interest energy charges (as Rs. 4.50 per Kwh), annual operation & maintenance cost.

Lesser diameter rising main may be cheaper in initial cost, but the operation cost may be more due to increased pump head. Computation of maximum water hammer pressure and the control measures will be done as per the recommendations of the CPHEEO Manual on Water Supply & Treatment.

In the computations, the following values will be adopted:

i) Bulk modules of water `k' = 2.07 x 108 kg/m2

ii) Modulus of elasticity `E' for DI = 1.7 x 1010 kg/m2

For minor/major road or nallah crossings proper protection to the lines will be provided. DI pipes as per IS 8329: 2000 are corrosion resistant with an expected life of about 100 years.

Velocity of sewage through this line shall be kept at an optimum level in order to maintain a minimum velocity for self-cleansing i.e. 0.6 m/s at average flow and maximum permissible velocity of 3.0 m/s at ultimate peak flow.

4B.2.8 Technical Evaluation for Selection of Pumps

Sewage pumps are used to pump wastewater from the lower level of gravity collection system to another system (as for intermediate pumping stations as shown in **Figure 4B.3**), or to the treatment plant for treatment (as for main pumping stations). Although sewage is screened before entering the suction wet well, it contains a large quantity of materials such as debris, grits, rags, fibre and plastic pouches, which find their way through the coarse screens. This is a typical problem under Indian conditions. Hence, sewage pumps should be reliable to handle such materials and accessible for quick maintenance, resistant to wear and tear, etc. The type of pump to be installed at each pumping station should be judged on its technical merits with respect to the pumping rate, total head, and physical composition of the sewage.

Figure 4B.3: Intermediate pumping systems

Operation and Maintenance is an important aspect to be considered while selecting the type of pumps. It is, therefore, necessary to consider case of installation and removal, materials of construction, safety features and frequency of lubrication etc. as important parameters.

In case of conventional centrifugal pumps, the chances of frequent clogging of impeller are more due to its closed design and lower solid handling capacity. Also, due to presence of Line Shaft Bearings, there is a need of frequent lubrication. There is more wear and tear of glands and other parts due to extended shafts. Because of their heavy weight and manual fixing onto the foundation, it is not easy to install and remove these pumps.

Due to their semi-open type impeller, submersible centrifugal pumps are less prone to clogging. Furthermore, the special cutting technique and tearing system provided on the suction side of the pump facilities disposing off soft materials like plastic pouches, small jute pieces, which is predominant in sewage. Pump bearings are of anti-friction type, maintenance free and are grease lubricated for long life. The bearings are adequate for taking normal thrust loads due to unbalanced hydraulic loads on the impellers.

The maintenance of submersible centrifugal pumps is comparatively less because there are no line shaft bearings, which need reliable lubrication and periodic replacement. Only mechanical seal of this type of pump may need replacement after certain working hours, thereby reducing the maintenance cost substantially. Selecting a pump with less moving parts and low rpm reduces wear and tear of parts and ensure trouble free operation. Submersible pumps offer state of the art technology in pump protection ensuring operation in toughest applications.

The above criteria for selection of pumps form just a basic guideline. The final decision of pump configuration is also determined by the availability of pump capacity in the market.

Screens & Screen Channel

Screening of incoming wastewater is required for the removal of large floating materials, which can damage the pumps.

Standby Units	50% (normally).
Clear spacing between screens bars	20 mm.
Thickness of screen bar	10 mm.
Type of working screens	Mechanical screen if depth of channel is less.
Type of standby screen	Manual screen.
Minimum Approach velocity @ avg. flow	0.3 m/sec.
Minimum velocity through screens	0.6 m/sec.
Maximum velocity through screens	1.2 m/sec.

4B.2.9 Electrical Load Capacity

Main Transformers and other electrical equipment are designed for peak flow electrical load requirement.

Standby Power Supply Source

In case of electrical power failure, a Diesel Generator set with an average flow load capacity is proposed at the pumping stations/STP with auto exchanger arrangement from grid power to DG power.

4B.3 Existing Storm Water Drainage System Management

4B.3.1 Storm Water Drainage and Diversion to Canal Flow

There is a need for all involved to understand and agree on an approach to the design philosophy for the interceptor sewer system. The approach is to minimize the sewage flows into the three main project Canals leading to the estuaries for the abatement of pollution in the Kochi Urban catchment and a healthy hygienic possible navigable system.

The objective of the interceptor sewers system is to trap sewerage flows (dry weather flows) being contributed into the main drains via the subdrains. Dry weather flows in the subdrains were determined in based on population projections and flow measurements shall also be ensured during the implementation with a varying time interval. Dry weather flows for future study horizons are then determined based on population distributions, population growth projections, current and planned future land use, estimates of development and population growth outside of the study areas, and estimates of flow contributions to sub-drains accounting on these population changes, sewer and drainage improvements planned or may be planned in the future and taking into account reduced per capita water supply for the future and its ensuing impact on sewerage generation in the project canal catchment areas.

Determination of dry weather flows in the sub-drains is required to evaluate the sizes of sewers, interception chambers, pumping stations and ancillary structures required for the project. Kochi witness a rainfall period as shown in **Figure 4B.4**.

YEAR	JAN		FEB		MAR		APR		MAY		JUN	
	R/F	%DEP	R/F	%DEP	R/F	%DEP	R/F	%DEP	R/F	%DEP	R/F	%DEP
2014	0.0	-100	11.1	-41	22.4	-28	90.7	-19	287.9	-4	550.1	-21
2015	2.4	-82	0.5	-97	37.2	19	229.3	105	176.2	-41	573.9	-18
2016	0.4	-97	91.4	386	3.4	-89	43.8	-61	322.8	7	624.6	-10
2017	16.8	28	0.0	-100	97.9	214	31.4	-72	306.0	2	706.3	1
2018	1.4	-90	7.1	-63	52.5	68	193.2	72	324.9	8	833.5	20

JUL		AUG		SEPT		OCT		NOV		DEC	
R/F	%DEP	R/F	%DEP	R/F	%DEP	R/F	%DEP	R/F	%DEP	R/F	%DEP
650.2	-3	877.0	119	298.8	1	434.8	45	118.5	-18	94.0	112
367.2	-45	241.2	-40	393.8	33	355.0	18	332.5	129	182.3	311
620.4	-7	238.7	-41	85.7	-71	160.5	-46	115.1	-21	19.5	-56
435.4	-35	415.8	4	445.3	50	293.0	-2	217.8	50	28.1	-37
1044.2	56	648.4	62	63.1	-79	402.7	34	246.9	70	56.6	27

Source: *http://hydro.imd.gov.in/hydrometweb/(S(o1w5la55rlrzvkaiosyylrry))/DistrictRaifall.aspx*
Rainfall in millimeters (R/F) shown below are the arithmetic averages of Rainfall of Stations under the District.
% Dep. are the Departures of rainfall from the long period averages of rainfall for the District.

Figure 4B.4: Kochi rainfall status

Throughout the year, in Kochi, there are almost average 124 rainfall days (4 Months) spreading from May to August End, and annual average of 2978 mm of precipitation. During the rainfall days, the sub drains will able to accumulate the most diluted dry weather flow to the canal. This can be discharged to the canal, as it is with lowest pollution loads, through the regulatory structures.

The interceptor shall be carrying to the optimal capacity only during the driest months (from December to March), when all the septic tanks and soak pits in the catchments contributing the dry weather flow with highest pollution loads.

In the transitional months from August to November, the project catchment yielding a mix flow condition of dry and wet weather flow. During these 4 months, the interceptors shall be fed as per the testing undertaken for the pollution loads in the sub drains, through the regulatory structures.

During the extreme events and storm occurrence, the flow also can be diverted to the canal flow surpassing the interceptor collection chambers. The following **Figure 4B.5** explains the storm water drains crossing the Elamkulam STP Interceptor Network, highlighted in pink color drains.

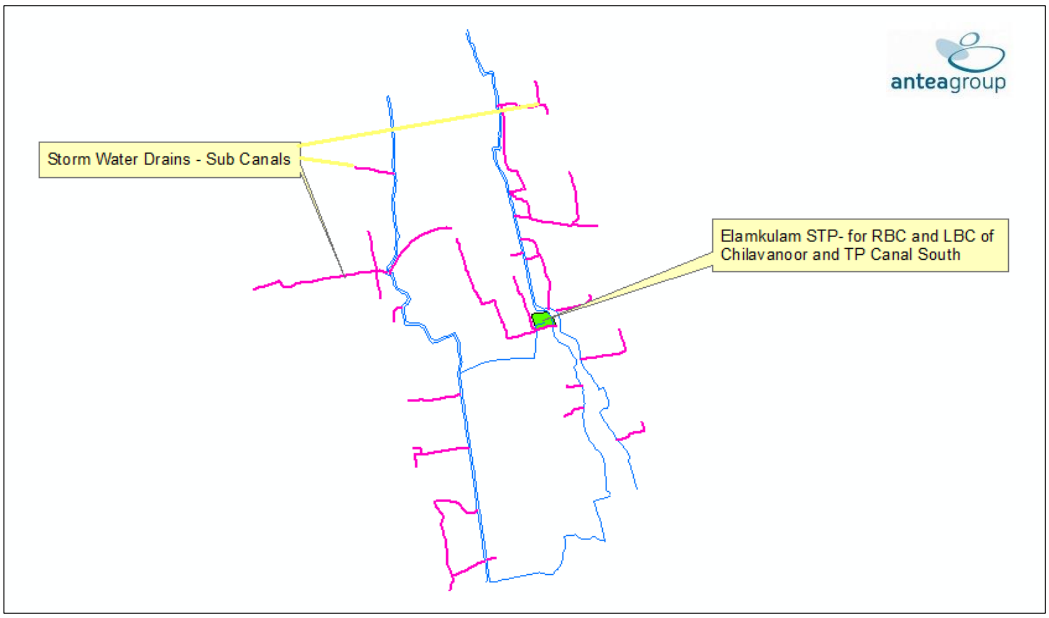


Figure 4B.5: Storm water drains crossing the Elamkulam STP Interceptor Network

Table 4B.7 gives the details of the Storm water drains crossing Chilavanoor and TP Interceptors.

Table 4B.7: Storm water drains crossing Chilavanoor and TP Interceptors

Name of Storm water drains crossing Chilavanoor Interceptors.	Length in Km	Name of Storm water drains crossing TP Interceptors.	Length in Km
Thammanam - Pulleppady Road	0.151	Swami Vivekananda Road 2	0.432
Water land road 2	0.246	Swami Vivekananda Road 1	0.311
Water land road 1	0.176	Pourasamithy Road	0.103
Vylassery Road	0.265	Parambithara Road	0.144
Stadium Link Road	1.015	Panambilly Nagar	0.572
Sakavu Abu road	0.618	Mullassery Canal	1.506
Railyard 1	1.118	Kottaikanal	0.435
Rail Yard 2	0.193	Koithara Canal LS	1.541
Rail Nagar 1	0.931	Kathoorba Nagar	0.389
Ponnurunni junction	0.465	Karshaka Road	0.212
Paradise Road	0.750	K C Abraham master Road	0.728
Near Fathima Church Road	0.636	Gandhi Nagar Road	0.890
Near DLF Apartment	0.425	**Total Length**	**7.263**
Kumaranashan Road	0.138		
Kumaranashan nNagar	1.899		
Friends avenue road	0.154		
Adimury Road	0.646		
Total Length	**9.826**		

4B.3.2 Proposed Interceptor Sewer

4B.3.2.1 Main Interceptor

Main interceptor is laid in both sides of the canal. The flow from each zone shall be collected by the sub drains and pumped into the main interceptor, during the lean season, and dry season. During the monsoon and storm period this flow shall be diverted to the Main canal through one-way flow through the diversion chamber.

The total flow of the left interceptor main is 6.620 MLD and the right Interceptor main is carrying 4.590 MLD. The details of the Interceptor and secondary interceptors of the - Left Bank and right bank Chilavanoor Canal is given in **Annexure 3B.3** of this DPR.

4B.3.2.2 Diversion Chamber

The purpose of the diversion chamber is to intercept wastewater from sub drains. The diversion chamber is installed nearby outlet of the sub drains connecting to the Main canal interceptor main. Therefore, high water level must be considered to design diversion chamber. Typical sections of diversion chamber are show in F**igure 4B.6**.

Based on the sewage flow conditions in the combined sewer and water level conditions of receiving water bodies, following four (4) cases given in **Table 4B.8** should be taken into consideration to divert the design wastewater to the interceptor sewer as given in **Figure 4B.7**.

Table 4B.8: Flow conditions for water levels in receiving water bodies

Case	Flow Condition	Water level of Down Stream
A	Dry weather flow	Low tide
B	Wet weather flow	Low tide
C	Dry weather flow	High tide
D	Wet weather flow	High tide

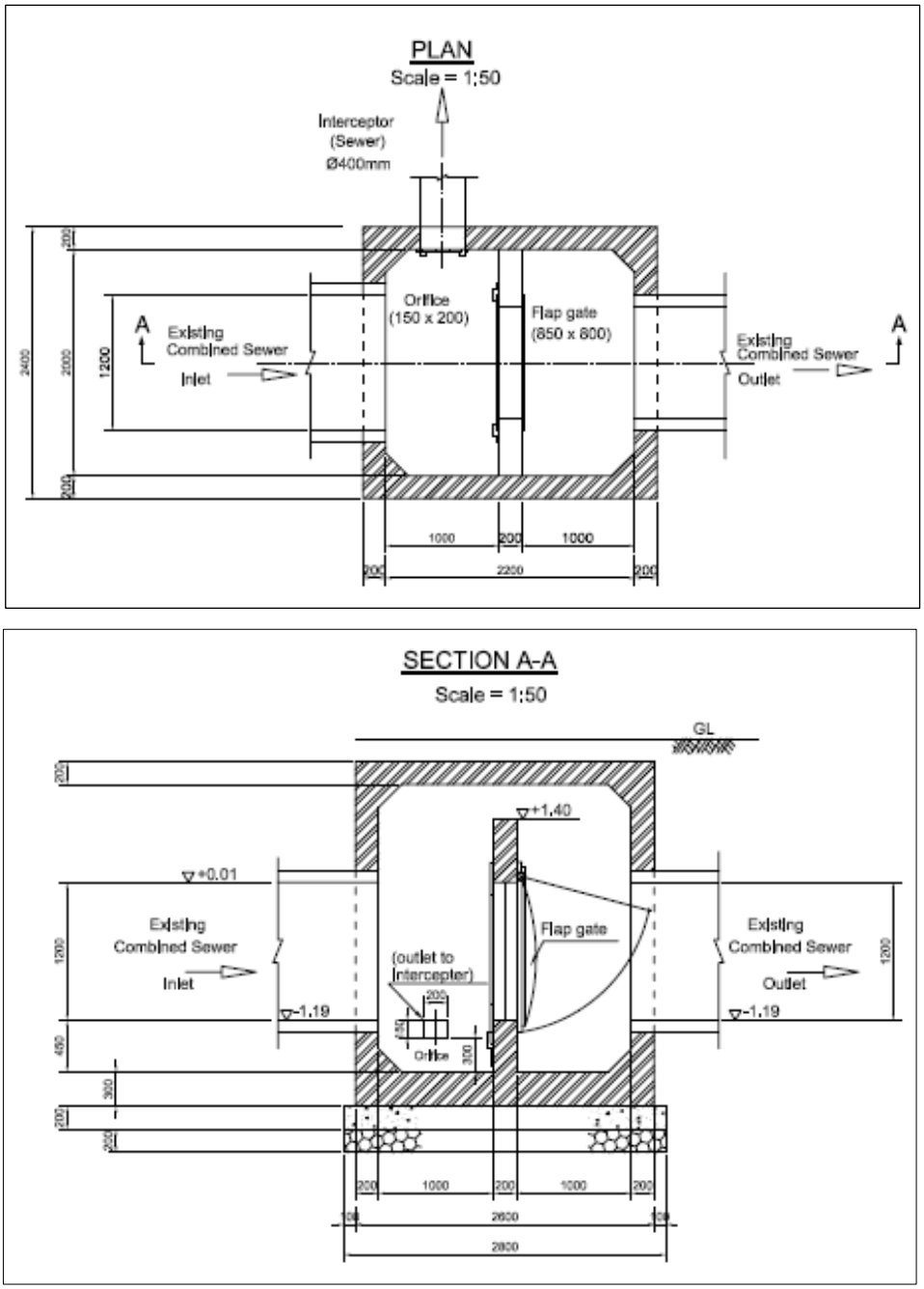
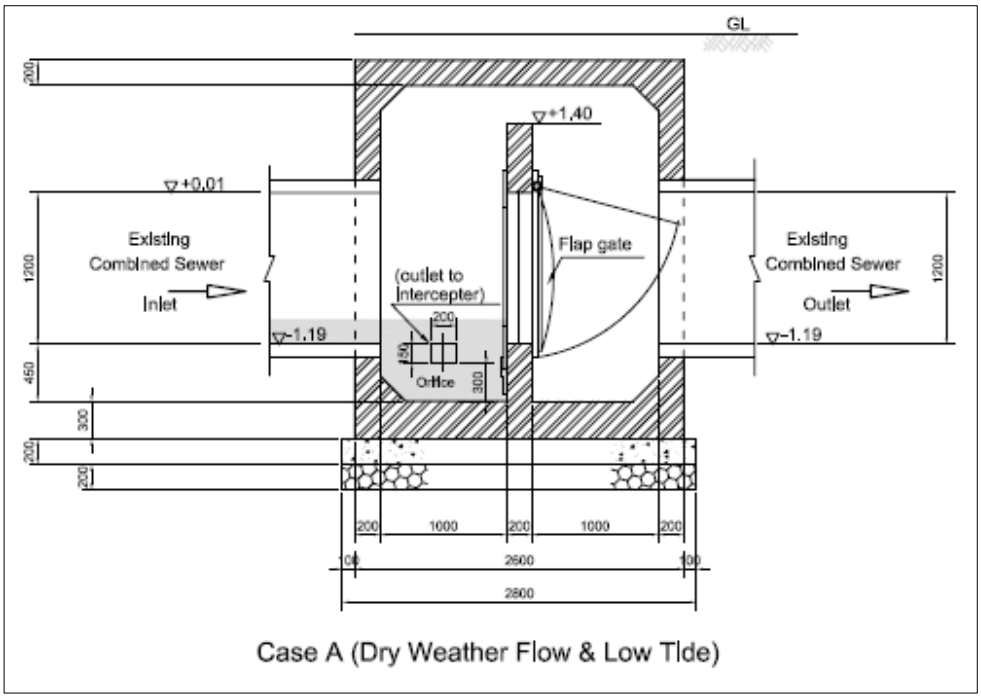


Figure 4B.6: The proposed typical diversion chamber

Typical plane internal dimension is proposed as 2m x 2.2m. T he orifice is designed to divert the wastewater to Interceptor Main.



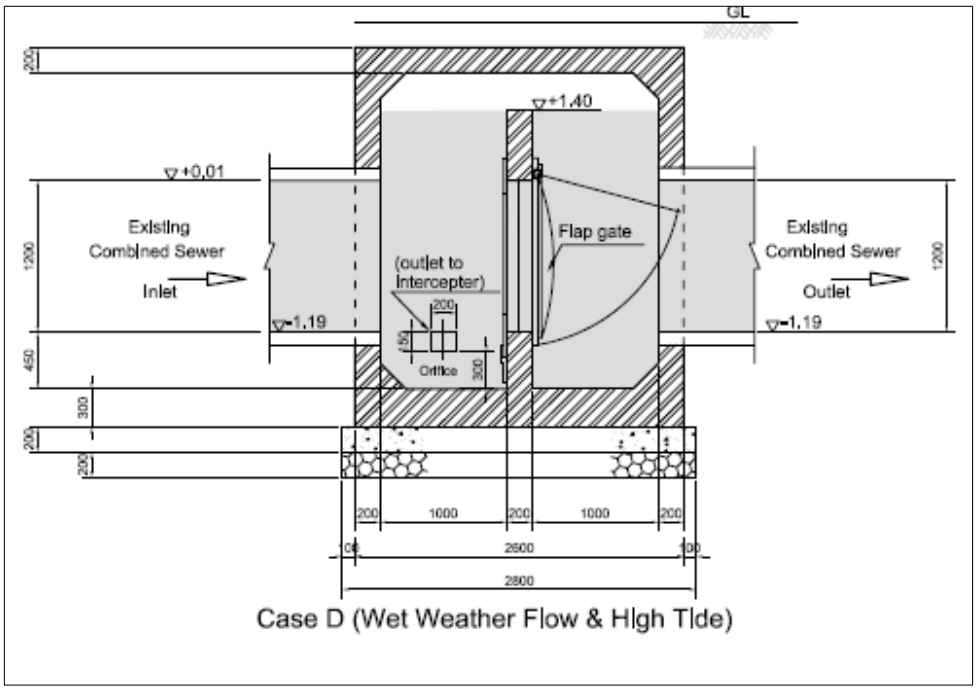


Figure 4B.7: Processes in proposed typical diversion chamber

4B.3.2.3 Intermediate Waste Pumping Station (IWPS)

If no intermediate wastewater pumping station (hereinafter referred to as “IWPS”) will be constructed, the depth of the conveyance sewer at the wastewater treatment plant would be estimated at deeper than GL. Hence, an ISPS is proposed to construct at the appropriate depth of interceptor or conveyance sewers, taking into consideration of the following technical and economical points of view:

a) To optimize the project cost consisting of construction and O/M costs.
b) To apply the conventional construction method for conveyance sewer.
c) To assure easier maintenance work of the conveyance sewer.
d) IWPS site would be selected to keep away from the concentrated urbanized area, because of high countermeasure cost for environmental deterioration, such as noise, bad smell, vibration.
e) Sufficient land.

Pumping Station:

Pumping stations handle sewage either as in-line for pumping the sewage from a deeper sewer to a shallow sewer or for conveying to the STP or outfall. They are required where sewage from low lying development areas is unable to be drained by gravity to existing sewerage infrastructure, and / or where development areas are too remote from available sewerage infrastructure to be linked by gravity means.

Lift Stations

In locations of high-water table, a typical conventional sewer construction poses a series of challenges when depths of excavation exceed about 3 m. Eventually, the depth of wet-well is also negatively influenced by this issue.

In such situations, it is advantageous to opt for intermediate lift stations, which are like “online”. In general, these are submersible pump stations, which are interposed in the gravity sewer network.

The procedure is to sink a wet-well on the road shoulder or an acquired plot beyond the shoulder and divert the incoming deeper sewer to it and the submersible pump set therein will lift the sewage and discharge it to the next on line shallow sewer. As the sewer progresses, any number of such lifts can be inserted based on the location. These shall be connected to dedicated electricity feeders as installation and O&M of standby diesel pump sets etc., are not feasible in such locations.

Pumping Mains and design Approach

These are designed and constructed in the same way as any other water pumping mains. The exception being that the design practice of economical size of pumping mains in conjunction with the electrical energy of the pump sets as used in water pumping mains is not applicable in sewage pumping mains. This is due to varying rates of discharge through the 24 hours like low, average, and peak flows through the same main at various parts of the day and night.

Design Formula: The Hazen Williams formula.

Computation of Pump Kilowatt

This is a function of the static head, friction losses and incidental other losses. The usual efficiencies of pump set for estimating the kW requirement can be taken as in **Table 4B.9**.

Table 4B.9: Efficiencies of pumps to be adopted for design purposes

No.	Type of Pump Set	Efficiency
1	Horizontal foot mounted centrifugal pump sets	0.85
2	Vertical shaft centrifugal pump sets	0.8
3	Submersible pump sets	0.65
4	Positive displacement pump sets	0.4

In actual practice based on the manufacturer's pump curves and duty point, the figures may vary and here again, the figures will vary from manufacturer to manufacturer and hence, suffice to state that for design purposes, these figures shall be used.

The kW of a pump shall be calculated as, kW required = Q×H/100.5/ή

where, Q: Discharge in liters per second

H: Total head to be got over in m

ή: Efficiency of the pump

This is usually called the brake horsepower. The actual horsepower is to include the efficiency of the motor. This is about 0.95 for modern new motors and 0.9 for motors nearing their life cycle of 15 years. Thus, the actual kW needed shall be taken for design purposes as.

Actual kW = Brake horsepower in kW / 0.9.

Velocity Considerations in Design of Pumping Mains

Pumping mains designed for velocities between 0.6 to 2.4 m/s are normally based on the most economical pipe diameters and typical available heads. For shorter pumping mains of less than 600 m and low lift requirements of less than 10 m, the recommended design force main velocity range is 1.8 to 2.7 m/s. This higher design velocity allows the use of smaller pipe, reducing construction costs. Higher velocity also increases pipeline friction loss resulting in increased energy costs.

The maximum velocity at peak conditions is recommended not to exceed 3 m/s.

The illustrative drawing of lift station is as given **Drawing Annexure 4B – D.1.**

4B.3.2.4 Sewerage Design Calculation for Interceptor Main: Conduits

The sewerage design calculation on sewer CAD software for the Interceptor main conduits is in **Figure 4B.8**.

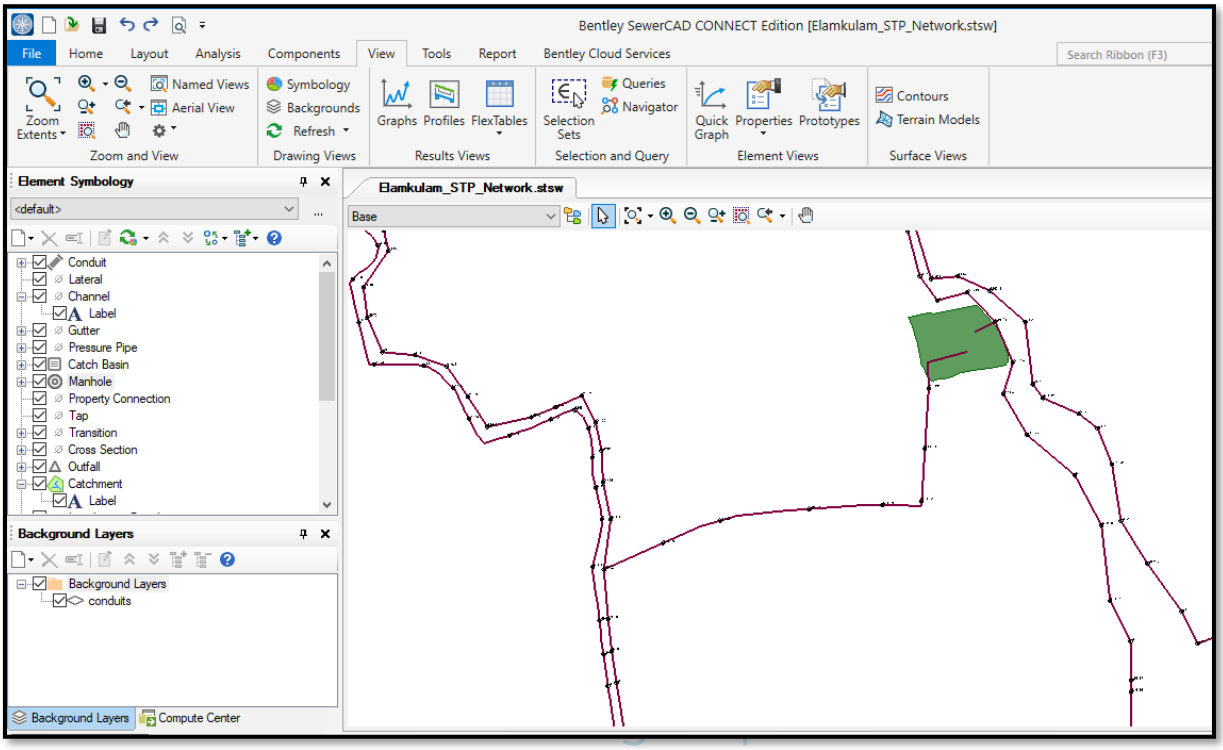


Figure 4B.8: Design calculation on sewer CAD for Interceptor main conduits

4B.3.2.5 Sewerage Design Calculation for Interceptor Main: Manhole

The sewerage design calculation on sewer CAD software for the Interceptor main manhole is as given in **Figure 4B.9**.

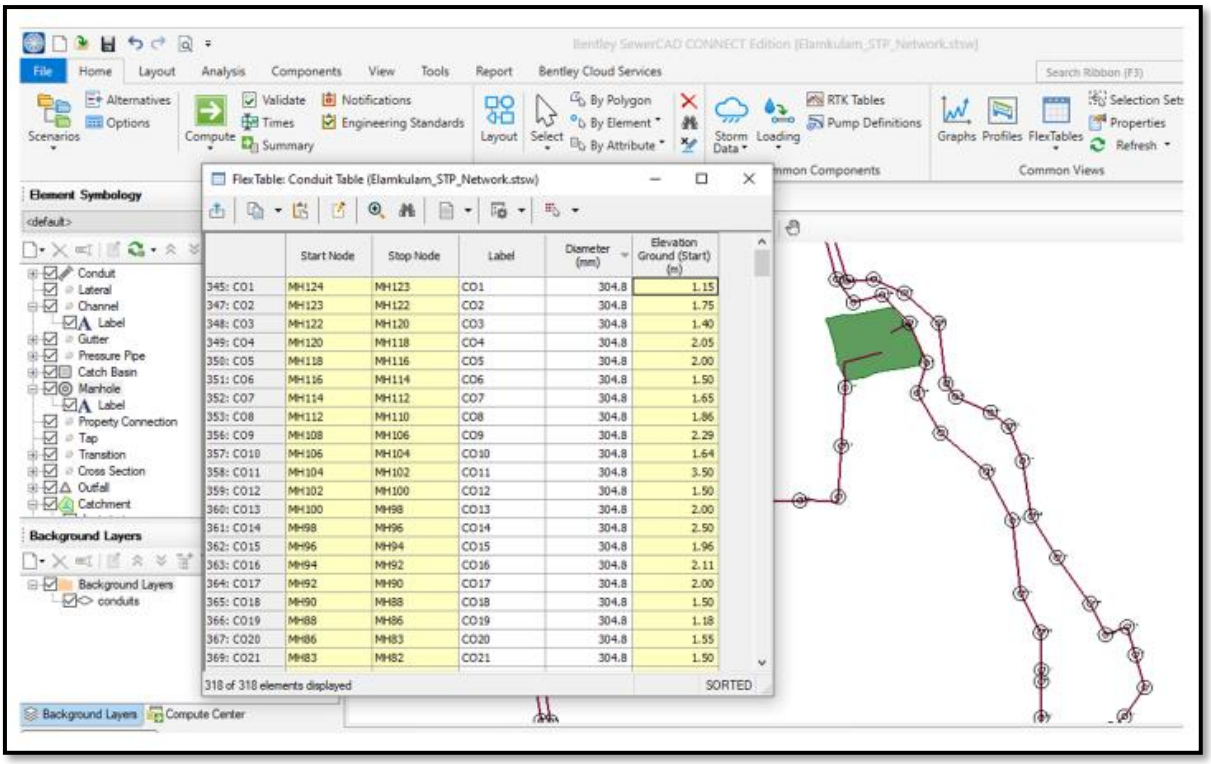


Figure 4B.9: Design calculation on sewer CAD for Interceptor main manhole

4B.3.3 Reference Codes followed

The following is the list of IS Codes that is referred to:

- Manual on Sewerage and Sewage Treatment Systems.
- Manual on Sewerage and Sewage Treatment Systems Part B Operation & Maintenance.
- Manual on Sewerage and Sewage Treatment Systems Part C Management.
- IS 1172:1993 Code of basic requirements for water supply, drainage, and sanitation.
- IS 1742:1983 Code of practice for building drainage.
- IS 2064:1993 Code of practice for selection, installation, and maintenance of sanitary appliances.
- IS 2470(Part 1):1985 Code of practice for installation of septic tanks: Part I design, criteria, and construction.
- IS 2470(Part 2):1985 Code of practice for installation of septic tanks: Part 2 Secondary treatment and disposal of septic tank effluent.
- IS 3114:1994 Code of practice for laying of cast iron pipes.
- IS 4111(Part 1):1986 Code of practice for ancillary structures in sewerage system: Part I Manholes.
- IS 4111(Part 2):1985 Code of practice for ancillary structures in sewerage system: Part II Flushing tanks.

- IS 4111(Part 3):1985 Code of practice for ancillary structures in sewerage system: Part III Inverted syphon.
- IS 4111(Part 4):1968 Code of practice for ancillary structures in sewerage system: Part 4 Pumping stations and pumping mains (rising mains).
- IS 4111(Part 5):1993 Code of practice for ancillary structures in sewerage system: Part 5 Tidal outfalls
- IS 4127:1983 Code of practice for laying of glazed stoneware pipes.

4B.4 Sewage Treatment Plant

A Sequential Batch Reactor (SBR) technology has been selected for the 5 STPs proposed under the project Catchment. A typical lay out plan sketch is given in **Figure 4B.10**.

Figure 4B.10: Schematic lay out plan of Sequential Batch Reactor

SBR technology is widely used in India for treating domestic sewage and industrial effluents to the highest possible quality. Plant capacity sizes ranging 0.5 MLD to 245 MLD are already functioning in India and the treated effluents are reused for industrial use, gardening etc.

The sewage treatment efficiency of SBR process is very high quality as compared with conventional treatment processes and is as given in **Table 4B.10**.

Table 4B.10: Comparison of treated effluent quality

Sl.No	Water quality paramters	SBR output (ppm)	Conventional(ppm)
1	BOD5	< 5	< 30
2	COD	< 50	< 250
3	Total Suspended Solids	< 10	< 30
4	Ammoniacal Nitrogen	< 1	No Treatment
5	Total Nitrogen	< 10	No Treatment
6	Total Phosphorous	< 1	No Treatment

A typical lay out of a 15 MLD STP at MRL refinery, in Mangalore, is shown in **Figure 4B.11**. SBR plants can be fully automated using advanced programming through PLC & SCADA. Plant can be remotely monitored and controlled through internet. A typical layout of SCADA Unit is shown in **Figure 4B.12**.

Figure 4B.11: 15MLD, ETP at MRPL Refinery, Mangalore

Figure 4B.12: SCADA lay out for a Sewage treatment plant

Sequential Batch Reactor treatment plant has components as given in **Figure 4B.12**.

In a conventional activated sludge system, the unit processes are accomplished by using separate tanks. In sequential batch reactor which is a modification to the activated sludge process the SBR performs equalization, biological treatment and secondary clarification in a single tank using a time-controlled sequence as given in **Figure 4B.13**. This technology is useful in areas where the land is limited and also where it is required to upgrade the existing wastewater treatment facilities. The existing plant can be retrofitted to ana SBR because the basins are already present.

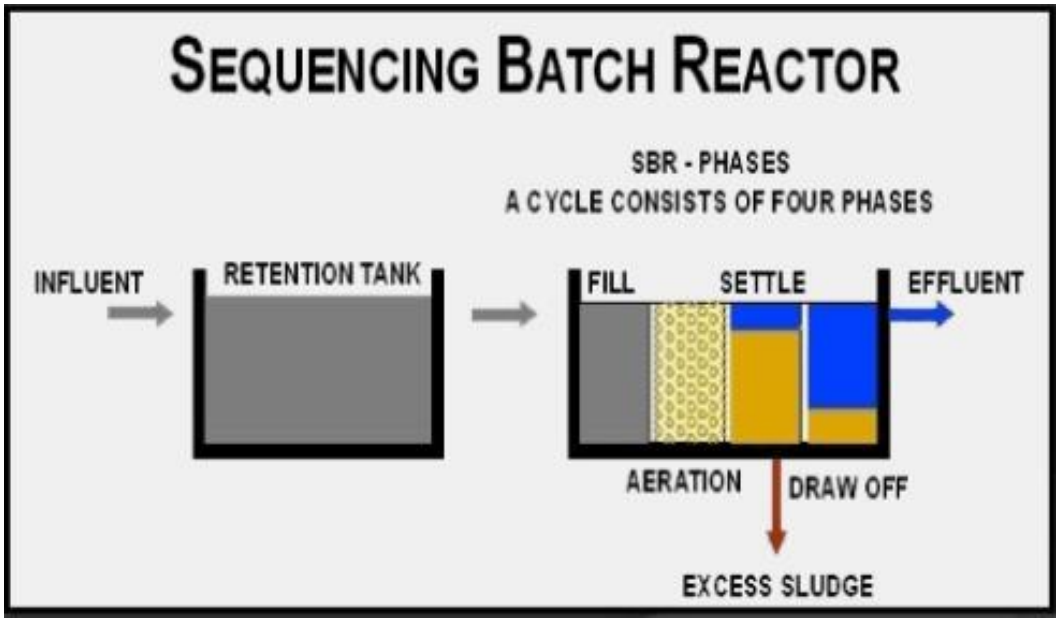


Figure 4B.13: Flow diagram of Sequencing batch reactor

SBR operating principles

SBR technology is a method of wastewater treatment in which all phases of the treatment process occur sequentially within the same tank. The SBR is a fill and draw activated sludge system. In this system wastewater is added to a single "batch" reactor, treated to remove undesirable component, and then discharged. The operating principle is explained in **Figure 4B.14**.

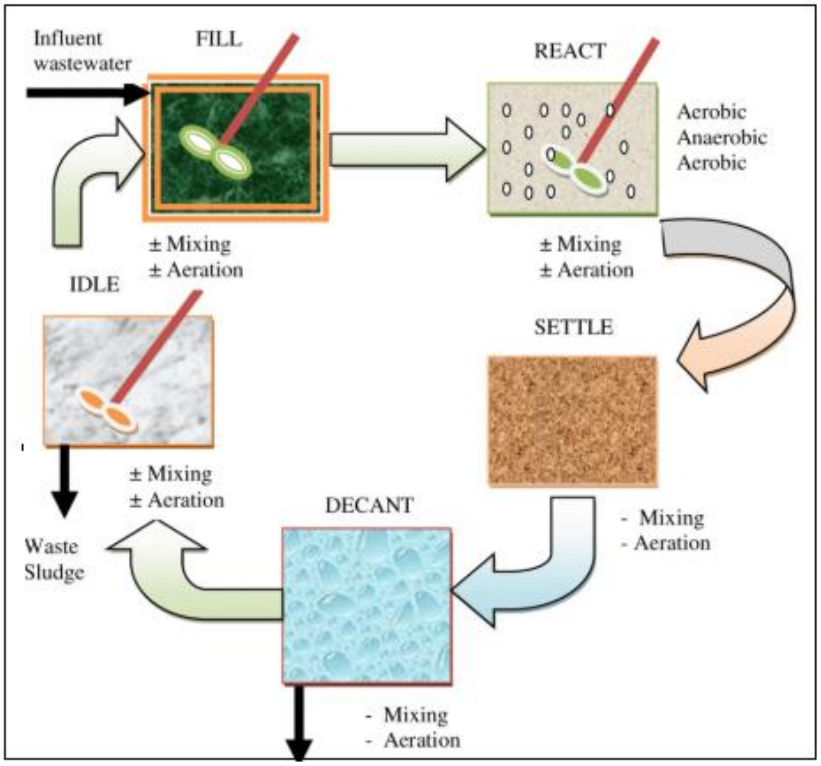


Figure 4B.14: SBR operating principles

1) **Fill Phase:** During the fill phase, the basin receives in influent wastewater. The influent brings food to the microbes in the activated sludge, creating an environment for biochemical reactions to take place, the fill phase is of 3 types 1) Static fill 2) Mixed fill and 3) Aerated fill.
2) **React Phase:** During this phase, no wastewater enters the basin and the mechanical mixing and aeration units are on. This phase allows further reduction of wastewater parameters.
3) **Settle Phase**: During this phase, activated sludge is allowed to settle under quiescent condition. The activated sludge tends to settle as a flocculent mass.
4) **Decant Phase**: Clarified treated effluent (Supernatant) is removed from the tank. No surface foam or scum is decanted.
5) **Idle Phase:** This step occurs between the decant and the fill phases. The idle period is used when the system is waiting for enough effluent to process.

There are 5 STP locations proposed in the project command and the capacity estimated based on the sewer load reaching the plants has been explained in detail under section 3B.2.3 of **Chapter 3B** (Functional Design) and the capacity served by each plant is given in **Table 4B.11**.

Table 4B.11: Capacity of proposed STP's

Sl. No	STP location	Proposed STP
1	Elamkulam STP - Chilavanoor & TP south	10
2	Vennala STP - Edappally south	10
3	Muttar STP-Edappally north	2
4	Puthukkalavattom STP - Chilavanoor north	5
5	Perandoor STP - TP north	4
	Total MLD	**31**

There are several firms in India that manufacture SBR technology components and who provide the construction knowhow. The costing for the 5 SBR plants is given in **Chapter 6** of this DPR.

4B.5 Sanitation Facilities

4B.5.1 Bio-Toilets

Bio-Toilets offer an innovative technology for disposal of human waste in an ecofriendly manner. These Bio -toilets can function at any atmospheric temp between -55 to 60-degree C. The bacterial consortium degrades night soil at temp as low as -55 degree C and produces colorless, odorless, and inflammable biogas containing 50 – 70% methane.

The main constituents of Bio-Toilet, as shown in **Figure 4B.15**, are prefabricated above the ground shelter and Bio Digester tank. Bio digester tank is a cylindrical structure with the provision of inlet for human waste and outlet for Biogas. Temp in the bio – digester is maintained between 5-30-degree C. A person can use the bio-toilet which is connected to the bio-digester. Night soil degradation occurs through microbial reaction which converts it into biogas. The smell of night soil, the disease-causing organisms in the night soil and the solid matter are eliminated totally. On dry weight basis 90% of the solid waste is reduced. The gaseous effluent (biogas) is continuously let off to the atmosphere. Biogas can be used for various energy incentive activities like cooking water and room heating. Liquid effluent can be drained to any surface or soak pit without any environmental hazards.

Figure 4B.15: Bio toilets

Temperature Controlled Bio toilets

In the case of ambient temperature drops to -40 degree C and lower, the low temp stops/ delays the natural biodegradation of the waste leading to its preservation (accumulation) for long time resulting in environmental hazard. Local heating by direct sunlight exposes the waste buried in the ice causing nuisance and foul smell. The melting ice takes the waste to rivers disturbing the aquatic eco system. Moreover, human waste is also responsible for spreading of water borne diseases like typhoid, cholera, Shigellosis, Amebic Dysenteries, Diarrhea etc.

This technology is suitable for any area/ application in India. The process under this technology culminates in to treated effluent which is free from Pathogens and is also environmentally acceptable. The technology has major two components:

1. Low temp active inoculums.
2. Temp controlled Bio digester.

A consortium of anaerobic bacteria has been formulated and adopted to work at temp as low as 5 ^{0}C. This is the component which acts as inoculums (seed material) to the bio digester and converts the organic waste into methane and carbon-dioxide. The anaerobic process in-activates the pathogens responsible for water borne diseases. Bio digester serves as reaction vessel for bio methanation and provides the anaerobic conditions and required temp for the bacteria. The optimum temp is maintained by microbial heat, insulation of the reactor and solar heating. A typical roadside bio-toilet Is shown in **Figure 4B.16**.

Figure 4B.16: Roadside bio-toilets

Function of Bio Toilets

Bio toilets have a colony of anaerobic bacteria that converts human waste into water and small amount of gases. The gasses are released to atmosphere and the water is discharged after chlorination. (**Figure 4B.17** & **Figure 4B.18**)

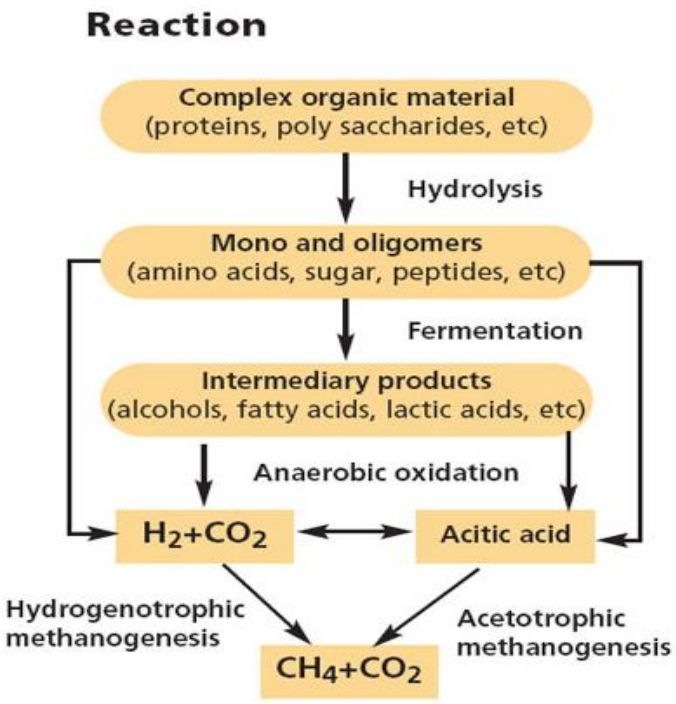


Figure 4B.17: Reaction process in a Bio-toilet

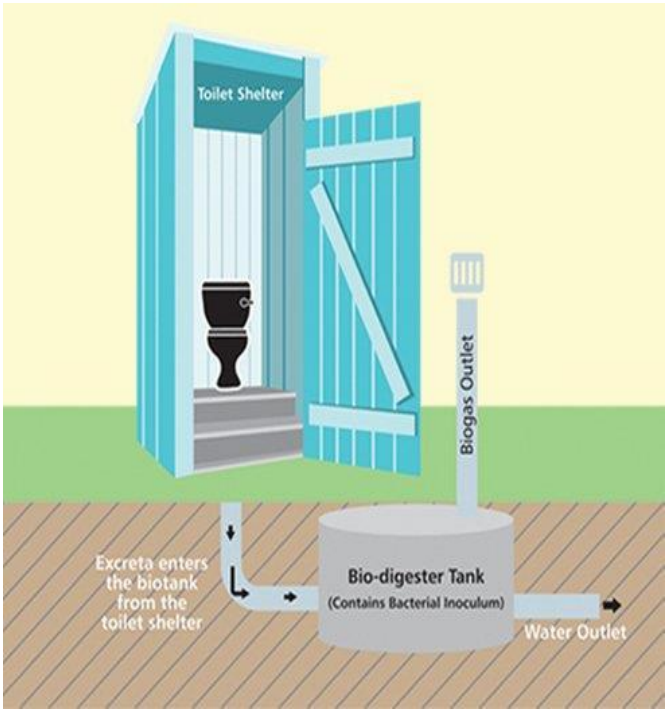


Figure 4B.18: Reaction process in bio-tank

Features of the Bio-toilets

The features of the toilet include:

- 100% sludge – Free disposal of human waste.
- Eco Friendly - Decomposes solid waste to water and biogas.

- Eliminates need for expensive waste treatment.
- Clean discharge - The water discharged from the Pronto Bio-Toilet is colorless, odorless, and devoid of solid particles.
- 100% hazard free – On a dry weight basis, 90% of the solid waste is reduced.
- 100% maintenance free – Bio-Digester tank do not require any form of maintenance
- No repeat dosing of bacterial inoculum.
- Easy to transport and install in any terrain.
- Plays a critical role in preventable healthcare.

Benefits

- Hygiene and Health- Prevents water borne and mosquitoes borne ailments and foul smell.
- Environment Friendly – No air and Land Pollution.
- Water – Cleans open defecation and water pollution.
- Energy – Biogas generated by 50 users = 100ml Kerosene.
- Durability – Life span more than 50 years.
- Space – Area occupied by one septic tank = 3 bio tanks.
- Maintenance – Bio Tanks are maintenance free.

A typical layout plan of Bio toilet setting out in the project catchment is shown in **Figure 4B.19.**

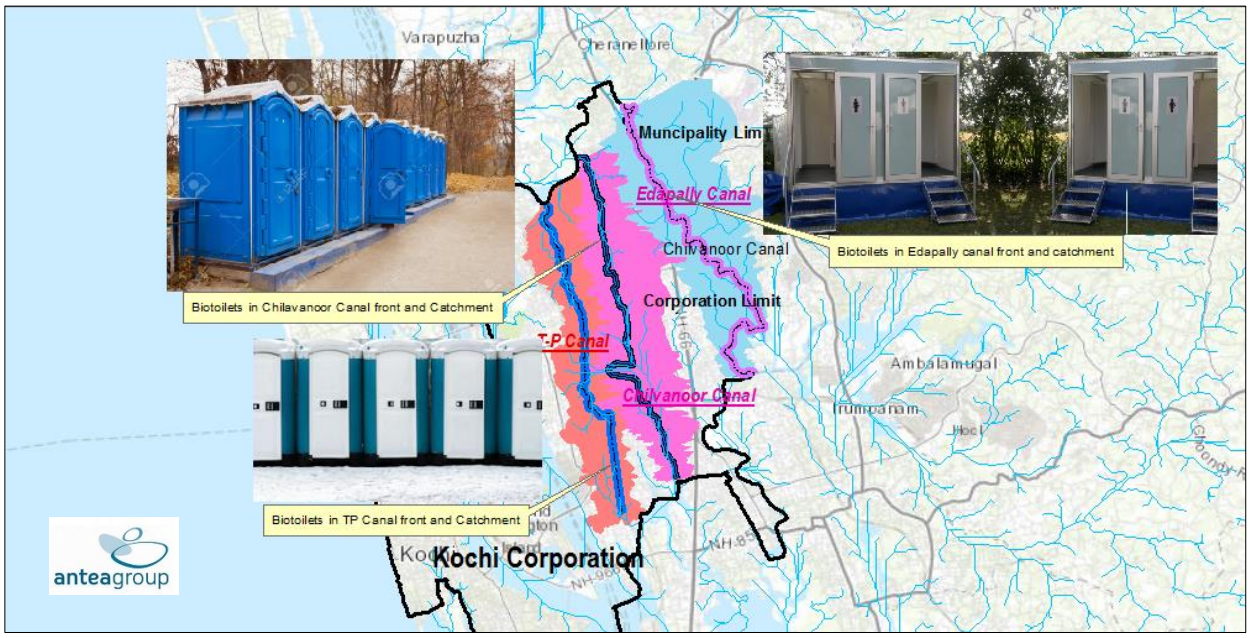


Figure 4B.19: Bio-toilet planning in IURWTS Catchment

4B.6 Engineering design for sewer networks to house hold connections

4B.6.1 Gravity and pumping sewage collection system

A separate and organized sewerage system is conceived to the extent the sewer lines to the entire project command for collection of sewage from individual households. The sanitary sewers are proposed such that it will not expected to receive either storm water run-off or untreated industrial effluent. The various components of the proposed network are discussed below.

4B.6.2 Sanitary sewer lines

Sewers are provided to convey wastewater from one location to another under gravity and therefore are normally laid deep enough to receive incoming flows from the contributing areas. Sewers must resist erosion and corrosion and its structural strength must be sufficient to withstand the backfill, impact, and live loads satisfactorily. The size and slope of sewer must be adequate for the flow to be carried and sufficient to prevent deposition of solids. Ease and economy of maintenance, safety to the personnel and the public, during its life as well as during construction period must be given due consideration.

In the design of sewerage system, the important discussion to be taken are location, size, slope and depth of sewer, material of sewer lines and appurtenances to be added such as manholes, junctions, vent pipes and other structures to minimize turbulence, save head loss and prevent deposits and nuisances by obnoxious gases. The aim of design is not only to make the sewer system functional, but also to build the system at low competitive cost.

Generally, the total available energy is utilized to maintain proper flow velocities in the sewer with minimum head loss. Hence, the sewerage system design is limited on one hand by hydraulic losses, which must be within the available limit, and on the other on maintaining self-cleansing velocities in sewers. Many a time, it is difficult to meet both the conditions simultaneously due to wide variations in rate of flow. Where differences in elevations are insufficient to permit gravity flow, pumping may be required. Considering the flat topography of the project command, at frequent interval when the invert level of the pipe goes below 2.5m from the ground level prevailing in the area, lift stations will be provided. These lift stations will lift sewage from one manhole and discharge it into the next one, to maintain design slope and prevent huge cuttings. However, special care will be taken to minimize the number of pumping stations/ lift stations during the detailed design and estimation stage while designing the sewer network.

Design process

In general, the sewers slope is maintained in the same direction as the street, existing roads, drains or natural ground surface and are connected to trunk sewers. The discharge point from the individual households will be to a manhole and from the manhole connected to secondary interceptors laid along either side of the sub canals before being discharge into a collection chamber and pumped into the primary interceptors. The primary interceptors are laid along the either sides of the main canals and pumped to the STPs. may be treatment plant or a pumping station, a lift station, a trunk or an intercepting sewer. Care will be taken to have discharge boundaries to follow the property limits or defined physical limits. The boundaries of sub zones area would be based on topography, economy or other practical considerations.

The most common location of sanitary sewer is in the middle of the street / road. A single sewer serves both sides of the street / road with approximately same length for each house connection. However, in very wide roads, it may be economical and practicable to lay sewer on each side. Situation may also arise where a few house connections on the side of the road will be collected at one point / manhole and the same, in turn, is connected to the sewer line on the same / other side of the road. Sewers may be laid in service roads to serve parallel rows of houses on either side. However, it is always preferable to lay sewer in the roads to avoid problems in accessibility for future O&M. In the present case trunk sewers will be aligned along the existing drainage courses as far as practicable.

Sewer lines is planned to be laid away from existing water supply and other utility lines as far as possible. Minimum horizontal clearance shall be 3 m and vertical clearance at least 0.5 m. When such situations are unavoidable, sewer is proposed to be encased in concrete or provided with sleeve pipes. Tees, wyes or chambers will be provided on sewer lines in order to avoid breaking the sewer for future connections.

Proper functioning of the sewer network depends on connectivity. In order that maximum connectivity is ensured, provision for house connection up to the property limit of each household will be included in the project.

Minimum size of sewer

The size of the sewer will be finalized based on sewer load using appropriate soft wares. At present for estimation purpose it is proposed to adopt the minimum size of sewer ranging from as 150 mm to 200mm diameter. Subsequently during the detailed design and estimation stage the exact sizes will be finalized. Modern sewer cleaning machineries will be used for sewer cleaning works.

Capacity of Sewer

All sewers will be designed to flow up to a maximum depth of flow of 0.80 times (ie.80%) the internal diameter of sewer at ultimate peak flow in order to ensure proper ventilation in sewers. However, such provision will be simultaneously checked for self-cleansing velocity in present peak flow condition, which becomes critical, as quantum flow at present condition is less.

Velocity in sewer

It is required to maintain minimum velocity through the sewer to ensure that suspended solids do not deposit and cause choking. Hence, it is mandatory to maintain "self-cleansing velocity" in sewer lines. The Manual by CPHEEO, Govt. of India stipulates the following:

Minimum self-cleansing velocity required is 0.6 m/sec at present peak flow and 0.8 m/s at ultimate design peak flow, to prevent commonly encountered 0.09 mm sand particles of sp.gr.2.65 from settling.

Maximum scouring velocity is limited to less than 3.0 m/sec to safeguard the sewer against erosion caused by sand particles and possible sulfide corrosion (as a result of release of hydrogen sulfide gas due to turbulence) minimum self-cleansing velocity is to be attained at least once a day.

Hydraulic Design Formula

For open channel flow, Manning's formula is used for designing slopes and diameter of the sewer line to carry the design flow at stated velocity.

For the hydraulic design of sewer networks appropriate software developed is used. The software follows all design parameters such as:

- Minimum Cover.
- Crown Matching.
- Minimum Velocity maintenance.
- Continuity of network checking.
- Slope as per diameter, velocity etc.
- Special gradient as per flow pattern.
- Maximum Depth of cutting.

Sewer transition

Sewer transition is defined as an event or point at which there is change in diameter of sewer of its alignment, junction of two or more sewer lines, etc. These changes can occur singly or as combination of

two or more factors. The preparation of hydraulic design of sewers will take into account the changes in hydraulic profile of sewers due to such transitions. Usually diameter of the sewer increases progressively.

Manholes

Sewer transition occurs wherever conduits of different characteristics are connected. The difference may be in flow, area, shape, grade and alignment, material of conduit etc. with a combination of a few or all characteristics. Manholes will be located at all such transitions with CI /PVC footrest for access. The typical cross section of an RCC manhole is given in **Figure 4B.20**. Cross section of an RCC drop manhole is given in **Figure 4B.21**. A bell mouth chamber is given in **Figure 4B.22** and an inspection chamber given in **Figure 4B.23**.

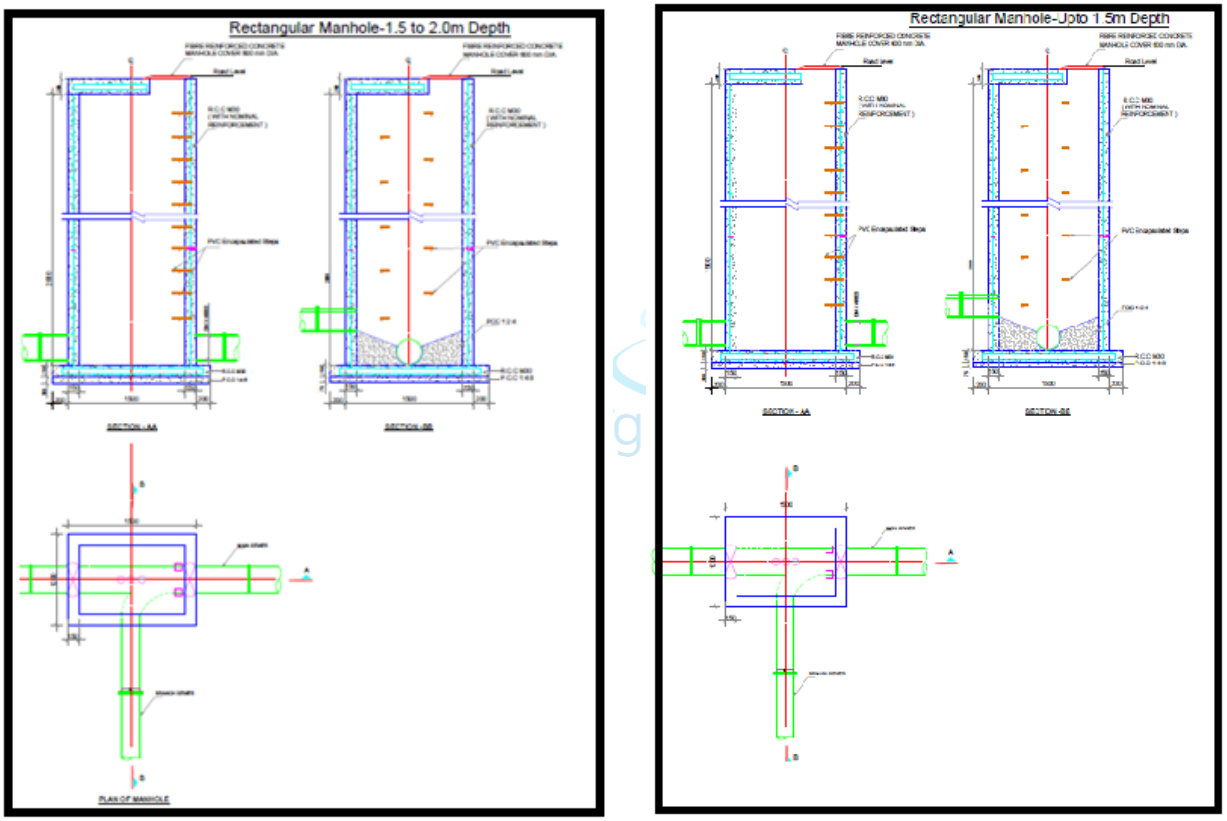


Figure 4B.20: Typical cross section of RCC manholes

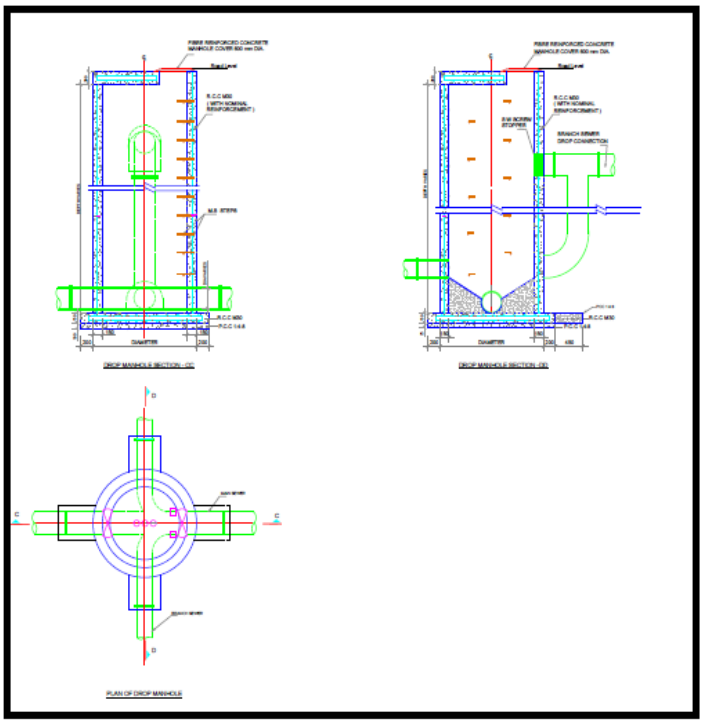


Figure 4B.21: Typical cross section of an RCC drop manhole

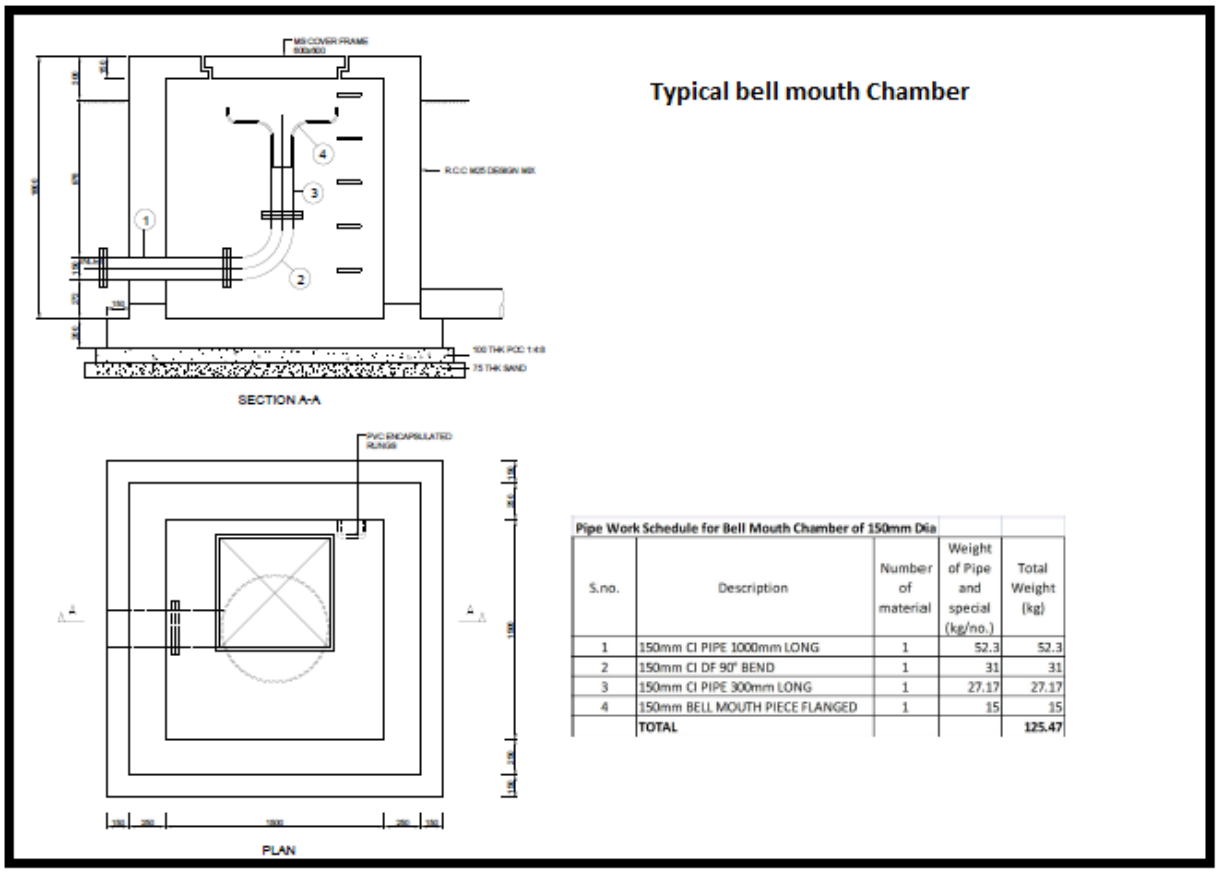


Figure 4B.22: Typical bell mouth chamber

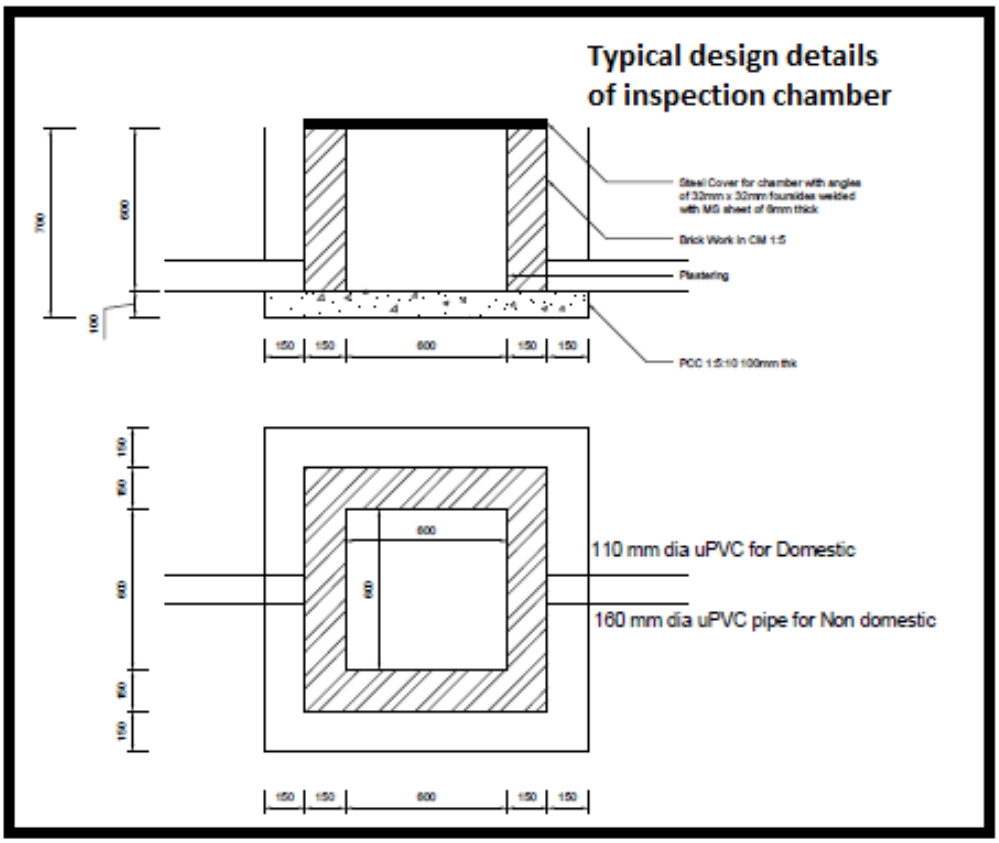


Figure 4B.23: Typical design details of inspection chamber

Manhole Spacing

For straight sections, the interval of manholes on sewers, which are to be cleaned manually, the maximum distance between manholes should be kept at 30 m. The spacing of manholes on large sewers above 900 mm diameter is governed by the following for sewers to be cleaned manually:

- The distance up to which silt or other obstruction may have to be conveyed along the sewer to the nearest manhole for removal.
- The distance up to which the materials for repairs may be conveyed through the sewer.

Ventilation requirement for men working in the sewer

The spacing of manholes above 90 to 150 m may be allowed on straight runs for sewers of diameter 900 to 1500 mm. Spacing of manholes at 150 to 200 m may be allowed on straight runs for sewers of 1.5 to 2.0 m dia., which may further be increased up to 300 m for sewers of over 2 m dia. A spacing allowance of 100 m per 1 m dia of sewer is a general rule in case of very large sewers. For sewers which are to be cleaned with mechanical devices, larger spacing can be provided but the spacing of manholes will depend upon the type of equipment to be used for cleaning sewers. According to the WHO charter, in which India is a member country, manual sewer cleaning is to be prohibited.

The dimensions of manholes provided for different depths as follows:

- For depths up to 2.5 m (Rectangular)
  - Up to 1.2m – 0.75m x 1.20m
  - Up to 2.5m – 0.90m x 1.50m
- For depths above 2.5 m (Circular)
  - Up to 6.0m – 1.5m diameter
  - Above 6.0m – 1.8m diameter

Drop arrangement

Drop arrangements are normally provided where the difference in inverts of an incoming sewer and receiving manhole exceeds 0.6 m. When the drop of invert of incoming manhole is higher than 0.60 meters, a drop manhole is provided or slope in successive stretches before the receiving manhole is increased to reach the receiving manhole with drop less than 0.60 meters with caution to ensure velocity during peak flow to remain below 3.0 meters/ second.

Material for Manholes

R.C.C. Manholes are presently suggested for estimation which will be confirmed at the detailed design and estimation stage for this project.

Lift arrangement

Lift man holes are provided at certain locations in the sewer line, to collect the sewage at the lowest point and pump the same to another manhole, in such a way that the natural gradient of the land is followed and depth of earth cutting is kept at the minimum possible.

House Service Connections

For large diameter sewers, house connections may be given through rider sewers. Sewers should be connected through manhole or drop manhole. Where there is no Y or T left for new connections, insertion of new Y or T is not prescribed.

Materials of pipeline

PVC and PE pipes are generally suggested for sewers. Various codes suggest

- To adopt DI pipes (IS. 8329 – 2000) for pumping and gravity main of sizes up to 600 mm dia for sewerage Schemes with Rubber Gasket joints.
- To adopt spirally welded M.S. Pipes above 600 mm dia, in conveying mains.
- To adopt RCC Pipes (IS. 458 – 2003) of non-pressure class for Under Ground Sewerage Schemes in Collection System.

- To adopt Stoneware pipes up to 300 mm dia for Under Ground Sewerage System.
- To adopt PVC – U (IS 15328 – 2003) for House Service Connections in Under Ground Sewerage Schemes.

Parametric analysis for the pipe materials of Stoneware, uPVC, HDPE, DWC were compared and it was concluded that the DWC pipes are most feasible material. Features related to various Pipe materials for gravity sewers when laid to a depth of 3.5m is given in **Table 4B.12**.

Table 4B.12: Parametric analysis for the pipe materials

Sl.No	Property	HDPE		uPVC		DWC		Stoneware	
		PE 100 PN6	Rating out of 4	SN8 S16.5	Rating out of 4	PE 100 PN6	Rating out of 4	pipe	Rating out of 4
1	Durability	>50 years	2	>35 years	1	>75 years	3	> 100years	4
2	Chemical Resistance	High	2	High	1	Inert	3	Inert	4
3	Flexibility	High	3	High	2	High	4	Rigid	
4	Length	6.0 m	4	6.0 m	4	6.0 m	4	0.6, 0.9 m	1
5	Load Bearing Capacity	High	4	Medium	3	High	4	High	4
6	Maintenance	Low	4	Low	4	Low	4	Medium	2
7	Soil settlement	High resistant	4	High resistant	4	High resistant	4	Low resistance	1
8	Seismic resistance	High resistant	4	High resistant	4	High resistant	4	Low resistance	1
9	Friction to flow	Low	4	Low	4	Low	4	Low	1
10	Jointing	Less	4	Less	4	Less	4	More	1
11	Workmanship	Less	4	Less	4	Less	4	More	1

Sl.No	Property	HDPE		uPVC		DWC		Stoneware	
		PE 100 PN6	Rating out of 4	SN8 S16.5	Rating out of 4	PE 100 PN6	Rating out of 4	pipe	Rating out of 4
12	**For 30m stretch**								
12.a	No. of joints	6 joints	4	6 joints	4	6 joints	4	35 Joints	1
12.b	Working duration	high	2	low	4	low	4	High	1
13	**Costing**								
13.a	**Pipe cost (2015)**								
	200	32028		22770		22620		9450	
	250	49980		36300		35340		14490	
	300	59670		57585		44190		25515	
13.b	**Laying & jointing**								
	200	1941.90		534		1453.26		1746.50	
	250	2535.90		776		1756.86		2310.79	
	300	2991.30		776		2273.88		3109.84	
	Total Cost for 30m Stretch								
	200	33970	1	23304	3	24073	2	11197	4
	250	52516	1	37076	3	37097	2	16801	4
	300	62661	1	58361	2	46464	3	28625	4
	Total Rating		**48**		**51**		**57**		**34**
Recommendation		**DWC**							

For estimation purpose DWC pipe material has been suggested in the design of collection system up to 3.5m . In case at any point the depth becomes greater than 3.5m RCC pipes with Sulphur resistant cement or CI pipes for depth above 3.5m is suggested.

Trenching

In general, open trench excavation, with protection of sides wherever necessary is adopted for laying sewers.

Laying and jointing of gravity sewers / Pressure Mains

The sewer lines will be laid and jointed in accordance with standard norms of manufacturer and requirements of relevant standards. Sewers will be encased in concrete where the required cover is not available. Special protection to sewer lines is provided at locations of road crossing, drain crossings, canal crossings etc.

Minimum cover and Maximum Depth of Sewer

Antea Group's proposal is to lay gravity sewer lines and pressure mains with minimum earth cover of 1.0 m above the top of the sewer laid along roads/streets where vehicular traffic is anticipated. Considering the high water table and permeability consideration the depth of sewers is proposed to be limited to 3.0 m as far as possible.

Type of bedding

The type of bedding for pipes suggested is of three types of bedding namely, type "B" i.e. shaped bottom or compacted granular bedding with carefully compacted backfill, type "Ab" i.e. concrete cradle – plain concrete with carefully tamped backfill and "Ac" i.e. concrete cradle RCC with 0.4% reinforcement.

4B.6.3 Pumping Stations - Design approach

Sizing of pumping station, its design and selection of pumps for a sewage pumping station involve a team of specialists concerning Civil, Electrical and Mechanical aspects to obtain a practicable design solution and operation of the pumping station. Different types of pumps have their own merits, demerits, and characteristics. There is an array of decisions to be taken while selecting and designing these pumps. The design of pumps broadly follows the following aspects:

- Determine pumping station location and purposes
- Determine the required pumping rates (average and peak)
- Determine the required lift, including the variations therein, as well as the transmission distances
- Determine the type of liquid
- Determine inflow and outflow conditions etc.

4B.6.3.1 Pumping Stations - Location

Pumping stations are normally located at the lowest point of the catchment area to be served. Selection of location of the pumping station requires a detailed study of the area to be served to ensure that the entire area can be adequately catered . The plinth level of pumping station shall be fixed, up so that it will not be flooded at any time. The location should also be easily accessible in all weather conditions.

4B.6.3.2 Determination of sewage Flows

The design is normally to cater for a 30 year design period. The basic steps of the existing procedure and therefore to:

- Estimation of existing population
- Assessment for development and growth of population
- Fixing per capita sewage generation and flow estimation
- Estimate peak factor
- Establishing maximum, average, and minimum designs flows for various stages.

Normally the flows reaching at any sewage pumping station vary too much for 24 hours. The in - flow pattern is generally as given here below:

- **Peak Flow:** It is during morning hours i.e. from 6 AM to 11 AM and 1 PM to 3 PM and from 6 PM to 7 PM (approximately for 8 hrs.)
- **Average flow:** It is from 5 AM to 6 AM, from 11 AM to 1 PM, from 3 PM to 6 PM and from 7 PM to11 PM. (approximately for 10 hrs.)
- **Minimum/Low flow:** It is from 11 PM to 5 AM. (Approximately for 6 hrs.)

As the pumps should not be operated too frequently and also sewage cannot be detained for a longer period in the sump well so that it does not turn septic and to avoid deposition of solids, the configuration of pumps should be such that above in - flow pattern reaching to the sewage pumping stations may be handled satisfactorily. For this, pumps with 6 starts / hr. are generally preferred. Wet well having ten minutes storage capacity are considered for this purpose.

It is recommended that 1 DWF – 3 Nos. with 2 as working and 1 as standby is provided in each pumping station. For maintaining constant head, automation is suggested by controlling the sluice valve besides Auto start / Auto stop with respect to maximum WL and Minimum WL.

4B.6.3.3 Selection of Pumps

Although sewage is screened and grit partially removed before entering the Suction well, it contains a large quantity of materials like debris, grits, rags, fibrous and polythene bags & plastic pouches etc. which find their way through the screens. This is a typical problem under Indian conditions. Hence sewage pumps should be reliable to handle such materials and accessible for quick maintenance and resistant to wear and tear etc.

Thus, the type of pump to be installed at each pumping station should be decided on its technical merits with respect to the pumping rate, total head, and physical composition of the sewage available. Further Operation & Maintenance is an important aspect to be considered while selecting the type of pump.

It is, therefore, necessary to consider the aspects of installation & removal, material of construction, safety features and frequency of lubrication etc. as important parameters while selecting type of pump for sewage application.

Hence Submersible non clog type pumps with rugged design having semi - open type impellers is suggested for sewage application.

(i) Submersible Non clog Pumps

Submersible non clog type pumps with semi open (single vane or 2 vanes) type impellers are available for handling sewage water and are being used all over world and in India also. Installation and Operation & Maintenance of these types of pumps is very convenient. These types of pumps have following merits over conventional type pumps:

- Installation is very economical also as land requirement is much less than horizontal type pumps as only one wet sump is required. Super structure requirement is also much lesser in this case as motors are of submersible type.
- Special cutting & tearing features are provided on the suction side of pump which facilitates disposing of soft materials like plastic pouches and small jute pieces etc., which are predominant in sewage.
- The bearings in submersible pumps are of anti-friction type, maintenance free and grease lubricated for long life.

It has fewer moving parts which reduces wear & tear of parts and ensure trouble free operation. As much sewerage projects were not being executed earlier, the manufacturing of these type pumps in India is not very old and hence very few reputed manufacturers are available and particularly of higher capacity & hence higher HP pumps.

(ii) Centrifugal Type Pumps

Horizontal Centrifugal type pumps are somewhat better in efficiency than submersible type pumps. Also these pumps are better from the maintenance point of view but due to limitation of suction lift and the problem of priming particularly in sewage application, these pumps are required to be installed with positive suction head in the dry well and preferably at a depth lower level than the invert level of wet well (sump well).

The main problems in such type of pumps are:

- These are having multi shaft system; hence their proper alignment is required.
- If accidentally some leakage happens from wet well the electric motor may get damaged.
- It requires much space for installation.
- Since cutting and tearing features are not available, there is possibility of entry of polythene bags, cloths, napkins etc. in the bowl leading to failure of the pumping system.
- It needs replacement of packing rope to avoid leakage.

Keeping in view of above problems, it is proposed to provide non-clog submersible type sewage pump set wherever possible. Wherever it is not possible, centrifugal type pumps with vertical shaft instead of horizontal shaft with vertical electric motor to be placed immediately above the pump connected through flexible coupling. This type of installation shall occupy lesser space and motor shall be safer in case of accidental flooding due to leakage of water from piping due to any reason.

Also, operation & maintenance of this type of pumps in sewage application is better than conventional Horizontal centrifugal type pumps.

4B.6.3.4 Velocity in pumping mains

The maximum velocity in delivery pipes shall be 3 m/s. Thus, the sizes of delivery pipes & their fittings are adopted on this basis and only standard sizes of CI pipes & specials are adopted.

The self-cleansing velocity for sewage is being adopted as 0.8 m/s at ultimate horizon year. In case minimum velocity during non-peak flow pumps in common pumping mains works out much below the settling velocity value, head of pump set will be increased for pressurizing the flow besides controlling the head using actuator.

4B.6.3.5 Suction Well

a) Wet Wells

Capacity of wet well sump is adopted considering CPHEEO Manual and NRCD guidelines for submersible and horizontal centrifugal type of pumps. A maximum of 10 minutes time at peak flow condition will be considered to size the sump well. For the other factors, the following two basic criteria are to be considered.

- Free fall of sewage into the sump well governed by the invert of the incoming sewer.
- Adequate space for pumps within the well to be removed for maintenance (submersible only).

In addition to these sizing criteria, the well must be self-cleansing and will be provided with a shaped base (benching). Detailed consideration needs to be devoted to the sump design to serve various Objectives, as mentioned here below:

- To prevent vortex formation,
- To obtain uniform distribution of the inflow to all the operating pumps and to prevent starvation of any pump.
- To maintain sufficient depth of water to avoid air entry during draw down of water level.

For getting best performance from the pumps, the wet well will be designed as per the guidelines mentioned in IS 15310:2003 – "Hydraulic Design of Pump Sumps and Intakes – Guidelines" and British Hydromechanics Research Association (BHRA).

b) Dry well / Valve chamber

Sizing of dry well (for horizontal centrifugal pumps) or Valve chamber (for submergible pumps) shall be adopted considering the requirement of pump spacing, common header diameter, fittings, valves, equipment, working and operating space.

c) Spacing of Pumps

The spacing between the lips of suction bell mouths of two pumps shall be adopted between 2D to 2.5D, as per guidelines given in CPHEEO manual. The dimension D is the diameter of the suction bell mouth installed at the inlet of each pump which generally vary between 1.5 d to 1.8 d where d is diameter of suction pipe. This is depending upon pump design and reference has to be made to pump manufacturer for specific dimensions. However, the value of D shall be adopted as 1.5 times of diameter of suction pipe for designing purposes.

d) Minimum Submergence of Pumps

The flow must reach the eye of pump's impeller with such absolute pressure head that it will be higher than the vapor pressure and NPSHR by the pump. Hence to avoid trapping of air into the pump and cavitation's, the minimum submergence has to be maintained.

Minimum submergence of pumps shall depend as per manufacturer's requirements and exact values of this parameter shall be finalized only after the award of contract. But for the design purposes and deciding the tentative depth of wet well (sump), this parameter shall be adopted as per the guidelines given in IS 15310:2003 - Hydraulic Design of Pump Sumps and Intakes – Guidelines and CPHEEO Manual.

e) Bottom Clearance

The bottom clearance below the suction bell of pump/ suction bell mouth shall be adopted as per the guidelines given in IS 15310:2003 - Hydraulic Design of Pump Sumps and Intakes and Guidelines in the CPHEEO Manual.

f) Ventilation of Pumping Station

Since toxic gases emanate from sewage, it is necessary to ensure proper ventilation for hazard-free working in pumping stations. For dry wells up to 4 m depth, natural inlet with exhaust fans can be used. If the depth of dry well is more than 4 m below ground level and for the wet wells, force inlet and forced outlet may be used. Such ventilation is mandatory as per safety regulations for moderate and large sewage pumping stations.

g) Travelling Crane

In pumping stations having centrifugal type pumps, one electrically / manually operated traveling crane, having longitudinal as well as transverse movements, and of suitable capacity shall be provided in the pumping station for handling the pumps and other equipment inside the pump house.

In pumping stations having submersible type pumps, one mono-rail type crane fixed on pillars and having traveling trolley for transverse movements along with lifting chain pulley block of suitable capacity shall be provided on the wet sump for handling pumps.

h) Pressure Gauge

For the trouble-free operation and long life of pump it is essential that it should be operated at the duty head and hence monitoring of pressure head is necessary. For this purpose, one electronic sensor type pressure measuring equipment along with digital type indicator shall be provided on the delivery side of each pump.

i) Flow Meter

For monitoring the quantity of sewage being pumped from a pumping station and also to monitor the condition of pump, it is essential to provide a suitable discharge measuring arrangement. Hence one number full bore electro-magnetic type flow meter of suitable size and capacity shall be provided in the common header at each pumping station.

4B.6.4 Rising Main

Sewage collected at pumping station through gravity lines have to be conveyed to higher elevations through pressure main. Hazen-Williams formula (as given earlier) is generally used for computing the frictional losses. The concept of design of rising main is to meet following requirements:

- The main must be self-cleaning with minimum flows.
- Velocities should not be excessive with design peak flows.

The pump capacity together with rising main diameter should be calculated considering pump cost, rising main cost, rate of interest, energy charges and annual operation and maintenance cost. Lesser diameter rising main may be cheaper in initial cost, but the operation cost may be more due to increase in pump head later. Computation of maximum water hammer pressure and the control measures will be done as per the recommendations of the CPHEEO Manual.

4B.6.5 Screens and Screen channel

Screening of incoming wastewater is required for the removal of large floating materials, which can damage the pumps.

Clear spacing between screen bars	- 25 mm
Thickness of screen bar	- 10 mm
Type of working screens	- Manual screen
Minimum velocity through screens	- 0.6 m/sec
Maximum velocity through screens	- 1.2 m/sec

4B.6.6 Electrical load capacity

Main Transformer and other electrical equipment are designed for peak flow electrical load requirement.

4B.6.7 Standby Power Supply Source

In case of electrical power failure, Diesel Generator set of peak flow load capacity is proposed for sewage pumping stations.

CHAPTER 5

VALUE ENGINEERING

5 Value Engineering

Introduction

Value Engineering is a management strategy and methodology with the aim to produce the activity function through innovative and creative work. Value engineering in the field of urban planning is very complex as it is difficult to quantify the function evaluation. With the urban sprawl experienced in the last 30 years, the open areas and parks have been limited to less than 1 percent of the total area of 44.32 Sq. Km of the project command. The historical characteristics and uniqueness of the project command lying in Kochi city limits are seen disturbed. It is thus imperative that the historical features, collective memory, and cultural contents of the command are in depth explored and brought into the planning process.

5.1 Canal Oriented Development

The canals were once the lifelines of the city of Ernakulum; ever house, every field used to face this canal as it catered them with their daily necessities. As the city grew, it's mode of commutation shifted from waters to the roads, years followed; resulted the city to turn its face away from these canals and as a result merely reduced them to open sewer drains- smelly and unpleasant.

The IURWTS Project canal beautification is a quest to rejuvenate and regenerate the canal ecosystems and open a new green corridor of Public greens. The city of Ernakulum a per the 2031 Master plan, the Public greens are less than 3%, it becomes the Government's solemn responsibility to add more public greens to ensure public health and welfare.

Even minor Restoration efforts of these canals, by the Kochi Corporation, reveals that its lost glory can be regained by providing a primary role to the canal and integrating them to the city structure by physical and functional connectivity. Moreover, public awareness must be created primarily to understand the importance of canal system in the modern city structure and its adaptive reuse.

The project canal bank beautification aims at interweaving the canal to the city fabric, by outlining recreational activities along its banks making it interactive and attractive for community and cultural benefits. The existing culture and heritage of the region is also considered while restoration. To make the canal front active, the banks are designed to be neighborhood parks facilitating adults and tots to engage themselves in various recreational activities such as jogging, meditating, yoga, exercising, playing etc., elevating the public health benefits; smaller commercial kiosk are attached with these parks to serve the neighborhood needs and serve as revenue generators for the maintenance of these stretches. Design has been developed with due respect to suit changing climatic and weather conditions round the year.

Canal oriented development is to be perceived as a holistic developmental concept to elevate the quality of community standards and green city planning, aimed at symbiotic and sustainable urban development with nature. Through the project, Canal will no longer be considered as an independent entity rather a green lively recreational corridor flowing across the city.

The three-pronged strategy to revitalize the canal front is given in **Figure 5.1**.

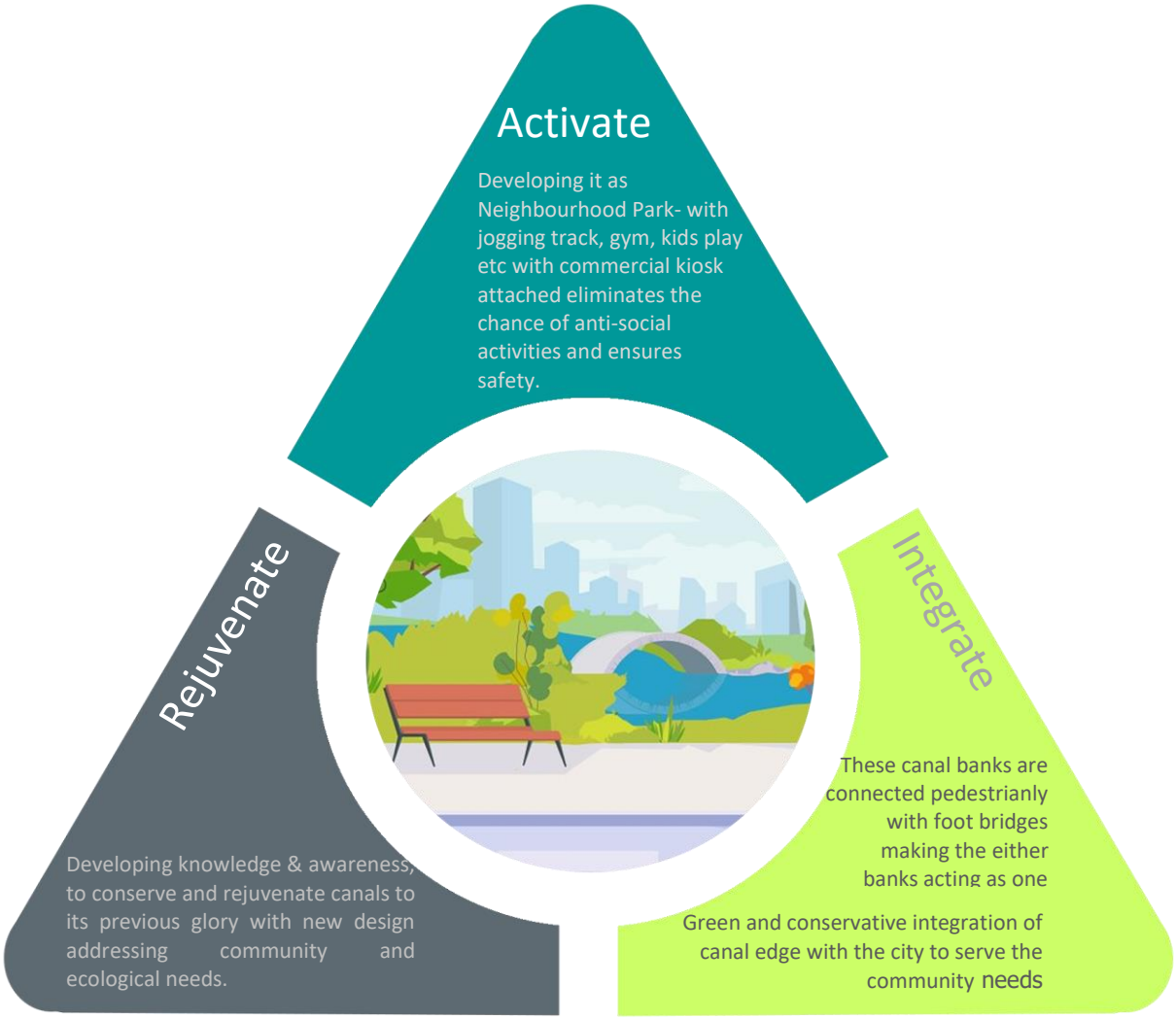


Figure 5.1: The three-pronged strategy

A stretch of Edappally canal is developed as a pilot in this DPR.

5.2.a Nodes of immediate impact

- Traffic nodes
- Commercial nodes
- Institutional (educational)nodes
- IT-park
- Industrial Node

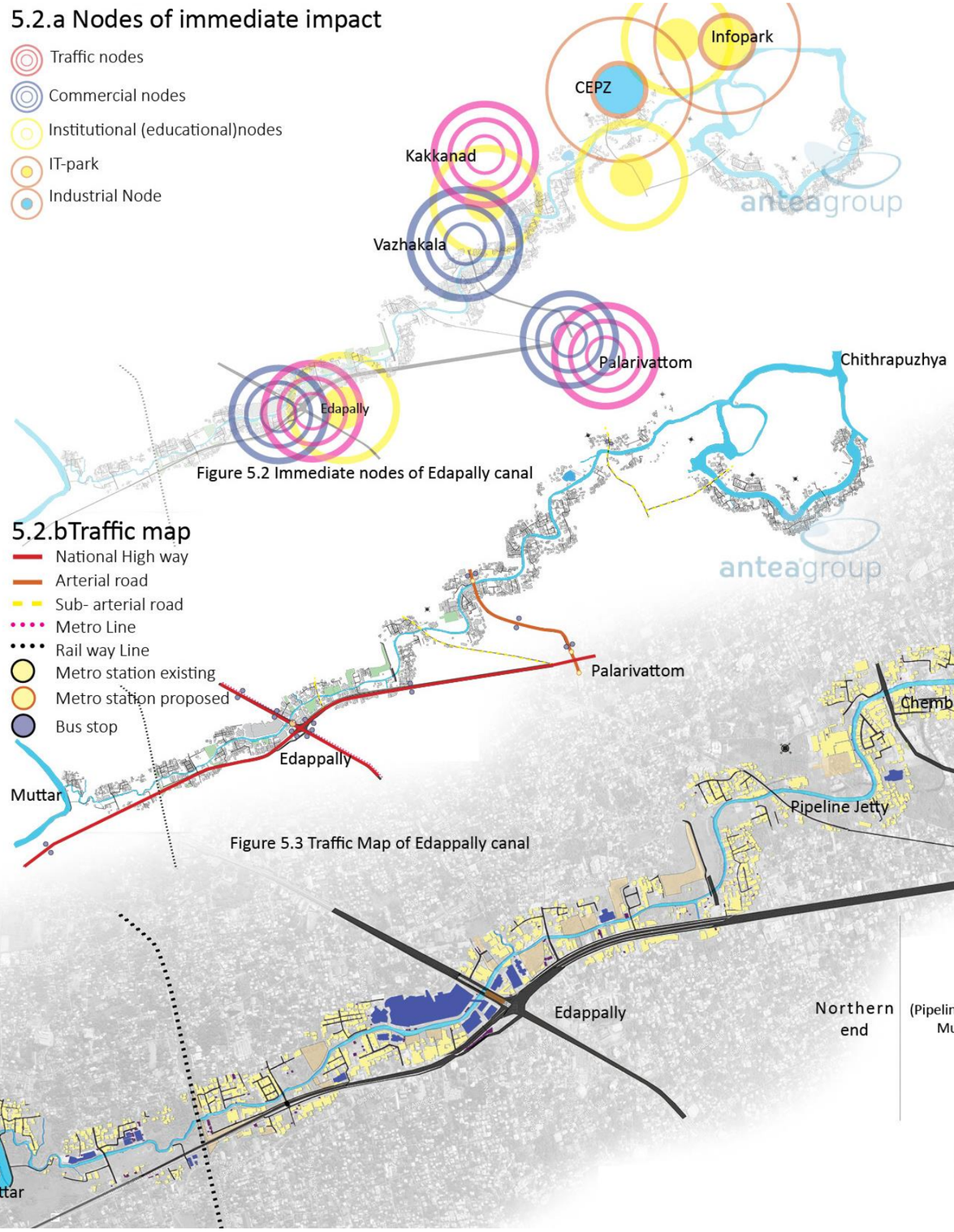


Figure 5.2 Immediate nodes of Edapally canal

5.2.bTraffic map

- National High way
- Arterial road
- Sub- arterial road
- Metro Line
- Rail way Line
- Metro station existing
- Metro station proposed
- Bus stop

Figure 5.3 Traffic Map of Edappally canal

5.2.c Land Use map

- Commercial
- Residential
- Institutional
- Open / vacant Ground
- Water body
- Canal

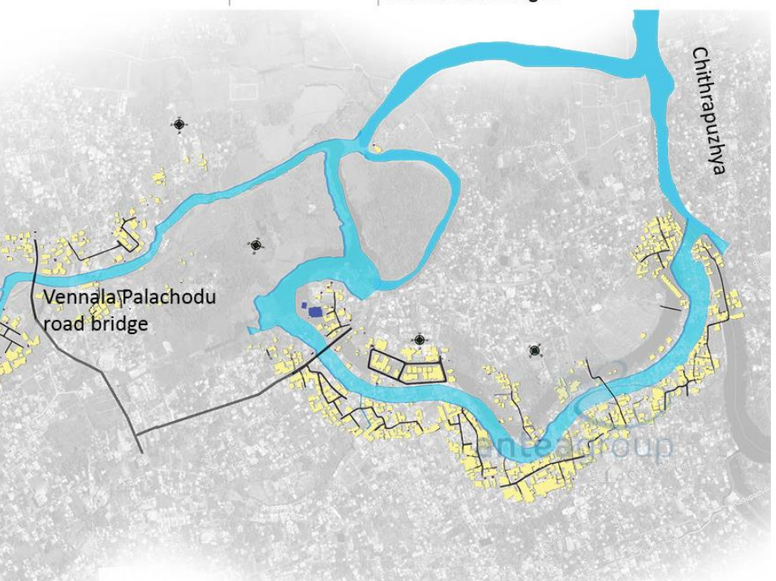


Figure 5.4 Land use map of Edappally canal

Southern end	(Chitrapuzha to Vennala Palachodu Bridge)	• Low density residential • Industrial sectors with higher no. of working class people working in manufacture and IT sectors • Institutional sectors with schools and collages
Middle area	(Vennala Palachodu Bridge to Pipeline jetty)	• Denser residential area • Institutional sectors with schools. • Local high density commercial markets • Mixed land-use area with office spaces and residential.
Northern end	(Pipeline jetty to Muttar)	• Denser residential area- multi storied apartments • Institutional sectors with schools. • Commercial hub • High density road junction • Mixed land-use area with office spaces and residential. • Institutional land use defined by hospital and school

5.2 Landscape analysis of Edappally canal

Land identification

Strategy of land identification has been based on

- Uninterrupted availability of vacant land
- Close affinity to developmental corridors - IT corridors
- Aimed at retaining and rejuvenation of existing greens to open to the public realm.

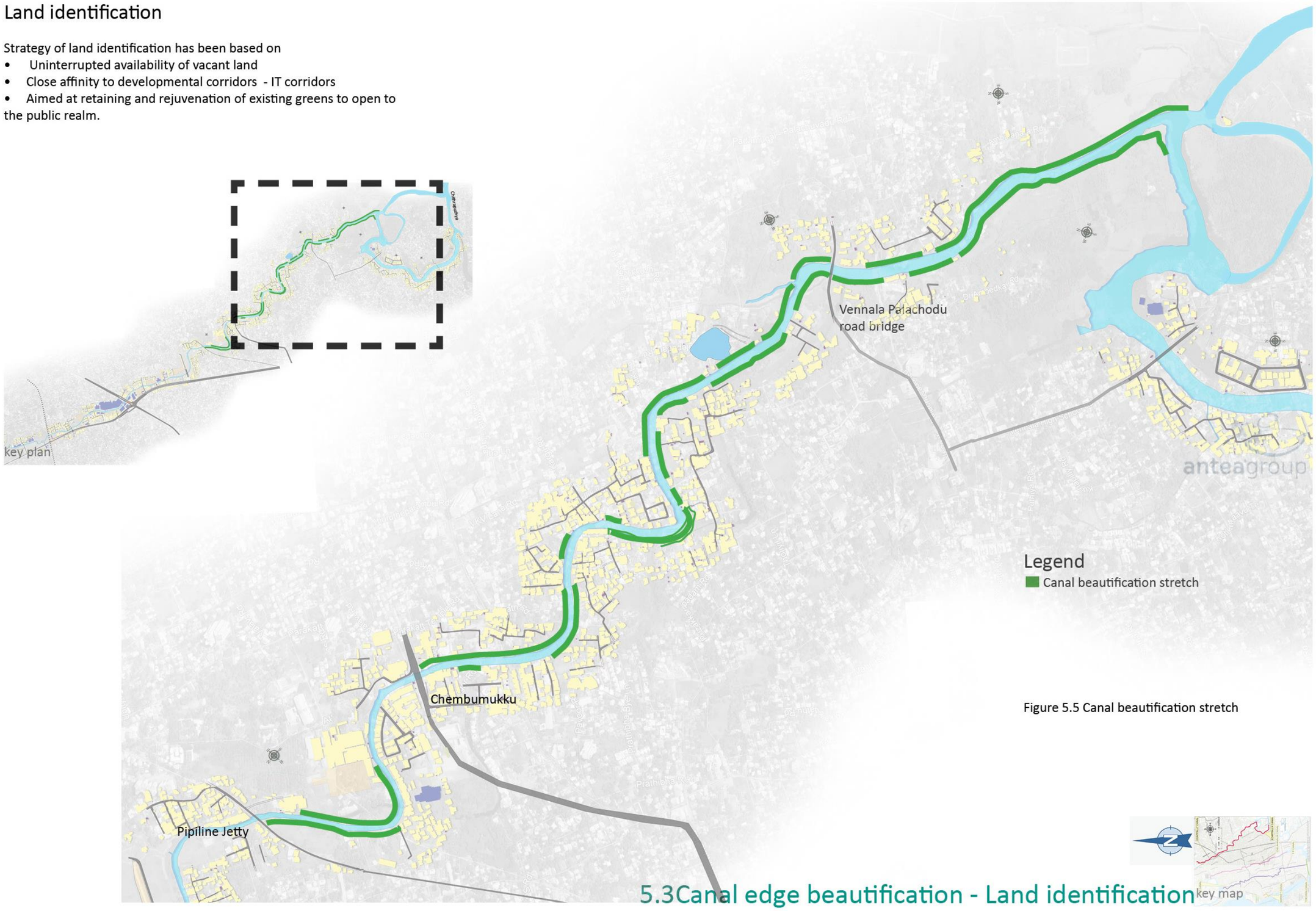


Figure 5.5 Canal beautification stretch

5.3Canal edge beautification - Land identification

With respect to the landscape analysis , the canal can be divided into 3 zones:

- ## Zone1:

This zone is in the high density region; passing through the high density commercial, Institutional and residential zones

Landscape strategy:
The canal edge development of this area addresses the fulfillment of community requirements;
Active canal edge for day-to-day activities- cycling and jogging tracks, Vendor kiosk, Outdoor amphitheaters focused on community gatherings.
This zone is more advertisement oriented with maximum no of billboards, way finders, etc

Figure 5.7 Zone plan of Edappally canal beautification

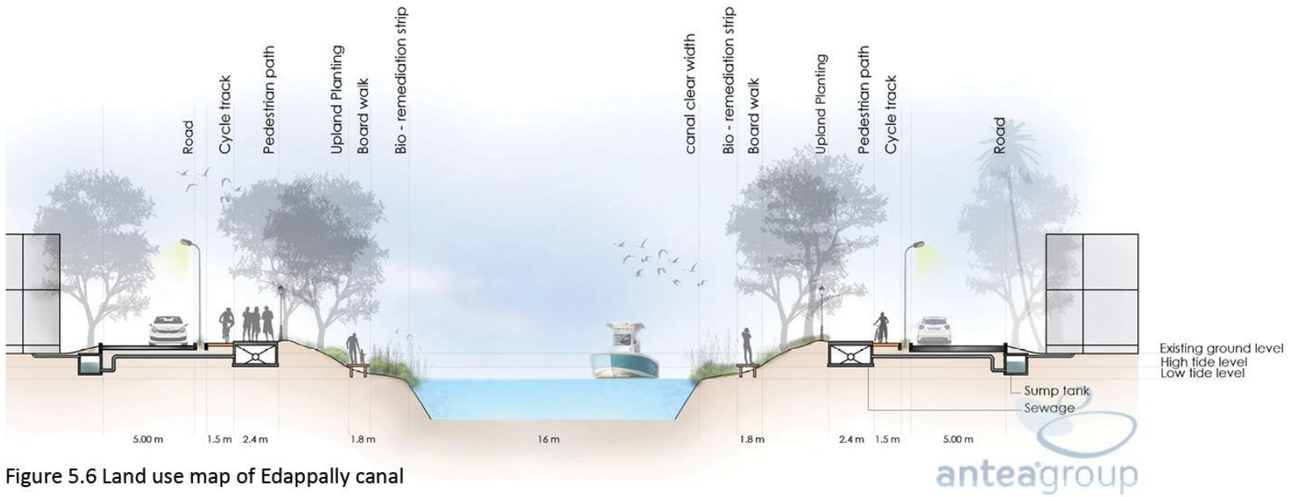
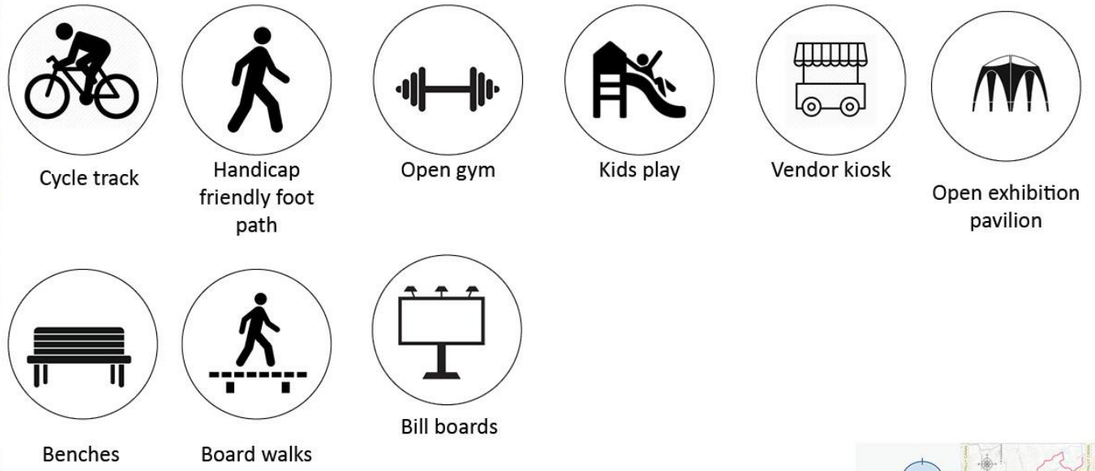


Figure 5.6 Land use map of Edappally canal

- ## Zone 2:

This zone is in the high medium region; passing through the Institutional and residential zones

Landscape strategy:
The canal edge development of this area addresses the fulfillment of community needs and environmental sensitivity.



Landscape Design Strategies

Figure 5.8 Access to canal bank

- Zone 3:

This zone is in the marshy eco - sensitive region.
Landscape strategy:
The canal edge development of this area addresses the eco-sensitive landscape approach. This region will be ticketed- this zone will have bird watching areas, board walks, areas physically experience water.

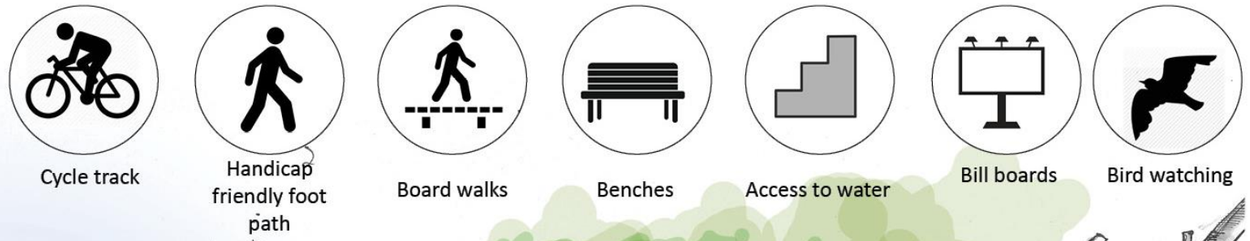


Figure 5.9 Canal edge at zone 3

Design Components:

Soft scape:

- **Usage of indigenous species- sustainable landscape**
- **Ecosystem enhancement by usage of native planting pallet.**
- **Reduced procuration and maintenance cost**
- **Large canopy tree cover proposed along the banks -reducing the surface heat gain and brining down heat island effect.**

Sensory Landscape for visually disabled:

Landscape is used as a tool to mark spaces with in this park by enlightenment of senses

- Fragrant soft-scapes (Figure 5.10) are used to identify places/ spaces.

Avenues of Mimusops elengi, Alstonia scholaris, shrub varieties of plumeria, Jasminum and Rosaceae shall be planted.

Figure 5.10 Dry well system
Source: knkx.org/

Figure 5.12 Water features used as sensory way finders
Source: blueskydreamers.com

Figure 5.11 Wind sculpture
Source: blueskydreamers.com/

Figure 5.13 Place defining with usage of smooth and rough texture
Source: blueskydreamers.com/

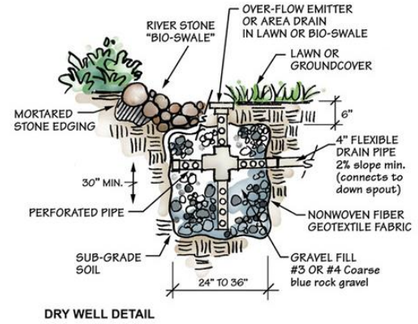


Figure 5.14 Dry well system
Source: hhf.com

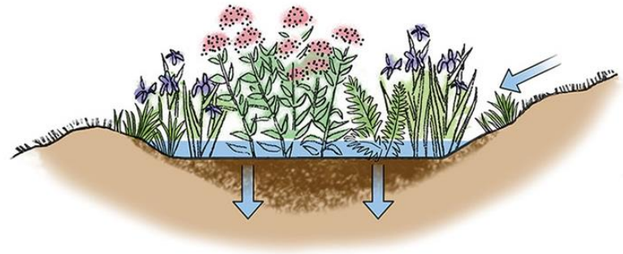


Figure 5.15 Rain garden
Source: gardeners.com

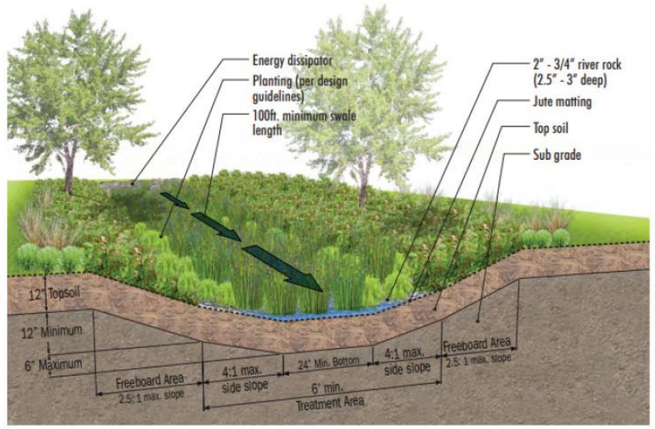


Figure 5.16 Vegetated swale
Source: cleanwaterservices.org

- Water feature (Figure 5.12) is used to create different sounds which will become a way finder as well a place marker tool for the blind.
- Wind sculptures (Figure 5.11) and trees such as black bamboo shall be used at different areas which produces sound as the wind blows, this helps the blind to mark the place as well as keeps the space rhythmic with natural music.
- Paving of course and smooth texture (Figure 5.13) used to define spaces- this helps the visually handicapped to identify spaces.

Hard scape:

- **Usage of low maintenance material pallet**
- **Plazas to be paved with of low carbon foot print materials such as locally available literate stone, Kerala granite cobble stone pavement, recycled plastic grass paver etc.**

Surface drainage:

- **Usage porous paving to reduce surface runoff.**
- **Runoff water to be collected to the drains and directed to dry-wells to ensure ground water recharge**
- **Vegetated swales and rain gardens are used to improve peculation.**

Water edge stabilization:

Retaining wall (Figure 5.18)
Bio remedial strip (Figure 5.17)-

- **Usage of indigenousness plant material to check on water quality through phyto- remediation.**
- **Root stabilization of banks grass root plants**
- **Ecosystem enhancement with mangrove plants in the bio remediation strip**

Illumination

Automated solar powered lights are proposed along the canal bank.

- Solar tree (Figure5.19)
- Solar pedestrian lights (Figure 5.20)
- Solar panels above the kiosk roofs
- Solar powered bollard lights (Figure 5.21)

Figure 5..17 Bio-remedial zone

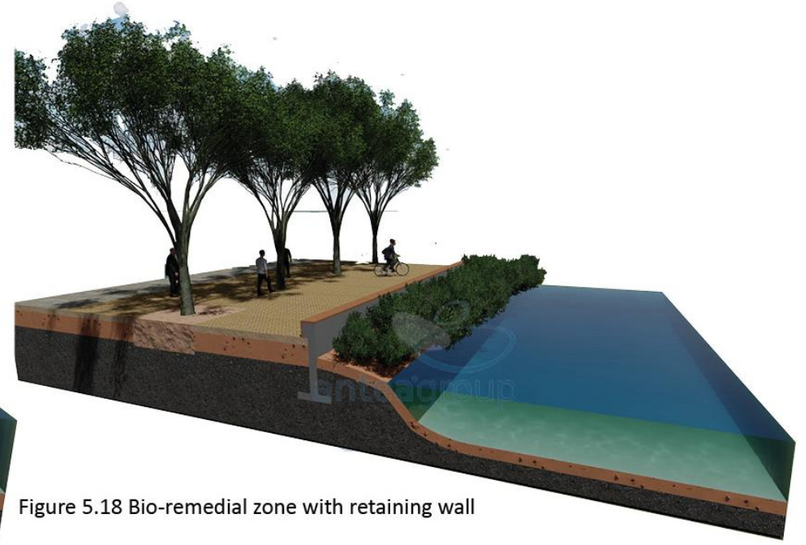


Figure 5.18 Bio-remedial zone with retaining wall

Figure 5.19 Solar tree
Source:landartgenerator.org

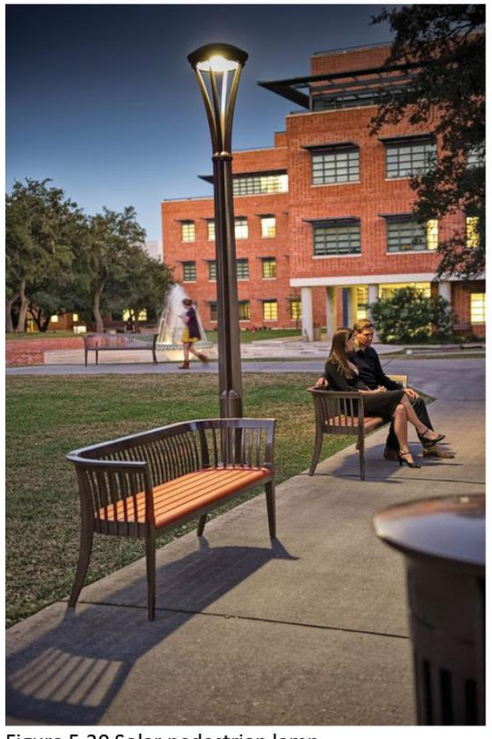


Figure 5.20 Solar pedestrian lamp
Source:Landscape Forms-Alcott

Figure 5.21 Solar bollard light
Source: outdoor-lighting.co.uk


Chainage- 357


Chainage- 287


Chainage- 370


Chainage- 372

Figure 5.22 Pictures of existing canal scenario of Edappally canal

Figure 5.23 View of the canal with the canal edge beautification

Amenities:

- Design principles related to preservation, integration, accessibility, identity, continuity, diversity, and safety support canal beautification. (The functional design for the canal development includes distance, density, and diversity aspects.
- Considering the location of Edapally, for creating a community space with a mixture of choices, canal front development will be much more than just a stop along the canal but rather become a destination itself. This will bring in value addition like increased tax revenues from sales and property taxes, increased property value, tourism, livelihood opportunity for many and provide an easy access to the other canal sites.

Plaza space — Every access point to this linear park is defined by a plaza, this ensures space for entry and exit activities. The plazas also accommodates utilities such as food kiosk, bio toilets, benches, exhibition pavilions, exhibition panels, etc

Foot path — Foot path runs along the canal edge, meandering and widening up at different segments to become plazas. These foot paths as away from vehicular traffic has the potential to serve as jogging tracks, indirectly boosting the community health - as greener micro ecosystem check on the air quality. Good canopy and presence of water improves thermal comfort of the park there by encouraging people to use the space. Tactile and ramps are used to to make the walk disabled friendly.

Board walk — Board walk is designed in the canal edge for passive recreational activities, and to bring people more close to the waters and there by educating them about the canal ecosystems and their benefits; this is planed just above the HTL of the canal. This space is used for recreational fishing.

OAT — Out door Amphitheater are planned along these canal edges aiming at shifting of community gatherings from roads to canal edges. These spaces can be used for small congregations, dramas, street plays etc, indirectly u8plifting the cultural values of the society.

Gym — Out door gym areas are an add on to the community health benefits, the morning and evening activities become booted with this space.

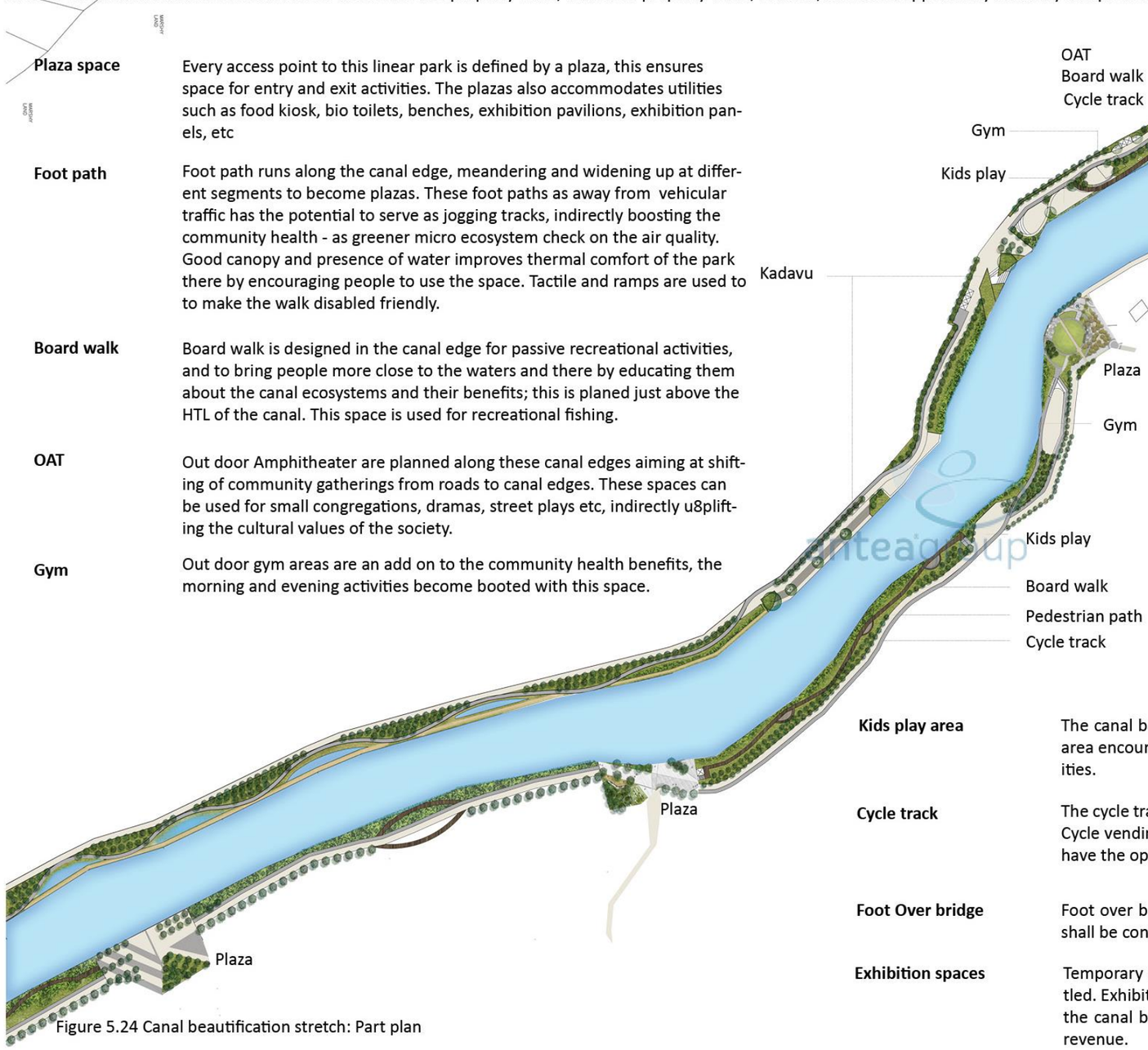


Figure 5.24 Canal beautification stretch: Part plan

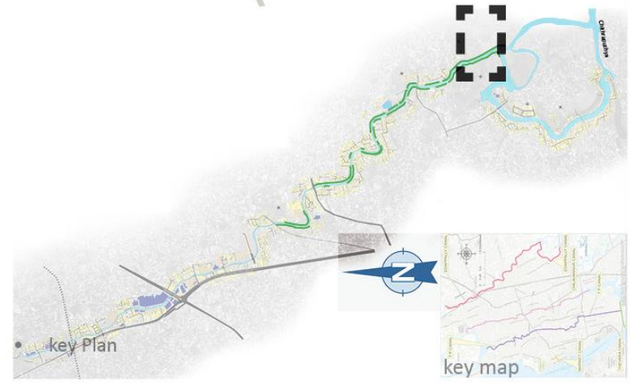


Figure 5.25 Key map

Kids play area — The canal bank development is a new prototype of a neighborhood park, the kids play area encourages the tots to use the space, encourages them to engage in outdoor activities.

Cycle track — The cycle track, runs along the canal edge meandering through the beautiful landscapes. Cycle vending areas provided along with cycle tracks ensure that layman or tourist both have the opportunity to cycle along the canal banks.

Foot Over bridge — Foot over bridges are provided at different intervals so as both sides of the canal bank shall be connected and can act as a single entity.

Exhibition spaces — Temporary structures are used as exhibition pavilions which can be used and dismantled. Exhibition panels are also provided that can hold small scale art expos; these helps the canal bank to become more interactive and vibrant, inviting in more foot fall and revenue.

Figure 5.26 Vendor kiosk

Figure 5.27 Bench and bill board

Figure 5.28 Amphitheater

Figure 5.29 Pedestrian bridge

Figure 5.30 Exhibition boards

Figure 5.31 Open gym

Figure5.32 Kids play

Figure 5.33 Open exhibition pavilion

5.4 Signage and way finders

The strategic use of signage can catch a guest's attention and engage them in a unique and meaningful way conveying necessary information, safety information and directions.

Signages are positioned considering easy to understand and notice. Stand-out colors are used from the background to ensure visibility. Signages need to be provided in Malayalam, Hindi and English languages with appropriate graphical symbols to ensure public readability.

5.4.1 Maps signage

Illustrative signage with canal edge beautification park plan is to be placed at every plaza. This will help the user to locate the different places and landmarks in and around the canal stretch and their connectivity (**Figure 5.34**).

Figure 5.34: Maps Signage

5.4.2 Information boards

These boards are used at the entry, near plazas, kids play area, etc. to add information's and user guidelines (**Figure 5.35**).

Figure 5.35: Information Boards

5.4.3 Totem signage

Totems are used as place makers ion this project, these totems itself can serve as landmark (**Figure 5.36**).

Figure 5.36: Totem signage

5.4.4 Signage for visually disabled

Signages with braille language inscription is incorporated for the help of visually impaired to locate the different facilities within the park without external help- these boards play a vital role making the project disabled friendly (**Figure 5.37**).

Figure 5.37: Information board and signage for visually disabled

5.4.5 Way finding

Legible signages with high contrast colors and pictorial representations has been incorporated into design consideration (**Figure 5.38**). these high contrast boards will ensure long distant visibility. These are very important to be placed to ensure the user never loses his way.

Figure 5.38: Way finding signage

5.4.6 Way finding for visually disabled

Tactile tiles are laid along the foot paths to ensure safe movement for visually disabled (**Figure 5.39**).

Figure 5.39: Way finding for visually disabled

CHAPTER 6

FINANCIAL ESTIMATES AND COST PROJECTIONS

6 Financial Estimates & Cost Projection

The Cost estimation is one of the most important steps in preparation of the DPR, tendering and project management. A cost estimate establishes the base line of the project costs for different stages of project development. A cost estimate at DPR stage represents a realistic projection of estimates provided by the engineers considering the ground conditions, available data and project requirement using required technical expertise. The detailed cost estimate provides a baseline for the assessment of financial performance during the project implementation. Cost estimate for infrastructure projects are based on unit cost for bill of quantities.

Unit costs for bill of quantities. A unit cost is assigned to each of the facility component or task that is represented by the bill of quantities. The total cost is the summation of the products of the quantities multiplied by the corresponding unit cost. The unit cost method is straightforward in principle but quite laborious in application. The initial step is to break down or disaggregate a task/activity into several tasks. Collectively, these tasks/activities must be completed for the construction of a facility.

Cost estimates can best be classified into three major categories according to their functions. A construction cost estimate serves one of the three basic functions: design, bid and control. For establishing the financing of a project, either a design estimate or a bid estimate is used.

Design estimates. For the owner or its designated design professional, the types of cost estimates encountered run parallel with the planning and design as follows:

- Screening estimates (or order of magnitude estimates)
- Preliminary estimates (or conceptual estimates)
- Detailed estimates (or definitive estimates)
- Engineer's estimates based on plans and specifications

For each of these different estimates, the amount of design information available typically increases with the requirement.

In the planning and design stages of a project, various design estimates reflect the progress of the design. At the very early stage, the screening estimate or order of magnitude estimate is usually made before the facility is designed and must therefore rely on the cost data of similar facilities built in the past. A preliminary estimate is based on the conceptual design of the facility at the state when the basic technologies for the design are known. The detailed estimate is made when the scope of work is clearly defined, and the detailed design is in progress so that the essential features of the facility are identifiable.

The engineer's estimate is based on the completed plans and specifications when they are ready for the owner to solicit bids from construction contractors. In preparing these estimates, the design professional will include expected amounts for contractors' overhead and profits.

As an example, we discuss the case of selection of crossover bridge option and the cost estimates for a proposed bridge across a canal. A screening estimate is made for each of the potential alternatives, such as a reinforced concrete bridge or a corrugated steel plate arch bridge. As the bridge type is selected, e.g. the technology is chosen is a corrugated steel plate arch bridge form, a preliminary estimate is made on the basis of the layout of the selected bridge form on the basis of the preliminary or conceptual design. When the detailed design has progressed to a point when the essential details are known, a detailed estimate is prepared based on the well-defined scope. When the detailed plans and specifications are completed, an engineer's estimate can be prepared based on items and quantities of work.

Bid estimates. For the bidding purpose to invite contractors, a bid estimate is submitted to the owner either for competitive bidding or negotiation consists of direct construction cost including field supervision plus a mark up to cover general overhead and profit. The direct cost of construction for bid estimates is usually derived from a combination of the following approaches.

- Subcontractor quotations
- Quantity take offs
- Construction procedures.

The contractor's bid estimates often reflect the desire of the contractor to secure the job as well as the estimating tools at its disposal. Some contractors have well established cost estimating procedures while others do not. Since only the lowest bidder is the winner of the contract in most bidding contests, any effort devoted to cost estimating is a loss to the contractor who is not a successful bidder. Consequently, the contractor may put in the least amount of possible efforts for making a cost estimate if it believes that its chance of success is not high.

Control estimates. For monitoring the project during construction, a control estimate is derived from available information to establish:

- Budget estimate for financing
- Budgeted costs after contracting but prior to construction
- Estimated costs to completion during the progress of construction.

Project Cost Accounts

Based on the engineering design analysis, the cost estimates are worked out as per Delhi Schedule of Rates (DSR 2019), Schedule of Rates of the State Government (PRICE), Local Market Rates and other relevant international codes as applicable. The cost estimates have been brought under 7 components as major heads:

1. Canal oriented development.
2. Urban regeneration.
3. Land Acquisition cost: Canal oriented development.
4. Operation and Maintenance specific contracts.
5. Rehabilitation & Resettlement, compensation for project affected people.
6. Development of Konthuruthy canal.

Each major head is divided in sub heads as given below:

1. Canal oriented development estimates include:
    i. Canal cleaning.
    ii. Canal widening and deepening.
    iii. Canal shore protection.
    iv. Reconstruction of roads along the canal.
    v. Reconstruction of road bridges.
    vi. Reconstruction of foot bridges.
    vii. Regulatory arrangements with automatic operations and pumping arrangements.
    viii. Construction of access road to road bridges.
    ix. Canal bank beautification with landscaping & promenade development.
    x. Construction of Jetties and Jetty /terminal building.
    xi. Construction of Corporate office of SPV with Operation Control Room and testing lab.
    xii. Construction of Access road to Jetties and Terminals.
    xiii. Purchase of Vessels / Boats for navigation of passengers and tourism.
    xiv. Navigational aids (5 Canals) Signages, Markers and Way finding signage etc.
    xv. Miscellaneous purchase of goods (Solar Installations, EV chargers and electrical systems & CCTVs).

2. Urban Regeneration estimates include:
    i. a) Construction of Sewer network including interceptor, pumping stations, manholes.
    b) Construction of Sewer network for households.

ii. Sanitation facilities in catchment area.
iii. Construction of Sewage Treatment Plants, pumping systems, chemicals etc.
iv. Solid waste management
v. Operation and maintenance for 15 years.

3. Land Acquisition: Canal Oriented Development and Urban Regeneration includes
   i. Land Acquisition cost along canal banks.
   ii. Access road for crossover road bridges and additional STPs.
   iii. Access road for jetty terminals.

4. Operation and Maintenance Specific Contracts includes:
   i. Specific additional Contracts
   ii. Environmental Monitoring (Air, Noise, Water, etc.) - for 5 years.
   iii. Project management cost, specialized work like LIDAR survey, public campaign/social awareness management etc.

5. Rehabilitation & Resettlement/Building Compensation including Land Acquisition includes:
   i. R&R - Building Construction Package - 7 blocks.
   ii. Removal of utilities including bridges/culverts (to be handled by respective department).
   iii. Land Acquisition cost.
   iv. Buildings Compensation cost for PAP.
   v. Buildings Compensation cost for PAF.

6. Development of Konthuruthy Canal (additional work)

6.1 Canal Oriented Development

i. **Canal cleaning and water hyacinth removal:** Water hyacinth and other floating materials including plastic waste deposited in the canal needs to be cleaned before the start of the project. Invasive plants like hydrilla is said to grow an inch a day. Water hyacinth can form dense mats and double in size in less than two weeks under favorable conditions. These aquatic weeds create situations which are ideal for mosquito growth. Hence, it is proposed that canal banks are cleaned at intermittent interval during the preconstruction phase, construction phase and on completion of the project. The estimated amount for cleaning and water hyacinth removal is proposed for the pre implementation, Implementation stage and on completion of the project is **INR 2.10 crores.**

The abstract of the estimate canal wise is given in **Table 6.1** and detailed costing is given in **Annexure 6.1.1**.

Table 6.1: Abstrcat cost for canal cleaning and water hyacinth removal

Description/Canal	Amount (INR)
Cleaning and water hyacinth removal with preparatory and final phase	
Edappally Canal	₹ 67,90,567.73
Thevara Perandoor Canal	₹ 34,08,068.28
Thevara Canal	₹ 2,00,393.90
Chilavanoor Canal	₹ 1,05,29,546.39
Market Canal	₹ 64,918.57
Total	**₹ 2,09,93,494.86**

ii. **Canal widening and deepening**: The project canals are proposed to be restored to the original width of canal as per village record and meeting the requirement for flood mitigation and navigation of vessels. The dredge level has been fixed taking into consideration the hydrogeological aspect and on the minimum navigation depth to be maintained during low tide water level in the canal. The deepening and widening process is to be undertaken both above and underwater, the estimation has accounted for the same. The 20% of the useful excavated material obtained from cutting is used for back filling the low-lying areas and the remaining conveyed to identified spots. The sub canals of the catchment are also proposed to be desilted. The total cost estimated is **INR 33.73 crores**.

The abstract of the estimate canal wise is given in **Table 6.2** and detailed costing given in **Annexure 6.1.2**.

Table 6.2: Abstract cost for Canal deepening and widening

Description/Canal	Amount (INR)
Earth work in or under water along with back filling on banks	
Edappally Canal	₹ 1,88,67,849.84
Thevara Perandoor Canal	₹ 1,31,41,198.87
Thevara Canal	₹ 22,64,984.82
Chilavanoor Canal	₹ 1,64,48,699.55
Market Canal	₹ 7,06,171.10
Earth work excavation on the side of the banks with backfilling on banks	
Edappally Canal	₹ 58,92,810.53
Thevara Perandoor Canal	₹ 94,33,909.17
Thevara Canal	₹ 3,38,700.29
Chilavanoor Canal	₹ 1,47,83,001.68
Market Canal	₹ 9,47,311.79
Earth work in or under water excavation and transporting out of site	
Edappally Canal	₹ 7,83,33,060.15
Thevara Perandoor Canal	₹ 6,91,10,077.31
Thevara Canal	₹ 1,04,38,530.30
Chilavanoor Canal	₹ 9,14,06,411.17
Market Canal	₹ 51,87,283.43
Total	**₹ 33,73,00,000.00**

iii. **Canal shore protection:** Different types of shore protection types were studied, and 3 types were selected based on site specific conditions. They include rubble masonry, steel sheet piles, and cast in situ types. Based on site specific conditions after analyzing different materials for shore protection the final decision will be taken at the detailed design stage of the project. The total cost estimated is **INR 138.48 crores**.

The abstract of the estimate canal wise is given in **Table 6.3** and detailed costing is given in **Annexure 6.1.3**.

Table 6.3 Abstract cost - canal shore protection

Description	Amount (INR)
Canal Shore Protection	
Edappally Canal	₹ 29,77,29,989.08
Thevara Perandoor Canal	₹ 55,15,23,770.50
Chilavanoor Canal	₹ 53,56,01,577.09
Total	**₹ 1,38,48,55,336.67**

iv. **Reconstruction of roads along canal.** The canal width has been encroached at different stretches along the canal and considering the developments that have taken place certain stretches of the roads are to be reconstructed. The total cost estimated is **INR 10.32 crores**.

The abstract of the estimate is given in **Table 6.4** and the detailed costing is given as **Annexure 6.1.4**.

Table 6.4: Abstract Cost for reconstruction of roads along canal

Description	Amount (INR)
Thevara-Perandoor Canal	₹ 5,47,42,162.83
Thevara Canal	₹ 4,85,09,220.97
Total	**₹ 10,32,51,383.80**

v. **Reconstruction of road bridges**: Various alternatives were studied, and 3 types were selected based on site specific conditions. They include innovative types of Corrugated Structural Plate Structures (CSP)arch bridge, concrete bridges, and steel girder types. Based on the time taken for construction, cost, and aesthetic consideration the final decision will be taken during the detailed design stage. The total cost estimated is **INR 69.45 crores**.

The abstract of the estimate canal wise is given in **Table 6.5** and the included as **Annexure 6.1.5.**

Table 6.5: Abstract cost for reconstruction of road bridges

Description	Amount (INR)
Edappally Canal	₹ 13,64,30,034.63
Thevara – Perandoor Canal	₹ 28,52,62,799.69
Thevara Canal	₹ 2,48,05,460.84
Chilavanoor Canal	₹ 24,80,54,608.42
Total	**₹ 69,45,52,903.58**

vi. **Reconstruction of foot bridges:** Steel structure which are environmentally acceptable, aesthetically pleasing, and easy to assemble are used for the reconstruction of 46 footbridges. The total cost estimated is **INR 16.10 crores.**

The abstract of the estimate canal wise is given in **Table 6.6** and the detailed costing included as **Annexure 6.1.6**.

Table 6.6: Abstract cost for reconstruction of foot bridges

Description/Canal	Amount (INR)
Edappally Canal	₹ 2,10,00,000.00
Thevara – Perandoor Chilavanoor	₹ 6,30,00,000.00
Thevara Canal	₹ 70,00,000.00
Chilavanoor Canal	₹ 6,30,00,000.00
Market Canal	₹ 70,00,000.00
Total	**₹ 16,10,00,000.00**

vii. **Regulatory arrangements with automatic operations and pumping arrangements**: Three major Canals will have locks at either ends to maintain the required water levels in the system for movement of navigation vessels. This system will also prevent the reverse flow of monsoon flood waters from the surrounding bodies into the canal and sediment inflow into the canals. The rough cost estimated is **INR 30 crores**.

The abstract of the estimate canal wise is given in **Table 6.7** and the detailed costing included as **Annexure 6.1.7**.

Table 6.7: Abstract cost of Regulatory arrangements

Description/Location	Amount (INR)
Edappally Canal – both ends	₹ 10,00,00,000.00
Thevara – Perandoor – both ends	₹ 10,00,00,000.00
Chilavanoor Canal – both ends	₹ 10,00,00,000.00
Total	**₹ 30,00,00,000.00**

viii. **Construction of access road to road bridges:** The bridges abased on the increase in height to have a clearance height of 4m for canal navigation, gradient correction to the access roads to road bridges are required. The total cost estimated is **INR 35.16 crores**.

The abstract of the estimate is given in **Table 6.8** and the detailed costing included in **Annexure 6.1.8**.

Table 6.8: Abstract cost for construction of access road to road bridges

Description/Canal	Amount (INR)
Edappally Canal	₹ 6,90,66,564.00
Thevara-Perandoor Canal	₹ 14,44,11,906.55
Thevara Canal	₹ 1,25,57,557.09
Chilavanoor Canal	₹ 12,55,75,570.91
Total	**₹ 35,16,11,598.55**

ix. **Canal bank beautification with landscaping & promenade development for pilot project (Edappally canal-4 km)**: Considering the availability of free space, limited encroachment and the location advantage, it is proposed to adopt a canal-oriented development concept for beautification of approximate 4 km stretch on either side of Edappally canal. The present canal bank beautification proposed is a commitment to the urban setting of Kochi city to restore balance, wellbeing and encourage lifelong tranquillity that is in harmony with nature and thereby adding to the tourist infrastructure of the city. These development spaces will also restore and offer escape from everyday stress and enhance heeling and community longevity. The estimated cost for beautification of around 6.83km on either bank of Edappally canal is Rs 50 crores. Provision has been included for landscaping and promenade development at selected stretches of other canals. The total cost estimated is **INR 55 crores**.

The abstract of the estimate is given in **Table 6.9** and the detailed costing included in **Annexure 6.1.9**.

Table 6.9: Abstract cost for Canal bank beautification

Description	Amount (INR)
Edappally Canal	₹ 50,00,00,000.00
All canals	₹ 5,00,00,000.00
Total	**₹ 55,00,00,000.00**

x. **Construction of Jetties and jetties Terminal buildings:** The primary factors considered while fixing the location of jetties was the intermodal connectivity with the rail metro, Water Metro, and road modes i.e. the first and last mile connectivity. The navigational width of 16.5m was estimated for 2-way movement in the project canals. The passenger's willingness to shift from public transport mode to canal mode have been studied in detail by a passenger traffic survey undertaken by NATPAC (2018). The next factor considered for fixing the location of the jetty and jetty terminals

was based on the analysis of the passenger traffic survey to use the locations. A total of 30 jetties and jetty terminals along the 5 canals are proposed and details brought out. The total cost estimated is **INR 10 crores**.

The abstract of the estimate is given in **Table 6.10** and the detailed costing included as **Annexure 6.1.10**.

Table 6.10: Abstract cost for construction of Jetties and jetties /terminal buildings

Description/Canals	Amount (INR)
Edappally Canal	₹ 3,00,00,000.00
Thevara-Perandoor Canal	₹ 3,33,33,333.33
Thevara Canal	₹ 66,66,666.67
Chilavanoor Canal	₹ 3,00,00,000.00
Total	**₹ 10,00,00,000.00**

xi. **Construction of office building for Special Purpose Vehicle along with testing lab:** An institutional mechanism to monitor the post implementation stage activities is suggested. In order to house the SPV office a block with plinth area of 1200 $m^2$is added to a jetty terminal along Edappally canal. The other facilities proposed in this building are a water quality testing laboratory, tidal fluctuation measurement unit, and CCTV control center connecting all the 3 control centers stations proposed along the three main canals. The building cost has been estimated, and lump sum provision added for other facilities. The total cost estimated is **INR 6 crores**. The abstract of the estimate is given in **Table 6.11** and the detailed costing included in **Annexure 6.1.11**.

Table 6.11: Abstract Cost of construction of SPV office building with testing lab

Description/Location	Amount (INR)
SPV office building with testing lab at Edappally Canal	₹ 6,00,00,000.00
Total	**₹ 6,00,00,000.00**

xii. **Construction of access roads to jetties and jetty terminals:** The access roads to the jetties are in a dilapidated stage and needs to be reconstructed to increase the ambience and to provide easy access. The total cost estimated is **INR 8.84 crores**.

The abstract of the estimate along with canal details is given in **Table 6.12** and the detailed costing included as **Annexure 6.1.12**.

Table 6.12: Abstract cost for construction of access roads to jetties / jetty terminals

Description/Canal	Amount (INR)
Edappally Canal	₹ 2,65,08,702.84
Thevara-Perandoor Canal	₹ 2,94,54,114.27
Thevara Canal	₹ 58,90,822.85
Chilavanoor Canal	₹ 2,65,08,702.84
Total	**₹ 8,83,62,342.80**

xiii. **Purchase of Vessels / Boats for navigation of passengers and tourism :** Based on the traffic survey results, the utility factors have been analyzed and reworked as regard to the speed to be maintained, type of boats required to cater to various demands of the public. Based on the results arrived from the traffic survey result, the number of boats required are estimated. The cost arrived based on the market rate is **INR 10 crores**.

The cost estimate is given in **Table 6.13** and the detailed costing included in **Annexure 6.1.13**.

Table 6.13: Abstract cost for purchase of vessels / boats for navigation

Type	Cost Header	Quantity	Amount (INR)
12m Catamaran (30 pax)	Luxury tourist (Phase1,2)	3	₹ 9,00,00,000.00
Support system	Software	1	₹ 40,00,000.00
	hardware	1	₹ 10,00,000.00
Wash, Traffic study	Studies	1	₹ 50,00,000.00
	Grand Total		**₹ 10,00,00,000.00**

xiv. **Navigational aids, Signages, Markers and Way finding signage, etc.**: Considering the canal cross section and requirements the navigation aids have been reworked along with numbers of signages, markers, way finding signages. The total cost estimated is **INR 2.47 crores**.

The abstract of the estimate is given in **Table 6.14** and the detailed costing included in **Annexure 6.1.14**.

Table 6.14: Abstract cost - Navigational aids, Signages, Markers and Way finding signage

Description/Canal	Amount (INR)
Edappally Canal	₹ 90,00,000.00
Thevara-Perandoor Canal	₹ 60,00,000.00
Thevara Canal	₹ 20,00,000.00
Chilavanoor Canal	₹ 60,00,000.00
Market Canal	₹ 17,00,000.00
Total	**₹ 2,47,00,000.00**

xv. **Miscellaneous purchase of goods (Solar Installations, EV chargers and electrical systems CCTV installation along canals) :** The total cost estimated is **INR 5 crores**. The abstract of the estimate canal wise is given in **Table 6.15** and the detailed costing included in **Annexure 6.1.15**.

Table 6.15: Abstract cost for Miscellaneous items

Description/Canal	Amount (INR)
Edappally Canal	₹ 1,70,00,000.00
Thevara-Perandoor Canal	₹ 1,00,00,000.00
Thevara Canal	₹ 60,00,000.00
Chilavanoor Canal	₹ 1,70,00,000.00
Total	**₹ 5,00,00,000.00**

6.2 Urban Regeneration

i. **Construction of sewer network (interceptor, pumping stations, manhole, etc.):** Sanitary sewer lines are proposed along both the canal banks to intercept the sewage load flowing into the main canal. The estimation of sewer load has been carried out on a catchment area basis considering all the sub-drains flowing into the main canals. The total estimated quantity after deducting the existing area served by sewer network is 30 MLD for projected population of 2051. It is proposed to transport the sewage flow by gravity-pumping system to the proposed STPs. Total length and size of pipes have been worked out as per CPHEEO guidelines for estimated sewage load from project catchment. The total cost estimated is **INR 161.83 crores**.

The abstract of the cost estimate along with canal details is given in **Table 6.16** and the detailed costing included in **Annexure 6.2.1a**.

Table 6.16: Abstract costs- Construction of sewer network

Description/Canal	Amount (INR)
Cost of Elamkulam Plant Network	₹ 62,90,77,190.01
Cost of Vennala Plant Network	₹ 45,94,30,267.67
Cost of Muttar Plant Network	₹ 13,74,30,942.99
Cost of Perandoor Plant Network	₹ 16,90,41,122.45
Cost of Puthukkalavattom Plant Network	₹ 22,33,50,690.19
Total	**₹ 1,61,83,30,213.31**

ii. **Construction of sewer network for households (interceptor, pumping stations, manhole, etc.)** Sanitary sewer lines are proposed for the households for the IURWTS catchment along both the canal banks to intercept the sewage load flowing into the main canal. The estimation of sewer load has been carried out for a total number of 60000 households. It is proposed to transport the sewage flow by gravity-pumping system to the proposed STPs. The total cost estimated is **INR 98.86 crores**. The abstract of the cost estimate along with canal details is given in **Table 6.17** and the detailed costing included in **Annexure 6.2.1b**.

Table 6.17: Abstract cost : Sewer network for households

Description/Canal	Amount (INR)
Cost of sewer Network for IURWTS catchment	₹ 98,86,42,107.82
Total	**₹ 98,86,42,107.82**

iii. **Sanitation facilities in catchment area including miscellaneous facilities**: In places where individual houses cannot be connected with proposed sewer network systems, the sanitation facilities like septic tanks and twin pits which are affordable options are proposed. During the implementation stage of the project, transitional sanitation facilities using bio-toilets are also considered along the canals. Community bio-toilets at every 500 m interval for the inhabitants staying nearby places where sewer works proposed to be implemented are included to support the project implementation. The total cost estimated is **INR 26.65 crores**.

The abstract of the estimate along with canal details is given in **Table 6.18** and the detailed costing included as **Annexure 6.2.2**.

Table 6.18: Abstract cost - Sanitation facilities in catchment area

Description/Canal	Amount (INR)
Edappally Canal	₹ 10,07,01,613.49
Thevara-Perandoor Canal	₹ 6,17,12,622.78
Thevara Canal	₹ 1,40,93,884.70
Chilavanoor Canal	₹ 8,08,11,398.13
Market Canal	₹ 92,05,670.84
Total	**₹ 26,65,25,189.96**

iv. **Sewage treatment plants (STPs):** The present proposal is to have 5 STP's. The NH-544 forms a ridge line cutting the catchment in the east-west direction. The wards falling on the southern side and the northern side catchments of the ridge of the 3 canals (Thevara-Perandoor (combined), Chilavanoor, and Edappally canals) was segregated. Based on the population projections estimated till 2051 the sewer loads were estimated for the catchment areas on the northern and southern side .The sewer load flow on southern side of Thevara- Perandoor and Chilavanoor catchments is proposed to be treated at Elamkulam STP and Sewer load on the southern side of Edappally catchment at Vennala STP. On the northern side sewer load from each of the 3 canals is proposed to be treated at Perandoor STP (T-P canal), Puthukkalavattom STP Chilavanoor) and Muttar STP (Edappally). The estimated cost including the O&M cost for 15 years is also estimated. The total cost estimated is **INR 101.96 crores**. The abstract of the estimate is given in **Table 6.19** and the detailed costing included in **Annexure 6.2.3**.

Table 6.19: Abstract cost estimates- Sewage treatment plants

Capital Cost of Sewerage Treatment Plants		
Sl. No	**Description/Canal**	**Amount (INR)**
1	Cost of Elamkulam Plant	₹ 22,73,30,000.00
2	Cost of Vennala Plant	₹ 21,39,96,666.67
3	Cost of Muttar Plant	₹ 5,85,99,333.33
4	Cost of Perandoor Plant	₹ 10,93,03,333.33
5	Cost of Puthukkalavattom Plant	₹ 9,38,63,333.33
	Total	**₹ 70,30,92,666.67**
Operation and Maintenance of STPs (15 years including 3 years of DLP)		
1	O&M Cost of Elamkulam Plant	₹ 10,21,20,000.00
2	O&M Cost of Vennala Plant	₹ 10,21,20,000.00
3	O&M Cost of Muttar Plant	₹ 2,04,24,000.00
4	O&M Cost of Perandoor Plant	₹ 5,10,60,000.00
5	O&M Cost of Puthukkalavattom Plant	₹ 4,08,48,000.00
	Total	**₹ 31,65,72,000.00**

v. **Solid waste management:** The solid waste generated in the catchment of the 5 canals has been estimated and the cost involved in collection of the solid waste through innovative methods is estimated. Kochi municipal corporation has already envisaged a proposal for converting the solid waste into energy at Brahmapuram, Kochi. The requirement of daily waste is 250 tons. The project catchment falls within corporation municipality and occupies nearly 50 percent of Kochi municipal corporation area. Hence rather than having a separate plant it is proposed to have a coordinated effort with KMC. The estimate cost for collection of solid waste for the initial 3-year period is estimated as **INR 3.83 crores**.

The abstract of the estimate is given in **Table 6.20** and the detailed costing included as **Annexure 6.2.4**.

Table 6.20: Abstract cost - Solid waste management

Description/Canal	Amount (INR)
Project canals	₹ 3,83,16,800.00
Total	**₹ 3,83,16,800.00**

6.3 Land Acquisition Cost: Canal oriented development and Urban regeneration

i. **Land Acquisition cost along the canal banks :** For maintaining the canal width as per village record and taking into consideration the flood mitigation and navigation requirement, the land area requirement is estimated along with the cost as per fair value rates of the GoK notification. The total land area estimated is **34.68 ha** and the total cost of land is **INR 404.99 crores**.

The abstract of the estimate is given in **Table 6.21** and the detailed costing included as **Annexure 6.3.1**.

Table 6.21: Abstract costs - Land Acquisition along the canal banks

Description/Canal	Amount (INR)
Edappally Canal	₹ 1,98,03,62,300.00
Thevara-Perandoor Canal	₹ 86,08,80,892.50
Thevara Canal	₹ 22,96,95,075.00
Chilavanoor Canal	₹ 94,87,18,575.00
Market Canal	₹ 3,02,94,000.00
Total	**₹ 4,04,99,50,842.50**

ii. **Access road for bridges and STPs:** The land area required for correcting the gradient of the access road is estimated as **2.22 ha.** and the estimated cost as per fair value of GOK is **INR 25.41 crores.** The abstract of the estimate is given in **Table 6.22** and the detailed costing included as **Annexure 6.3.2**.

Table 6.22: Abstract costs for Land Acquisition for access road to bridges

Description/Canal	Amount (INR)
Edappally Canal	₹ 12,75,15,937.50
Thevara-Perandoor Canal	₹ 6,89,07,375.00
Thevara Canal	₹ 32,13,000.00
Chilavanoor Canal	₹ 5,45,49,281.25
Total	**₹ 25,41,85,593.75**

iii. **Access road for jetty terminals:** The land area required for reconstruction of access roads to jetties/terminals is estimated as **0.6 ha.** and estimated cost as per fair value rates of GOK is **INR 6.87 crores**. The abstract of the estimates is given in **Table 6.23** and the detailed costing is included in **Annexure 6.3.3**.

Table 6.23: Abstract costs - Land Acquisition for access road for jetty/ terminals

Description/Canal	Amount (INR)
Edappally Canal	₹ 2,06,55,000.00
Thevara-Perandoor Canal	₹ 2,29,00,000.00
Thevara Canal	₹ 45,90,000.00
Chilavanoor Canal	₹ 2,05,55,000.00
Total	**₹ 6,87,00,000.00**

6.4 Specific Contracts and environmental monitoring

There are a few important canals adjoining the IURWTS Project command which needs to be restored in line with the works proposed under this project. In order to prepare a separate DPR for these projects a provision of Rs 2.50 crores is proposed under this project. During the project implementation stage in order to undertake the environmental monitoring a provision of 2.00 crores is proposed. An amount of 30 crores has also been demarcated for project management, specialized works like LIDAR survey, public awareness campaign / social awareness management etc. The total cost estimated for these three

subheads is **INR 34.50 crores**. The abstract of the cost estimate is given in **Table 6.24** and the detailed costing is included in **Annexure 6.4**.

Table 6.24: Abstract cost for Operation and Maintenance Specific Contracts

Sl. No.	Description	Amount (INR)
1	Specific Additional Contracts	₹ 2,50,00,000.00
2	Environmental monitoring (air, water, noise, etc.) lumpsum provision – 5 years	₹ 2,00,00,000.00
3	Project management cost, specialised work like LIDAR survey, public campaign/social awareness management	₹ 30,00,00,000.00
	Total Amount	**₹ 34,50,00,000.00**

6.5 Rehabilitation & Resettlement, Land Acquisition and Building Compensation

i. R&R - Building Construction Package - 7 blocks.
ii. Removal of utilities including railway bridges/culverts (to be handled by respective department).
iii. Land Acquisition cost.
iv. Buildings Compensation cost for PAP.
v. Buildings Compensation cost for PAF.

The total cost estimated is **INR 196.72 crores**.

The abstract of the cost estimates is given in **Table 6.24** and the detailed costing is presented in **Annexure 6.5.1** and **7.5.2** and the DPR submitted for R&R proposal is given as **Appendix Volume 1**.

Table 6.25: Abstract cost – R&R, Land Acquisition and Building Compensation

Description	Amount (INR)
R&R - Building Construction Package - 7 blocks	₹ 78,75,56,556.48
Removal of utilities including railway bridges/culverts and demolition	₹ 30,00,00,000.00
Land Acquisition cost - 7.73 acres (already acquired)	₹ 29,61,00,000.00
Buildings Compensation cost for PAP@104 Nos. full building loss @ INR 18.08 Lakhs	₹ 18,80,00,000.00

Description	Amount (INR)
Buildings Compensation cost for PAF @791 partial loss of building @INR 5 Lakh	₹ 39,55,00,000.00
Total	**₹ 196,72,00,000.00**

6.6 Development of Konthuruthy Canal (additional work)

Development of Konthuruthy canal consists of major activities such as deepening and widening of the existing canal, construction of road and foot bridges, shore protection and other miscellaneous activity. As this is an additional work only an approximate estimate has been provided for the development of this canal. The total cost estimated is **INR 34 crores.** The abstract of the cost estimates is given in **Table 6.26** and the detailed costing is presented in **Annexure 6.6**

Table 6.26: Abstract cost - Development of Konthuruthy canal

Description	Amount (Rs)
Development of Konthuruthy canal	₹ 34,00,00,000.00
Total	**₹ 34,00,00,000.00**

6.7 Summary of Cost Estimates

The cost summary of all the project components and activities is given in **Table 6.27**.

Table 6.27: Cost summary of project components /activities of IURWTS project

Sl. No	Description	Cost Estimates - Canal wise (Values in Rs Crores)					Total Amount
		Edappally canal	Thevara-Perandoor	Thevara canal	Chilavanoor Canal	Market canal	
1	**Canal Oriented Development**						
i	Cleaning and water hyacinth removal during preparatory and final phase	0.68	0.34	0.02	1.05	0.01	2.10
ii	Deepening of Canal Widening of Canal	10.31	9.17	1.30	12.26	0.69	33.73
iii	Shore Protection	29.77	55.15		53.56		138.48
iv	Reconstruction of roads along the canal		5.47	4.85			10.32
v	Construction of Road bridges	13.64	28.53	2.48	24.80		69.45
vi	Construction of Foot over / Pipeline bridges	2.10	6.30	0.70	6.30	0.70	16.10

Sl. No	Description	Cost Estimates - Canal wise (Values in Rs Crores)					Total Amount
		Edappally canal	Thevara-Perandoor	Thevara canal	Chilavanoor Canal	Market canal	
vii	Regulatory arrangements with automatic operations and pumping arrangements	10.00	10.00	0.00	10.00	0.00	30.00
viii	Construction of access road to road bridges	6.90	14.44	1.26	12.56	0.00	35.16
ix	Canal Beautification in canal banks with landscaping & promenade development	50.00	5.00				55.00
x	Construction of Jetties	3.00	3.33	0.67	3.00	0.00	10.00
	Construction of Terminal buildings						
xi	Construction of Corporate office of SPV with Operation Control Room and testing lab	6.00	0.00	0.00	0.00	0.00	6.00
xii	Construction of Access road to Jetties and Terminals	2.65	2.95	0.59	2.65	0.00	8.84
xiii	Purchase of Vessels / Boats for navigation of passengers and tourism.	10.00					10.00
xiv	Navigational aids (5 Canals)	0.60	0.40	0.10	0.40	0.10	2.47
	Signages, Markers and Way finding - Civil packages	0.30	0.20	0.10	0.20	0.07	
xv	Solar Installations	1.00	1.00	0.00	1.00	0.00	5.00
	EV chargers and electrical systems	0.70	0.00	0.60	0.70	0.00	
	Total - A	**147.65**	**143.22**	**12.70**	**129.86**	**1.66**	**432.65**
2	**Urban Regeneration**						
i(a)	Construction of Sewer network including interceptor, pumping stations, manholes	59.69	43.22		58.92		161.83
i(b)	Sewer networks for households	98.86					98.86
ii	Sanitation facilities in catchment area	10.07	6.17	1.41	8.08	0.92	26.65
iii (a)	Sewage Treatment Plants (5 Nos. of total 30 MLD) and its pumping systems	27.26	9.39		33.66		101.96
iii (b)	Operation & Maintenance 15 years - Sewage Treatment Plants 5 Nos.	12.25	4.08		15.32		
iv	Solid waste management *(To be handed over by Kochi Corporation)*	3.83					3.83
	Total - B	**211.96**	**62.86**	**1.41**	**115.98**	**0.92**	**393.13**
	Total (A+B)						**825.78**

Sl. No	Description	Cost Estimates - Canal wise (Values in Rs Crores)					Total Amount
		Edappally canal	Thevara-Perandoor	Thevara canal	Chilavanoor Canal	Market canal	
3	**Land Acquisition Cost: Canal Oriented Development**						
i	Land Acquisition Charges along canal banks	198.06	86.08	22.96	94.87	3.02	404.99
ii	Access road for bridges and additional STPs.	12.75	6.89	0.32	5.45	0	25.41
iii	Access road for jetty terminals	2.06	2.29	0.46	2.06	0.0	6.87
	Total - C	**212.87**	**95.26**	**23.74**	**102.38**	**3.02**	**437.27**
	Total (A+B+C)						**1263.05**
4	**Project management, specialised works, public campaign / social awareness management Environmental Monitoring & Specific Additional Contracts**						
i	Specific Additional Contracts	2.5					2.50
ii	Environmental Monitoring (Air, Noise, Water, etc) - for 5 years	2					2.00
iii	Project management cost, specialised work like LIDAR survey, public campaign/ social awareness management etc.	30					30.00
	Total - D						**34.50**
5	**Rehabilitation & Resettlement/Building Compensation including Land Acquisition**						
i	R&R - Building Construction Package - 7 blocks						78.76
ii	Land Acquisition cost - 7.73 acres (already acquired)						29.61
iii	Buildings Compensation cost for PAP@104 Nos. building @ Rs. 18.08 Lakh						18.80
iv	Buildings Compensation cost for PAF @791 building @Rs 5 Lakh						39.55
v	Removal of utilities including railway bridges/culverts *(to be handled by respective department)* and cross structure demolition						30.00
	Total - E						**196.72**
	Total (A+B+C+D+E)						**1494.27**

Sl. No	Description	Cost Estimates - Canal wise (Values in Rs Crores)					Total Amount
		Edappally canal	Thevara-Perandoor	Thevara canal	Chilavanoor Canal	Market canal	
6	**Development of Konthuruty Canal (Additional work)**	34					34
	Total -F						**34**
	Total (A+B+C+D+E+F)						**1528.27**

6.8 Phasing of Expenditure for IURWTS project

For cost benefit analysis estimation, the phasing of the capital expenditure has been considered in the ratio of 48:33:19 for canal-oriented development and 50:40:10 for the infrastructure development revenue stream models. It is assumed that the land acquisition cost to be utilized during the 1st year of project implementation. The year-wise phasing of these cost components is given in **Table 6.28**.

Table 6.28: Phasing of expenditure

Sl. No.	Components	Type of costs	Total cost (INR crores)	Phasing (INR crores)		
				Year 1	Year 2	Year 3
1	Canal oriented development and urban regeneration / Project Affected People	Land acquisition cost & Project Affected People	495.62	495.62	0.00	0.00
		Capital cost	825.78	396.37	272.51	156.90
2	Rehabilitation & resettlement / removal of bottlenecks/ specific projects	Land acquisition cost	29.61	29.61		
		Capital cost	177.26	85.08	58.50	33.68
	Ratio of capital phasing (48:33:19)	**Total for (1+2)**	**1528.27**	**1006.69**	**331.00**	**190.58**

CHAPTER 7

REVENUE STREAMS

7 REVENUE STREAMS

The IUWRTS Project aims to achieve better living conditions and tourism promotion in the canal catchments by focusing on canal-oriented transport development approach. Being a large environmentally sustainable infrastructure project, it is a capital-intensive project with a long gestation period. The project envisages connecting residents and businesses within 1000-meter distance on both sides of the COD to the sewerage network, boat jetties and parks.

As an inland transport, environment and public utility project, the revenues from the boat service and other canal-oriented activities will not be sufficient to make the project financially viable. Therefore, other revenue generating models such as Value Capture Financing (VCF) and Transit Oriented Development (TOD) will be explored. The VCF and TOD are methods of funding infrastructure improvements by recovering all or some of the increase in property value attributable to the public infrastructure investment.

The VCF is an approach which to enables States and city governments raise resources by tapping a share of increase in the value of land and other properties like buildings resulting from the public investments and policy initiatives, in the identified area of influence. In urban planning, a transit-oriented development (TOD) is a type of urban development that maximizes the amount of residential, business and leisure space within the walking distance of public transport. It promotes a symbiotic relationship between dense, compact urban form and public transport use. In doing so, TOD aims to increase public transport ridership by reducing the use of private cars and by promoting sustainable urban growth.

The following VCF framework is proposed for implementation in the IUWRTS covering an area of 1000 meters on both sides of the Canal Oriented Development (COD). The benefits accruing from the same may be transferred to the SPV undertaking this project.

7.1 Land value tax

Land value Tax is proposed on all properties (other than vacant land) in 1000-meter distance on both sides of the COD to capture property value appreciation ensuing from the project and to help stabilize property prices. An Additional Tax amounting to 200 % of the existing Land Tax is proposed to be imposed in 1000-meter distance from both sides of the COD of IURWTS. (**Table 7.1**)

Legislative amendment required: Amendment of Act 13 of 1961-Kerala Land Tax Act is required for Land value tax.

Table 7.1: Land Value Tax

Particulars	Current Value	Proposed Value
Land Value Tax	**Panchayats**- Rs. 5 per Are for land **Town panchayats and Municipalities** Rs. 10 per Are for land **Municipal Corporations** Rs. 20 per Are for land	**Panchayats** Rs. 15 per Are for land **Town panchayats and Municipalities** Rs. 30 per Are for land **Municipal Corporations** Rs. 60 per Are for land

7.2 Vacant Land Tax (VLT):

Currently, no Vacant Land Tax is levied in Kerala. Implementation of development projects will enhance the value of the vacant properties around the project. As part of VCF framework, a Vacant Land Tax is proposed on such lands in 1000 meter distance from the canal alignment. A new tax, namely Vacant Land Tax amounting to Rs.1000 per Are per annum is proposed to be imposed in 1000-meter distance on both sides of the COD project. This levy will be applicable to vacant land kept vacant without any construction or commercial activities. (**Table 7.2**)

Legislative amendment required: Amendment of Act 13 of 1961-Kerala Land Tax Act is required.

Table 7.2: Vacant Land Tax

Particulars	Current Value	Proposed Tax
Vacant Land Tax (VLT) - for land kept vacant without any construction including lands solely kept aside for parking	Nil	Rs.1000/- per are per annum, w.r.t vacant land as on 1st April of every year

7.3 Luxury tax (Property tax)

Currently, under the Kerala Building Tax Act, Luxury Tax is levied on residential buildings with built up area over and above the specified limit. An additional Luxury tax amounting to 50% of the existing rate is proposed to be imposed on the buildings having plinth area of more than 278.90 sq.m in 1000 meter distance on both sides of the COD. (**Table 7.3**)

Legislative amendment required: Amendment of Act 7 of 1975-Kerala Building Tax Act is required for luxury tax (property tax) .

Table 7.3: Luxury Tax (Property Tax)

Particulars	Current Value (After Budget 2020)		Proposed Value	
Luxury tax (Property Tax)	**Plinth Area Sq.** 278.9 - 464.5 464.5 - 696.75 696.75 – 929 > 929	**Rs/sq. m** Rs. 5,000 Rs. 7,500 Rs. 10,000 Rs. 12,500	**Plinth Area Sq.** 278.9-464.5 464.5-696.75 696.75–929 > 929	**Rs/sq. m** Rs 7,500 Rs 11,250 Rs 15,000 Rs 18,750

7.4 Development charges (Impact fees)

Currently, no development charges are levied. Development charges are proposed in the project area in order to link the development charge to the market value of land which will go up upon completion of the project. A onetime development charge as per table below is proposed to be imposed with respect to new commercial buildings in the 1000-meter distance on both sides of the COD. (**Table 7.4**)

Legislative amendment required: A new rule to be formulated in Kerala Municipal Building Rules (KMBR) and Kerala Panchayat Building Rules (KPBR) for Development Charges (Impact fees).

Table 7.4: Development charges

Particulars	Current Value	Proposed Value
Development Charges (Impact fees)	Nil	For commercial constructions including residential apartment constructions by builders, 3000 sq. ft to 5000 sq. ft -Rs.1,00,000/-Above 5000 sq. ft - Rs.1,00,000/- +Rs.5/sq. ft

7.5 Premium on relaxation of rules or additional FSI/FAR

A premium is proposed on relaxation of FAR rules to allow for additional development rights beyond the permissible limits within 1000 m on both sides of the canal alignment. The proposal is for sharing the FAR premium, i.e. for FAR above 2.5 and up to 4, 50% of the fee shall be shared with the local government body. (**Table 7.5**)

An additional premium for granting FAR higher than 4 in the 1000 m distance from the canal alignment, will be fully collected by the SPV.

Legislative amendment required: This will require amendment to Municipal Building Rules (KMBR) and Kerala Panchayat Building Rules (KPBR) for Premium on relaxation of rules or additional FSI/FAR.

Table 7.5: Premium on relaxation of rules

Particulars	Current Value	Proposed Value
Premium on relaxation of rules or additional FSI/FAR	Rate of additional FAR – Rs. 5000 per sqm for FAR beyond 2.5 to 4	50% share of FAR premium between FAR 2.5 to 4 to be assigned to IUWRTS SPV and 100% share of FAR premium beyond 4 at Rs.5000/- to be assigned to IUWRTS SPV.

7.6 Tax Increment Financing

The Fair value of the property could be revised and Additional Stamp Duty and Registration fees for property transactions could be charged for properties within the specified area to capture the land value appreciation ensuing from the COD. A revision of fair value of property in 1000 meters on both sides of the COD is proposed since the value of the said land will appreciate disproportionately vis-à-vis other area. The difference in the Stamp Duty / Registration charges based on the old value and new value shall be transferred to IUWRTS SPV. The proposal is to increase the fair value to 1.25 fold of the revised fair value as per the Budget 2020 and for passing of additional stamp duty and registration fees on account of increase in fair value to the SPV. (**Table 7.6**)

Legislative amendment required: No legislative amendment required. Notification under Kerala Stamp Act and amendment is required for passing of additional stamp duty and registration fees on account of increase in fair value.

Table 7.6: Fair value

Particulars	Current Value	Proposed Value
Fair Value	As notified by Govt	Fair value of the properties situated within a distance of 500 m of both sides of COD to be made 1.25-fold of the existing value (after increase as proposed in Budget 2020)

7.7 Sewerage network connection fee

The project envisages connecting the households and businesses to the Sewerage networks. A onetime connection charge of Rs1000-2000 is proposed for the residential, Rs2000-3000 for businesses and Rs3000-5000 for restaurants and industries in 1000 meters on both sides of the COD. An additional sewage cost of 20% of water bill shall be charged by SPV getting 15% during the free operation phase (5 Years) and 5% after free operation phase. (**Table 7.7**)

Table 7.7: Sewerage network connection fee

Particulars	Current Value	Proposed Value
Sewerage network connection fee	Nil	A onetime connection charge of: a) Rs. 1,000-2,000 for residential houses, depending upon the floor area b) Rs. 2,000- 3000 for businesses and c)Rs. 3000-5000 for hotels and industries. in 1000 meters on both sides of the COD.

7.8 Green surcharge on fuel

An environmental surcharge or Green surcharge on fuel is proposed to be imposed in the Greater Kochi Agglomeration Area on petrol and diesel. This would encourage the use of public transports and reduce the use of environmental pollutant fossil fuel and to limit the number of old vehicles in the city, thereby reducing the air pollution. It will also work as an incentive for the commuters to use public transport. It is proposed to impose a Green surcharge as 25 paise per liter of petrol and 40 paise per liter of diesel in the Greater Kochi Agglomeration area. (**Table 7.8**)

Legislative amendment required : New section to be inserted in Kerala surcharge on Taxes Act, 1957, for levy of surcharge on Tax on petroleum products.

Table 7.8: Green surcharge on fuel

Particulars	Current Value	Proposed Value
Green Surcharge on fuel	Nil	25 paise per litre of petrol, 40 paise per litre of diesel recommended across Greater Kochi Agglomeration Area

7.9 Surcharges on Private Vehicle Tax

A surcharge of 10% on the vehicle tax for private vehicles registered in the Greater Kochi Agglomeration area is proposed for limiting the use of private vehicles other than EVs and encourage migration to public transport. (**Table 7.9**)

Legislative amendment required : New section to be inserted in Kerala surcharge on Taxes Act, 1957, for levy of surcharge on Tax on Motor Vehicles.

Table 7.9: Surcharge on Private vehicle tax

Particulars	Current Value	Proposed Value
Surcharges on Private Vehicle Tax other than EV	Nil	10% green surcharge on existing Tax across the Greater Kochi Agglomeration area

CHAPTER 8

INVESTMENT CRITERIA & COST BENEFIT ANALYSIS

8 INVESTMENT CRITERIA & COST BENEFIT ANALYSIS

The cost benefit analysis is an important tool to assess the economic viability of any proposed project and help in seeking funding from financial institutions. It aims to ensure that how the resources are allocated, and benefits accrued efficiently and how the proposed investments will help in terms of overall benefits to the area and the welfare of the people.

All resource inputs used by a project have an opportunity cost because, without the project, they could create value elsewhere in the economy. An economically viable project requires that:

1. It represents the least-cost or most efficient option to achieve the intended project outcomes.
2. It generates an economic surplus above its opportunity cost.
3. It will have sufficient funds and the necessary institutional structure for successful implementation and operation and maintenance.

Financial evaluation is carried out from the investment return perspective of the project and considers incremental cash flows (both revenues and costs) generated by the project. The purpose of financial evaluation is to assess the ability of the project to generate adequate incremental cash flows to recover its financial costs (capital and recurrent costs) without external support.

Both economic analysis and financial evaluation involve identification of project cost and benefits during the years in which they occur and converting all future cash flows to their present value using the technique of discounting to reflect the time value of money. Both analyses generate net present value (NPV) and internal rate of return (IRR) indicators, termed economic NPV (ENPV) and economic IRR (EIRR) in the case of economic analysis and financial NPV (FNPV) and financial IRR (FIRR) in the case of financial evaluation.

The financial analysis appraises the project in terms of return on investment while the economic analysis appraises the project in terms of contribution to the social and economic welfare of the project area. Economic and financial analysis along with sensitivity analysis has been undertaken for major project components (Canal and Canal bank development and Urban regeneration) of IURWTS Project and presented in this chapter. These project components are shown in **Table 8.1**.

In order to make the project financially viable, various revenue generating components have been included as part of the project. These include operation of boat services, canal side advertisement, canal-oriented development (COD) by way of canal beautification, regeneration of areas in the immediate vicinity of canals.

Table 8.1: Components of IURWTS project

Project Component for financing	Sub-projects
Canal Oriented Development	A. Canal Oriented Development and Urban regeneration

The financial viability analysis has accordingly been carried out based on this configuration. The possible concession period for the project to be arrived is based on the return offered by the project (for commercial development) in terms of FIRR for the time interval considered.

Table 8.2: Year-wise Investment

Sl. No.	Activities	Amount (INR in crores)			
		Year 1	Year 2	Year 3	Total
1	Land acquisition – COD (1 year) (Progress 100%)	437.27	-	-	₹437.27
2	Rehabilitation & Resettlement/building compensation and utility shifting	196.72	-	-	₹196.72
3	Canal development (3 years) (% Progress 48: 33: 19)	207.67	142.77	82.02	₹432.65
5	Urban Regeneration (3 years) (% Progress 48: 33: 19)	188.70	129.73	74.69	₹393.13
	Total	**1030.36**	**272.50**	**156.71**	₹1459.77
6	Specific contracts, Project Management cost, Social awareness management etc.	16.56	11.39	6.56	₹34.5
	Grand total	**1046.92**	**283.89**	**163.27**	**₹ 1494.27**
	Percentage	**70.1%**	**18.99%**	**10.9%**	**100%**
	Development of Konthuruthy Canal (Additional work)				**₹34.00**
	Grand total				**₹ 1528.27**

Source of finance

KMRL being the Special purpose vehicle (SPV) for this project will seek funds from Kerala Infrastructure Investment Fund Board (KIIFB) to provide a loan of INR **1528.27** crores to help finance the following investment components of the project:

- Cost of civil works, goods procurement, operation, and maintenance cost.
- Resettlement and rehabilitation cost.
- Land acquisition cost for all works including infrastructure development procurement.
- Utility shifting cost.

The Project Executing Agency (PEA/SPV) will explore other funding modes including private investment, Public Private Partnership (PPP), Build Operate and Transfer (BOT) etc. to finance the commercially viable revenue generating subprojects, components, and activities. Investment summits and roadshows would be held targeting the prospective investors, chamber of commerce and federations, NRIs investment forums etc. The various sources considered by SPV for financing are shown in **Table 8.3**.

Table 8.3: Sources of financing

Sl. No.	Source of financing	Amount (INR in crores)
A	**Kerala Infrastructure Investment Fund Board (KIIFB)**	
1	Canal Oriented Development and Urban Regeneration - Cost of civil works, goods procurement.	₹633.99
2	Resettlement and rehabilitation cost/building compensation	₹166.72
3	Land acquisition cost for all works (excluding land for revenue streams)	₹437.27
4	Utility shifting cost	₹30
5	Project Specific contracts, Project Management cost, Social awareness management etc	₹34.5
6	**Total**	**₹ 1494.27**
	Development of Konthuruthy Canal (Additional work)	**₹ 34.00**
	Grand total	**₹ 1528.27**

8.1 Canal Oriented Development and Urban Regeneration

The canal-oriented development (COD) and urban regeneration (UR) are the two major sub-projects that is proposed for investment to improve the inland water transport and sanitation facilities in the project canal command.

8.1.1 Project Cost

The cost for the project consists of two major components:

- Capital cost.
- Operation and maintenance cost.

a) Capital Cost

The capital costs considered for the analysis comprise capital investment, which includes civil works, development of canals, construction of jetties, purchase of boats, land acquisition, resettlement and rehabilitation, utility shifting, operation and maintenance and environmental and social safeguard compliance, taxes and duties, project management costs and physical contingencies. The detailed cost estimate is given in **Chapter 6** (Financial Estimates and Cost Projections). The summary of cost estimate is given **Table 8.4**.

Table 8.4: Summary of cost estimate – Canal Oriented Development

Sl. No.	Description	Amount (INR in crores)
1	Canal oriented development	₹432.65
2	Urban regeneration	₹ 393.13
3	Land acquisition charges for COD	₹ 437.27
4	Rehabilitation & resettlement/building compensation and utility shifting	₹ 196.72
	Subtotal - COD	**1459.77**
5	Project specific contracts	34.5
	Total	**1494.27**
6	Interest during construction[1]	404.14
7	Centage cost	30
	Total	**1898.41**

[1]*Interest @12% has been provided for 60% of the cumulative projected investment for Year 1 & 2 and 90% of the Year 3 (**Table A.3**).*

b) Operation and Maintenance (O&M) Cost

O&M costs are recurring costs, comprising routine operation and maintenance components. These include the salaries and wages paid to the employees, the cost of utilities such as electricity, water, repairs and maintenance, insurance etc. In order to execute and operate the project, land acquisition, development of canals, operate and maintain the boats, a permanent full-time team consisting of one Director, one Deputy Directors five Technical officers/ Information/ accounts and administrative officers, five Technical/Accounts Assistants and eighty boat crews will have to be employed. Additional support staff including crews, cleaners, plumbers, electricians, security guards etc. will be employed upon completion of the project. Apart from the staff cost, miscellaneous expenditure like electricity, stationery, office maintenance etc. will be incurred during the project implementation period and operating period as shown in **Table 8.5**. Additionally, the resettlement and rehabilitation center and park will employ 58

staff as given in the staff estimate **Table 8.6**. To account for these expenditures, yearly provision of INR 5.44 crores has been provided in the first year.

Table 8.5: Operation and maintenance cost

Sl. No.	Item of expenditure	Nos.	Average rate/Month (INR)	Total /year (INR)
	For the entire project period			
	I. FIXED COST			
	SALARIES & WAGES			
1	Director	1	1,00,000	12,00,000
2	Deputy Director	1	70,000	8,40,000
3	Technical/ Account officers	5	40,000	24,00,000
4	Technical Assistants	5	25,000	15,00,000
5	Technical Assistant / crew	80	25,000	2,40,00,000
6	Securities	8	20,000	19,20,000
7	Sweepers	8	15,000	14,40,000
8	Gardner	10	15,000	18,00,000
9	Electrician	4	15,000	7,20,000
	Total staff cost	**122**		**3,58,20,000**
	Office Maintenance			
10	Miscellaneous expenses		20,000	2,40,000
	Total/Year (INR in crore)			**3.61**
	II. VARIABLE COST (Fuel charges)			
1	No. of boats	3		
2	Fuel intake per day per boat	10		
3	Fuel rate per litre Rs	75		
	Total fuel charges / year (300 days) (INR in crores)			**0.07**
	Grand total / year (INR in crores)			**3.67**

Table 8.6: Operation & maintenance cost - Resettlement & Rehabilitation

Sl. No.	Title	No of staff	Monthly salary (INR)	Annual (INR)
1	Manager	1	30,000	30,000
2	Block supervisors	5	20,000	1,00,000
3	Civil supervisor	2	20,000	40,000
4	Electrician	5	18,000	90,000
5	Plumbers	5	18,000	90,000
6	Gardeners	10	12,000	1,20,000
7	Cleaners (5x6)	30	10,000	3,00,000
	Total staff cost	**58**		**7,70,000**
	INR in crores			**0.08**
8	Miscellaneous expenses		20,000	2,40,000
	INR in crores			0.02
	Total cost (INR in crores)			**0.10**

Maintenance cost

Yearly maintenance cost for the canal-oriented developments including jetties and access roads have been provided at the rate of 2% of Canal oriented development costs and 3% for Urban regeneration cost. In the case of equipment (boats) the maintenance cost is taken at 4% of the equipment cost.

Depreciation and amortization

As per assumption, the entire construction or project cost will be amortized equally over the operation period in order to provide for its depreciation. The project depreciation has been factored into allow for BOT procurement (by either government and/or private operator), since the canal oriented development facility has to be returned to Government at the expiry of concession period at zero cost and as such the project should reflect zero value with the project company at the time of transfer. As the facility shall remain at the end of project period for further commercial use, after providing for value appreciation of the land acquisition and development cost at the rate of 8% per annum in the first 10 years and 4% thereafter and full depreciation for the equipment over a period of 25 years, the remaining project cost is credited as project benefit (residual value) at the end year.

Inflation and Indexation

All costs and revenues have been priced at current price for the base year (2019-2020). Based on the detailed analysis of past trend and projection of future trend for WPI, 6% inflation has been factored for calculation future revenue and expenditures.

8.1.2 Benefits and revenue

It is expected that the canal-oriented development will result in the following benefits which are elaborated in detail:

Financial

1. Operation of passenger and tourist boat service.
2. Billboards and advertisement on canal side.
3. Leasing of commercial space at jetties and parks (Rental from shops and kiosks).
4. Cycle renting.
5. Fishing rods renting.
6. Parking fee.

Economic

7. Savings in business, commercial and personal opportunity cost.
8. Benefit from new job creation.
9. Benefit from savings in healthcare.

Seasonal and weekend festive activities, including multi-state food courts and cultural activities may be organized to optimize the income from the above revenue streams.

1. Revenue from operation of passenger and tourist boats

The main source of operating revenue will be operation of passenger and tourist boats in the regenerated canals. Three regenerated canals (Edappally, Chilavanoor, and Thevara- Perandoor} will be operational for passenger and tourist boat services. It is estimated that 3 passenger boats will be launched as mentioned in **Chapter 3** (Functional Design) **and Chapter 4 (**Engineering Design). It is expected that the passenger boats will have a minimum charge of INR 8/km and additional fare of INR 0.75/km. Assuming a 50% occupancy rate, it is estimated that the boat service will contribute INR 2.5 crores of revenue in the first year of operation. Details of the estimate is given in **Table 8.7**. It is expected that fare will be increased by 6% annually and the number of passengers by 5% for the first ten years.

Table 8.7: Revenue from operation of boat service

Sl. No.	Description	Canals				Total
		Edappally	Chilavanoor	Thevara-Perandoor	Market	
	Passenger boats					
1	Number of boats	1	1	1		3
2	Passenger demand/hr	379	572	614		

Sl. No.	Description	Canals				Total
		Edappally	Chilavanoor	Thevara-Perandoor	Market	
3	Number of passengers expected per day	320	320	320		960
4	Minimum fare (INR)	50.00	50.00	50.00		
5	Additional fare per passenger per km (INR)	0.75	0.75	0.75		
6	Total fare collection per day (INR)	28,000	28,000	28,000		84,000
	Total revenue per year (INR in crores; 300 days)	0.8	0.8	0.8		2.5
	Annual revenue discounted for 50% occupancy	0.42	0.42	0.42		1.26

2. Billboards and advertisement revenue

The second main source of revenue is from the advertisement hoardings to be installed on the both sides of the canals. One billboard will be installed in every 20-meter distance along both sides of the canals. It is expected that the billboards could be leased out for average rental of INR 1,200 per sqm per month. The total expected revenue from the billboards in the base year will be INR 8.38.in the first year. It is assumed that the charges will be increased by 6% annually, due to improved occupancy rate, inflation adjustments and cost escalation. Details of the estimate is given in **Table 8.8**.

Table 8.8: Revenue generation from advertisement

Sl. No.	Description	Canals				Total
		Edappally	Chilavanoor	Thevara-Perandoor	Market	
1	**Boats**					
	Number of boats	1	1	1		3
	Area available (sq. m) @ 5 sq. m per boat	5	5	5		
	Revenue per sq. m area/month (INR)	375	375	375		
	Total revenue per year (INR in Lakhs)	**0.23**	**0.23**	**0.23**		**0.69**
2	**Boat Jetties**					
	Number of jetties	9	9	12		
	Area available (sq. m) @ 40 per jetty	360	360	480		
	Revenue per sq. m area/month (Rs)	750	750	750		
	Total revenue per year (INR in Lakhs)	**32.4**	**32.4**	**43.2**		**108**
3	**Canal bank billboards**					
	Length of canals	11.23	11.15	9.88	0.664	

Sl. No.	Description	Canals				Total
		Edappally	Chilavanoor	Thevara-Perandoor	Market	
	Area available (sq. m) @ 160 per/km	1,784	1,763	1,800		
	Revenue per sq. m area/month (INR)	1,200	1,200	1,200		
	Total revenue per year (INR in Lakhs)	**227.64**	**256.90**	**258.74**		**743.27**
	Total revenue per year (INR in crores)	**2.60**	**2.90**	**3.02**		**8.52**

3. Rental from shops and kiosks

One shop space of 9m^2 will be provided in every 100-meter distance on both sides of the three canals (Edappally, Chilavanoor and Thevara Perandoor) and there will be a total of 300 kiosks in 5 km of canal sides with boat service. It is expected that each shop space could be rented for INR 4,000 per month. This will fetch annual rental income of INR 1.44 crores in the first year of operation. It is assumed that the charges will be increased by 6% annually to provide for inflation adjustments and cost escalation. Details of the estimate is given in **Table 8.9**.

Table 8.9: Revenue from renting of shops and kiosks

Sl. No.	Description	Canals				Total
		Edappally	Chilavanoor	Thevara-Perandoor	Market	
1	Length of canals	11.23	11.15	9.88	0.664	
2	Boating area	10	10	10		
3	Number of Kiosks (1 per 100 meters on both sides, 20/km)	200	200	200		
4	Ave. rent per kiosk/month (INR)	4,000	4,000	4,000		
	Total revenue per year (INR in crores)	**0.96**	**0.96**	**0.96**		**2.88**

4. Revenue from cycle hiring

Cycling tracks will be provided on both sides of the canals and total 40 cycle hiring points will be installed with 5 cycles in each point. The cycle tracks and cycles will be offered to the public at an affordable cost for using for sporting and recreational activities. It is expected that a cycle could be rented for INR 50/ hr. for average 4 hr./day for 250 days/year. The estimated annual revenue from the cycle renting is INR 2.40 crores in the first year of operation. It is assumed that the charges will be increased by 6% annually to provide for inflation adjustments and cost escalation. Details of the estimate is given in **Table 8.10**.

Table 8.10: Revenue from cycle hiring

S. No.	Description	Canals				Total
		Edappally	Chilavanoor	Thevara-Perandoor	Market	
1	Length of canals	11.23	11.15	9.88	0.664	
2	Boating area	5.00	5.00	5.00		
3	1 per 250 meters on both sides, 8/km	80	80	80		
4	No. of cycles per point	20	20	20		
5	Rate per hour (INR)	100	100	100		
6	Average daily usage (Hr)	4	4	4		
7	No. of days a year	250	250	250		
	Total revenue per year (INR in crores)	**16.00**	**16.00**	**16.00**		**48.00**
	Annual revenue discounted for 80% usage	**12.80**	**12.80**	**12.80**		**38.40**

5. Revenue from fishing points

There will be designated fishing points along the canal sides where public could hire fishing rods. Ten fishing points with 10 rods each will be provided on each side of the canals. It is expected that the fishing rods could be rented for INR 50/ hr. for average 4 hr. daily for 250 days/year. Assuming a 60% usage rate, the estimated annual revenue from fishing rod hiring is INR 1.8 crores in the first year. It is assumed that the charges will be increased by 6% annually to provide for inflation adjustments and cost escalation. Details of the estimate is given in **Table 8.11.**

Table 8.11: Revenue from fishing points

Sl. No.	Description	Canals				Total
		Edappally	Chilavanoor	Thevara-Perandoor	Market	
1	Length of canals	11.23	11.15	9.88	0.664	
2	Boating area	10	10	10		
3	Number of fishing points	20	20	20		
4	Number of fishing rods per point	20	20	20		
5	Rate per hour (INR)	100	100	100		
6	Average daily usage (Hr)	4	4	4		
7	No. of days a year	250	250	250		
	Total revenue per year (INR in crores)	**4.00**	**4.00**	**4.00**		**12**
	Annual revenue discounted for 60% usage	**2.40**	**2.40**	**2.40**		**7.20**

6. Parking fee

Paid parking area with 20 lots each will be provided in every 500-meter distance (40 per km) on both sides of three canals. It is expected that the parking space will be used for 6 hrs. daily at INR 20/hr. for 300 days a year. Assuming 80% usage rate, the estimated annual parking revenue is INR 3.46 crores in the first year. It is assumed that the charges will be increased by 6% annually to provide for inflation adjustments and cost escalation. Details of the estimate is given in **Table 8.12**.

Table 8.12: Revenue from parking fee

Sl. No.	Description	Canals				Total
		Edappally	Chilavanoor	Thevara-Perandoor	Market	
1	Length of canals	11.23	11.15	9.88	0.664	
2	Boating area	5.00	5.00	5.00		
3	Number of parking lots/km (20 per 500 m)	40	40	40		
4	Total number of parking lots	400	400	400		
5	Rate per hour (INR)	30	30	30		
6	Average daily usage (Hr)	6	6	6		
7	No. of days a year	300	300	300		
	Total revenue per year (INR in crores)	**2.16**	**2.16**	**2.16**		**6.48**
	Annual revenue discounted for 80% occupancy	**1.73**	**1.73**	**1.73**	**-**	**5.18**

7. Savings in business, commercial and personal opportunity cost

The main objective of the project is to prevent water clogging and flooding in the catchment area of the canals. This will result in substantial indirect economic and financial benefits to the businesses and individuals in terms of savings in business, commercial and personal cost. The business will benefit on account of savings in sales, profit, working days, productivity, loss of business, stock-in-trade, repairs and maintenance of vehicles, furniture and equipment, damages to household equipment, lost man-days etc. The prevention of flooding will ensure smooth functioning of the transport operators such as buses, taxies, autos, rail, metro rail and commercial vehicles which will prevent their revenue losses. The general public will save their possible loss in working days and earnings. Though it is difficult to measure such savings in monitory terms, it is assumed that at least 45,000 enterprises and individuals will save on average INR 75,000 a year. The expected savings in the first year is INR 337.50 crores and will be increased by 6% annually to provide for inflation adjustments and cost escalation. Details of the estimate is given in **Table 8.13**.

Table 8.13: Savings in business, commercial and personal opportunity cost

Sl. No	Description	Canals				Total
		Edappally	Chilavanoor	Thevara-Perandoor	Market	
1	Length of canals	11.23	11.15	9.88	0.664	
2	Number of beneficiaries (business & individuals)	15,000	12,000	10,000	8,000	45,000
3	Savings per business/individuals	75,000	75,000	75,000	75,000	
	Total revenue per year (INR in crores)	**112.50**	**90.00**	**75.00**	**60.00**	**337.50**

8. Benefit from savings in healthcare

The clearing of canals will improve the quality of water and air in the catchment area and the health conditions of the people living around. It is assumed by Antea Group that there are nearly about 1,13,000 people living in the area and improved living conditions could save INR 3,000 per resident/ year on account of cost of medicine and hospitalization. The estimated savings in the first year is INR 33.90 crores which will be increased by 6% every year. Details of the estimate is given in **Table 8.14**.

Table 8.14: Savings in health care

Sl. No.	Description	Canals				Total
		Edappally	Chilavanoor	Thevara-Perandoor	Market	
1	Length of canals, km	11.23	11.15	9.88	0.664	
2	No. of people in the catchment area	38,000	30,000	25,000	20,000	1,13,000
3	Savings in medical expense/ individual/ year (INR)	3,000	3,000	3,000	3,000	
	Total revenue per year (INR in crores)	**11.40**	**9.00**	**7.50**	**6.00**	**33.90**

9. Additional employment

As indicated in **Table 8.5** and **8.6**, it is expected that the project will require at least 180 direct fulltime staff on monthly salary basis at a total payroll cost of INR 3.7 crores in the first year. It is assumed that the salary will be increased by 6% annually.

8.2 Results of the Economic and Financial Analysis

This analysis has taken into account only the direct economic benefit ensuing from the project (**Table 8.15**).

Table 8.15: Economic and Financial Returns – Summary (INR in crores)

Description	Cost (INR in crores)
Investment cost	**1,434.21**
Interest during construction*	404.14
Centage cost	30
Total cost	**1,898.41**
ERR	26.41%
IRR	5.24%

**Assuming that the project is fully financed by borrowed fund*

The EIRR and FIRR of the project need to be compared with cost of capital for taking investment decision. The ERR and IRR of the component are 26.41% and 5.24% respectively (**Table 8.17**). Assuming that the entire project will be financed by borrowed fund at a financing cost of 12%, the IRR is well below the cost of capital and the project will experience funding deficit for its sustainable operation. However, the ERR of the project is much higher than 12%. Given the changing climate conditions, heavy rain and repeating flood situation, the project should consider the ensuing climatic condition, environment, economic and social benefits. If the project investment cost is financed by borrowed fund, instead of government budgetary allocation, commercial activities need to be developed around the project, using the developed land and facilities for business and commercial purposes.

8.3 Sensitivity analysis of economic and financial analysis

The economic and financial analysis have been estimated assuming a normal economic condition for the project period under consideration. However, the actual future situation might differ due to various risk factors and favorable or unfavorable economic or climate conditions which are unpredictable. Therefore, a sensitivity analysis has been carried out to assess the ultimate project economic outcome if the following conditions occur:

i. Escalation in project cost by 15%.
ii. Decrease in project benefit by 15%.
iii. Both of the above.

The results of the sensitivity analysis for the above scenarios for different project periods is given in **Table 8.16**. The EIRR for the project ranges from 19% to 24% for a 15 years project period, between 21 % to 26% for 20 years and 21.6 % to 26.4% for 25 years. Similarly, the FIRR ranges from -11% to -7 % for 15-years period, between -5 % to -2 % for 20 years and 3.6 % to 5.2 % for 25 years.

Table 8.16: Sensitivity Analysis of the Project Cost and Revenue

Sl. No.	Scenario	Rate of ERR & IRR for project period (years)					
		15 Years		20 Years		25 Years	
		EIRR	FIRR	EIRR	FIRR	EIRR	FIRR
1	Normal	24.0%	-7.0%	26.0%	-2.0%	26.4%	5.2%
2	15% increase in project cost	22.0%	-8.0%	23.0%	-3.0%	24.1%	4.5%
3	15% decrease in benefits	21.0%	-9.0%	23.0%	-4.0%	23.6%	4.3%
4	15% increase in cost and 15% decrease in benefits	19.0%	-11.0%	21.0%	-5.0%	21.6%	3.6%

8.4 Key assumptions

i. The estimate of economic and financial benefits followed a very conservative approach. The economic and financial internal rate of return (EIRR/FIRR) and cost-benefit ratio are estimated for 25 years.

ii. The salvage value of the project has been calculated after providing for value appreciation of the land acquisition and development cost at the rate of 8% per annum in the first 10 years and 4% thereafter and full depreciation for the equipment over a period of 25 years.

iii. As the investment cost to the entity will be including taxes and duties, for calculating the EIRR, the cost elements of project are estimated in financial terms at market prices without converting into Economic cost through multiplying with the Standard Conversion Factor (SCF).

iv. The project does not envisage any import of equipment and therefore no provision has been made for forex fluctuation.

v. Excluded costs: Post project management (operation and maintenance for 5 years for Canal oriented development), Environmental Monitoring (Air, Noise, Water, etc.) for 5 years and financing charges during implementation years have been excluded for economic and financial analysis. The majority of project management costs are for organizational structure and capacity development.

vi. Maintenance cost: Yearly maintenance cost for the developments, buildings and other items have been provided at the rate of 2% of Canal oriented development costs and 3% for Urban regeneration cost. In the case of equipment (boats) the maintenance cost is taken at 4% of the equipment cost.

Table 8.17: ERR & FIRR for Canal Oriented Development

Year	Cost of Development	Canal maintenance cost	Boats maintenance cost	Operational cost	Total Cost	Boat service	Advertisement	Kiosk rent	Cycle hiring	Fishing area	Parking fees	Additional Employment	Savings in & business personal loss	Benefit from savings in Healthcare	Total	Net & economic financial benefits	Financial Net benefits
2020	(703)			(1.93)	(704.77)							1.93			1.93	(703)	-704.77
2021	(483)			(2.04)	(485.25)							2.04			2.04	(483)	-485.25
2022	(278)			(2.16)	(280.37)							2.16			2.16	(278.21)	-280.37
2023		(20.15)	(0.80)	(3.67)	(24.62)	1.26	8.52	2.88	38.40	7.20	5.18	3.66	337.50	33.90	438.50	413.88	38.82
2024		(21.36)	(0.85)	(3.89)	(26.10)	1.40	9.03	3.05	40.70	7.63	5.50	3.89	357.75	35.93	464.89	438.79	41.21
2025		(22.64)	(0.90)	(4.13)	(27.67)	1.55	9.57	3.24	43.15	8.09	5.82	4.13	379.22	38.09	492.85	465.19	43.75
2026		(24.00)	(0.95)	(4.38)	(29.33)	1.72	10.15	3.43	45.74	8.58	6.17	4.38	401.97	40.38	522.50	493.18	46.46
2027		(25.44)	(1.01)	(4.64)	(31.09)	1.91	10.76	3.64	48.48	9.09	6.54	4.64	426.09	42.80	553.94	522.85	49.33
2028		(26.97)	(1.07)	(4.92)	(32.95)	2.12	11.40	3.85	51.39	9.64	6.94	4.92	451.65	45.37	587.27	554.32	52.39
2029		(28.58)	(1.13)	(5.21)	(34.93)	2.36	12.09	4.09	54.47	10.21	7.35	5.21	478.75	48.09	622.61	587.69	55.64
2030		(30.30)	(1.20)	(5.52)	(37.02)	2.62	12.81	4.33	57.74	10.83	7.79	5.52	507.48	50.97	660.09	623.06	59.09
2031		(32.12)	(1.28)	(5.86)	(39.25)	2.90	13.58	4.59	61.20	11.48	8.26	5.86	537.92	54.03	699.82	660.58	62.77
2032		(34.04)	(1.35)	(6.21)	(41.60)	3.22	14.39	4.87	64.88	12.16	8.76	6.21	570.20	57.27	741.96	700.36	66.68
2033		(36.09)	(1.43)	(6.58)	(44.10)	3.42	15.26	5.16	68.77	12.89	9.28	6.58	604.41	60.71	786.48	742.38	70.68
2034		(38.25)	(1.52)	(6.97)	(46.74)	3.62	16.17	5.47	72.89	13.67	9.84	6.97	640.68	64.35	833.67	786.92	74.92
2035		(40.55)	(1.61)	(7.39)	(49.55)	3.84	17.14	5.80	77.27	14.49	10.43	7.39	679.12	68.21	883.69	834.14	79.42
2036		(42.98)	(1.71)	(7.84)	(52.52)	4.07	18.17	6.14	81.90	15.36	11.06	7.84	719.86	72.31	936.71	884.19	84.18
2037		(45.56)	(1.81)	(8.31)	(55.67)	4.31	19.26	6.51	86.82	16.28	11.72	8.31	763.06	76.64	992.91	937.24	89.23
2038		(48.29)	(1.92)	(8.80)	(59.01)	4.57	20.42	6.90	92.03	17.26	12.42	8.80	808.84	81.24	1,052.48	993.47	94.59
2039		(51.19)	(2.03)	(9.33)	(62.55)	4.85	21.64	7.32	97.55	18.29	13.17	9.33	857.37	86.12	1,115.63	1,053.08	100.26
2040		(54.26)	(2.15)	(9.89)	(66.31)	5.14	22.94	7.76	103.40	19.39	13.96	9.89	908.81	91.28	1,182.57	1,116.27	106.28
2041		(57.51)	(2.28)	(10.49)	(70.28)	5.45	24.32	8.22	109.61	20.55	14.80	10.49	963.34	96.76	1,253.53	1,183.24	112.65
2042		(60.97)	(2.42)	(11.11)	(74.50)	5.77	25.78	8.71	116.18	21.78	15.68	11.11	1,021.14	102.57	1,328.74	1,254.24	119.41
2043		(64.62)	(2.57)	(11.78)	(78.97)	6.12	27.32	9.24	123.15	23.09	16.63	11.78	1,082.41	108.72	1,408.46	1,329.49	126.58
2044		(68.50)	(2.72)	(12.49)	(83.71)	6.49	28.96	9.79	130.54	24.48	17.62	12.49	1,147.35	115.25	1,492.97	1,409.26	134.17
2045		(72.61)	(2.88)	(13.24)	(88.73)	6.87	30.70	10.38	138.38	25.95	18.68	13.24	1,216.19	122.16	1,582.55	1,493.81	142.22
2046		(76.97)	(3.06)	(14.03)	(94.06)	7.29	32.54	11.00	146.68	27.50	19.80	14.03	1,289.17	129.49	1,677.50	1,583.44	150.76
2047		(81.59)	(3.24)	(14.87)	(99.70)	7.72	34.49	11.66	155.48	29.15	20.99	14.87	1,366.52	137.26	1,778.15	1,678.45	159.80
2048	1,914.00	(86.48)	(3.43)	(15.77)	1,808.32	8.19	36.56	12.36	164.81	30.90	22.25	15.77	1,448.51	145.49	1,884.84	3,693.15	2,083.39
Total	450	(1,192)	(47)	(223)	(1,013.04)	109	504	170	2,272	426	307	223	19,965	2,005	25,981	24,968	22,740
															EIRR/FIRR	**26.41**	**5.24**

CHAPTER 9

RISK ASSESSMENT AND MITIGATION MEASURES

9 RISK ASSESSMENT AND MITIGATION MEASURES

9.1 Introduction

The IURWTS Project is complex in nature and involve wide ranging components with the objective to improve the water transport system and promote tourism and leisure activities through restoration of canals and urban regeneration in the project command. Such new ideas always give birth to new challenges and new risks, which come across during the development and execution of the project of this magnitude.

Risks/threats to this project could involve financial/monetary, schedule, scope, safety, environmental, and many other types. For this reason, the Risk Evaluation Mitigation Strategy (REMS) given below addresses all known risks through the life of the Project. REMS is primarily to identify the probability of risk during the various stages of the Project. Those risks, which are more directly associated with the construction phase, will be addressed, and added to the Risk Register later. More detail regarding risk will be added and provided during the latter part of the design phase and well before the construction phase begins. Further identified risks during the construction and operating phase will added to the Risk Register proposed to be maintained.

9.2 Risk Evaluation and Mitigation Strategies (REMS)

An approach for a risk assessment and evaluation strategy is as shown in **Figure 9.1.** The purpose for risk identification is to search for, and locate, sources of risk exposure, termed risk event before they realized. Risk identification workshops will be conducted for all Project packages as shown below. However, the activities involved in this project categorized under four risk groups as given in **Table 9.1**.

The Risk Mitigation Plan (RMP) and Environment Management Plan (EMP) approved by MoEF&CC will be part of the contract obligations. Monitoring in this regard will be undertaken by the General Consultant and communicated to the SPV for this project.

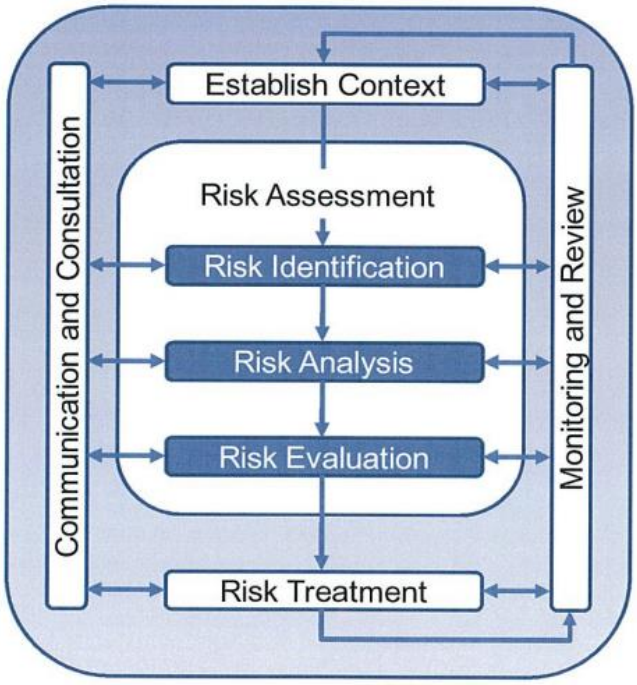


Figure 9.1: An approach for a risk assessment and evaluation strategy

Table 9.1: Classification of risk groups for activities under IURWTS Project

Risk Group	Description
RG 01	Canal Development (deepening, widening, shore protection, canal beautification)
RG 02	Sewage Treatment/ Sewerage System
RG 03	Jetty and Jetty Terminal Construction
RG 02	Boats, Navigation Aids Package
RG 04	Alternative revenue streams

The Risk Manager through Antea Group facilitates risk workshops for various contracts before the tendering process. The primary tool to be used to record, analyze, evaluate, and disseminate risk information will be the Risk Register.

The methodology involved under REMS will involve six steps given in **Figure 9.2**.

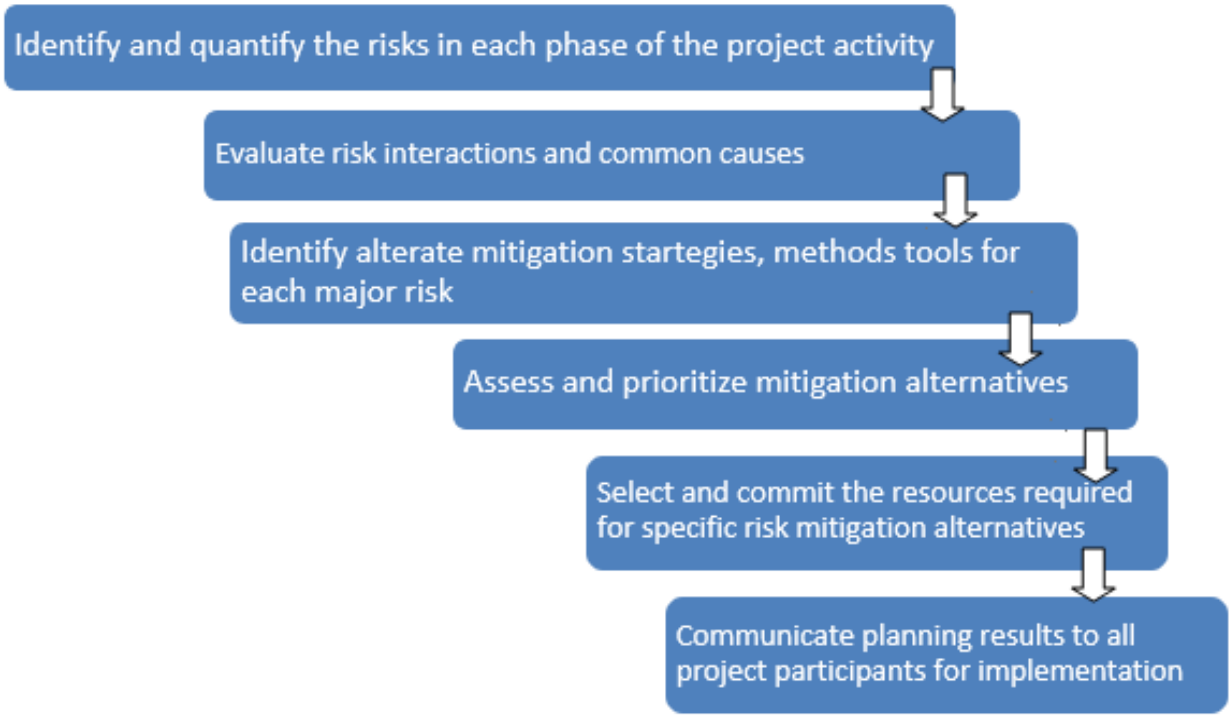


Figure 9.2: Methodology for REMS

9.3 Risk Mitigation Planning

The ultimate purpose of risk identification and analysis is to prepare for risk mitigation. Risk mitigation planning needs to be an ongoing effort that cannot stop after a qualitative risk assessment, or a Monte Carlo simulation, or the setting of contingency levels. Risk mitigation includes front-end planning of how major risks will be mitigated and managed once identified. Therefore, risk mitigation strategies and specific action plans should be incorporated in the project execution plan.

Transfer of risk

Risk transfer can be possible only when both the contractor and owner fully understand the risks and the rewards apportioned for the same. Unless there is a quantitative measurement of the risks, attempts by the project participants to shift the responsibility for risks will not provide fruitful results. Contractors generally agree to take risks only in exchange for adequate rewards and this is possible only if the risk is quantified. Before the tenders are invited the prospective bidders' risks that are allocated to the contractors and the owners should be made known. This is to avoid unpleasant surprises and subsequent litigation.

Risk avoidance

One of the risk response strategies is **risk avoidance**. This strategy entails adjusting the project plan so that the conditions triggering a risk event are no longer present and the risk is eliminated. While this strategy cannot be applied to all project risks, it is most effective for preventing risks.

Risk control

Risk control refers to assuming a risk buffering step to reduce, mitigate, otherwise manage its imapct or likelihood. Risk contol is not necessarily inexpensive.

9.4 Development of Risk Matrix for IURWTS Project

9.4.1 Qualitative Risk Analysis

For this project, qualitative analysis will be utilized to define relative risk ratings for the purpose of risk prioritization at the individual package level.

The probability and impact scale reflected in the **Table 9.2** will be used to assess all identified risk events and a risk rating matrix will be applied to determine the rating of each risk. Qualitative risk probability scale and Qualitative risk rating matrix for this project is shown in **Table 9.3** and **Table 9.4,** respectively. Quantitative risk analysis for Project risk management is undertaken as a separate procedure.

Table 9.2: Qualitative Risk Impact Assessment Scales

Loss type	Risk Impact				
	C1 Insignificant	C2 Minor	C3 Moderate	C4 Major	C5 Severe
Timeline	Overall impact on timeline is less than 7 days	Overall impact on timeline is less than 14 days but more than 7 days	Overall impact on timeline is less than 30 days but more than 14 days	Overall impact on timeline is less than 60 days but more than 30 days	Overall impact on timeline is more than 60 days
Budget	Overall impact on budget is less than 5% of total budget	Overall impact on budget is less than 10% but more than 5% of total budget	Overall impact on budget is less than 25% but more than 10% of total budget	Overall impact on budget is less than 50% billion but more 25% of total budget	Overall impact on budget is more than 50% of total budget

Loss type	Risk Impact				
	C1 Insignificant	**C2 Minor**	**C3 Moderate**	**C4 Major**	**C5 Severe**
Operating loss	No significant impact on base operation	Minor impact on base operation	Moderate impact on base operation	Major impact on base operation	Severe impact on base operation
Quality	No impact on quality of Project deliverables	Minimal quality issues that can be addressed in short time frame with minimal interaction	Some quality issue that require immediate management action	Significant quality issue that require Project Director's intervention	Significant quality issue that require Project Owner's intervention
Safety/ Health	First aid case/ exposure to minor health risk	Medical treatment case/ exposure to major health risk	Lost time injury/ Reversible impact on health.	Single fatality or loss of quality of life/ Irreversible impact on heath.	Multiple fatalities/ Widespread impact on health.
Environment	Minimal environmental impact	Material environmental harm – short term remedial incident.	Serious environmental harm – remediable within Project life.	Major environmental harm remediable post Project completion.	Severe environment harm Irreversible.
Legal & Regulatory	No legal impact	Minor legal concerns with minor impact	Some legal concern with manageable level of impact.	Serious legal concern with significant impact on operation.	Legal non-compliance with risk of shut down of operation and significant penalties

Loss type	Risk Impact				
	C1 Insignificant	**C2 Minor**	**C3 Moderate**	**C4 Major**	**C5 Severe**
Reputation/ Social/ Community	Slight impact, slight public awareness may exist but no public concern.	Limited impact – local public concern	Considerable impact – regional public concern.	National impact – national public concern	International impact – international public concern

Table 9.3: Qualitative risk probability scale

Scales	Probability	Description
Almost certain (P5)	> 75%	Almost certain to occur
Likely (P4)	51% - 75%	More likely to occur than not
Possible (P3)	26% - 50%	Fairly likely to occur
Unlikely (P2)	6% - 25%	Unlikely to occur
Rare (P1)	0 – 5%	Extremely unlikely

Table 9.4: Qualitative risk rating matrix for IURWTS Project

Scales	C1 Insignificant	C2 Minor	C3 Moderate	C4 Major	C5 Severe
Almost Certain (P5)	(3) Medium	(26) High	(31) High	(5) Extreme	(16) Extreme
Likely (P4)	(19) Medium	(14) Medium	(13) High	(4) High	(21) Extreme
Possible (P3)	(23) Low	(2) Medium	(1), (9), (22), Medium	(7), (18), (27) High	(12) Extreme
Unlikely (P2)	(11) Low	(24) Low	(25), (29) Medium	(8) Medium	(15) High
Rare (P1)	(20) (30) Low	(6) Low	(17) Medium	(10) Medium	(28) High

Upon completion of risk assessment, all risks can be ranked in terms of their individual risk rating, with the risks that have the highest rating constituting those that require the most attention when planning the risk responses.

9.4.2 Quantitative Risk Analysis

The analysis of identified risk events will result in priorities using the qualitative risk analysis process. Their effect on Project activities will be estimated and a numerical rating applied to each risk. The result will then be documented in this section of the risk mitigation plan. The quantitative analysis will be performed later after DPR review is completed and package strategies is decided after approval of block cost estimates by KMRL.

9.4.3 Risk response planning

Each major risk will be assigned to a Project team member for monitoring purposes to ensure that the risk will not "fall through the cracks". For each major risk, one of the following approaches will be selected to address it:

- Avoid – eliminate the threat by eliminating the cause.
- Mitigate – Identify ways to reduce the probability or the impact of the risk.
- Accept – Nothing will be done.
- Transfer – Make another party responsible for the risk (buy insurance, outsourcing, etc.).

For each risk that will be mitigated, the Project team will identify ways to prevent the risk from occurring or reduce its impact or probability of occurring. This may include prototyping, adding tasks to the Project schedule, adding resources, etc.

For each major risk that is to be mitigated or that is accepted, a course of action will be outlined for the event that the risk does materialize in order to minimize its impact. The mitigation strategy may be coordinated and reviewed by KMRL as required.

9.4.4 Risk monitoring, controlling, and reporting

The level of risk on a Project will be tracked, monitored, and reported throughout the Project lifecycle. A "Top 10 Risk List" will be maintained by the Project team and will be reported as a component of the Project status reporting process for this Project. It is to be noted that the Project Risk Register is a dynamic

form in which the top 10 risk list changes based on the stage of the project. All Project change requests will be analysed for their possible impact to the Project risks.

A Risk Register will be maintained by the Project Managers and Package Managers for each Project and each package. Summary list of all risks identified under each package to be maintained and followed. The register will be reviewed as a standing agenda item for Project team meetings. Changes to the risk register, especially those where a risk is increasing or remains a high threat, will be highlighted and discussed individually. Charts, schematics, graphs, tables will be used and/or added as appropriate to portray effects and impact properly and effectively.

The major risks have been identified at this stage of the project and accordingly based on experience as explained in detail in the earlier paras, a risk matrix (Model) has been prepared for this project for ready reference and initiating mitigation as required is given in **Table 9.5**.

Table 9.5: Risk matrix for project activities in IURWTS Project

Sl. No	Risks	Type of Assessed Risk and Response	Mitigation measures proposed
	Planning & Design Phase		
1	Cancellation or Change in Design Scope	Possible (P3) Moderate (C3) Mitigate	Identify ways to reduce the probability of cancellation or design scope by making the entire project transparent
2	Community Opposition	Possible (P3) Minor (C2) Avoid	Public awareness campaigns through electronic and print media can be carried out before execution of the project.
3	Adverse Weather Conditions	Almost certain (P5) Insignificant (C1) Mitigate	Proper planning and scheduling to complete weather impact activities like excavation, deepening & cutting etc to be completed before monsoon and the super structure to be built up.
4	Environmental Permits	Likely (P4) Insignificant (C4) Avoid	Avoid by initiating timely action considering the minimum time required to adhere to the formalities by govt agencies for issue of permit.

Sl. No	Risks	Type of Assessed Risk and Response	Mitigation measures proposed
	Pre-Construction Phase		
5	Land Acquisition / Availability risk	Almost Certain (P5) Moderate (C3) Mitigate /Transfer	
6	Statutory Permits	P3 (possible) C3 (Moderate) Avoid	Avoid by initiating timely action considering the minimum time required to adhere to the formalities by govt agencies for issue of permit.
7	Disputes with Slum Dwellers (Social risks)	Almost Certain (P5) Major (C4) Mitigate /Transfer	Increased communication and reviews to avoid occurrences of disputes. Timely mitigation measures to settle disputes by properly assessing the situation and arriving at a win-win situation. An effective resettlement plan needs to be in place along with the project.
8	Non-adherence of EMP	P2 (unlikely) C4(Major) Transfer	Include provisions in the contract conditions to transfer the liability to the defaulter.
	Construction Phase		
9	Design	P3 (possible) C3 (Moderate) Avoid	To avoid the chances of faulty design by proper check in the design phase.
10	Geotechnical/Geological	Rare (P1) Major (C4) Avoid	To avoid the chances of faulty geotechnical investigation by proper check in the design phase.
11	Removal of Hazardous Material / Wastes	Unlikely (P2) Insignificant (C1) Mitigate	To mitigate the situation by including proper safety measures in the planning stage.

Sl. No	Risks	Type of Assessed Risk and Response	Mitigation measures proposed
12	Disposal of Dredge / Desilting / Earth Cutting material in project command	Possible (P3) Severe (C5) Mitigate	Mitigated by identifying Government lands in advance and utilising the excavated earth to the maximum for raising the low-lying stretch on the canal banks.
13	Timely Allotment of Funds	likely (P4) Moderate (C3) Mitigate	Sustained allocation of funding adequate for the project and government patronage needs to be ensured for the successful implementation of the project.
14	Completion and Commission	Likely (P4) Minor (C2) Transfer	To mitigate the situation by ensuring in the contract condition proper quality checks and quality monitoring during the construction phase and for transfer of risk to the executing agency.
	Other Construction Phase Risks		
15	Latent Defects	Unlikely (P2) Severe (C5) Mitigate	Mitigate by ensuring proper site investigation at the planning phase and ensuring conditions in the contract to assess the situation during site visits arranged before tender finalisation and quoting the rate accordingly.
16	Utility Relocation	Almost certain (P5) Severe (C5) Transfer	Proper mitigation measures taken at the planning stage by the SPV and conditions in the contract to undertake further geophysical investigation if found necessary before commencement of the work.

Sl. No	Risks	Type of Assessed Risk and Response	Mitigation measures proposed
17	Archaeological Findings risk	Rare (P1) Severe (C5) Avoid	Proper legal framework framed before the tender process and included in the contract condition to mitigate the risk in a shared manner.
18	Encroachment into the acquired land	Possible (P2) Major (C5) Mitigate	Provision for funds to provide fencing in the contract at the planning stage to prevent encroachment.
19	Sewage Disposal	Likely (P4) Insignificant (C1) Mitigate	Mitigated by provision of fund to provide transitional measures during the construction phase and for Individual houses left out from the sewer networks to be provided with septic tanks, DEWATS etc.
20	Risk on account of improper security issues at site	Rare (P1) Insignificant (C1) Avoid	Avoid by provision for Proper ID cards, Surveillance measures, Entry restrictions, Minimum activities during school time to be ensured.
21	Force Majeure	Likely (P4) Severe (C5) Accept	To mitigate the situations by accepting the facts and taking proper preventive measures and risk shared by both the contracting parties.
	Revenue Risks		
22	Risks for revenue generation stream planned in the project command to identify private partners	Possible (P3) Moderate (C3) Mitigate	Carry out a 'what if' analysis based on the possible scenarios of demand. Indirect benefits also to be considered in order to highlight the economic benefits.
23	Competing facilities and network risk	Possible (P3) insignificant (C1) mitigate	Mitigated by government commitment to the agreement conditions and proper

Sl. No	Risks	Type of Assessed Risk and Response	Mitigation measures proposed
			legal framework suggested at the planning stage.
24	Boat demand risk	Possible (P3) Minor (C2) Mitigate	Mitigated by providing buffer stock in the planning stage so that the rise or fall in boat usage can be mitigated.
25	Public perspective risk	Unlikely (P2) Moderate (C3) Transfer	Mitigation by provisions in the contract to transfer the risk which allows for reductions in the payments to the extent that the contracting agency is failing to meet the requirements.
26	Utility cost risk	Almost certain (P5) Moderate (C3) Transfer	Mitigated by having a shared approach by keep a cap on the price fluctuation and ensuring a legal framework and a separate institutional mechanism.
27	Technology obsolescence risk	Possible (P3) Major (C4) Mitigate	Mitigated by proper deliberations at the planning stage by identifying the best technology options.
	Political and regulatory risks		
28	Dumbing garbage and waste back into canals after the project has been implemented (Environment risk)	Possible (P1) Major (C5) Mitigate	Proper institutional mechanism with adequate powers to impose fine on the defaulters who throw waste into the water bodies.
29	Risk due to breach of contract	Unlikely (P2) Moderate (C3) Avoid	Mitigated by proper government commitment assured before the commencement of the contract by ensuring a legal framework and institutional mechanism.

Sl. No	Risks	Type of Assessed Risk and Response	Mitigation measures proposed
30	Risk of asset specific regulation	Rare (P1) Minor (C2) Mitigate	Mitigated by ensuring proper regulations, legal framework, and separate institutional mechanism.
31	Risk during termination phase	Almost certain(P5) Moderate (C3) Mitigate	Institutional mechanism and legal frame works worked out to assess the cost of the assets at the transfer stage.

CHAPTER 10

ENVIRONMENTAL AND SUSTAINABILITY ASPECTS

10 ENVIRONMENTAL AND SUSTAINABILITY ASPECTS

Introduction

Sustainable development is a development that meets the needs of the present without compromising the ability of future generations to meet their own needs. Abstract scheme of sustainable development is as shown in **Figure 10.1**. Sustainability is a multidisciplinary complex problem addressing the environmental and socio-economic impact of the development. Most important factors to be considered for a sustainable development is interactions among society, conservative and environment friendly designs, optimised operation, and maintenance strategies etc.

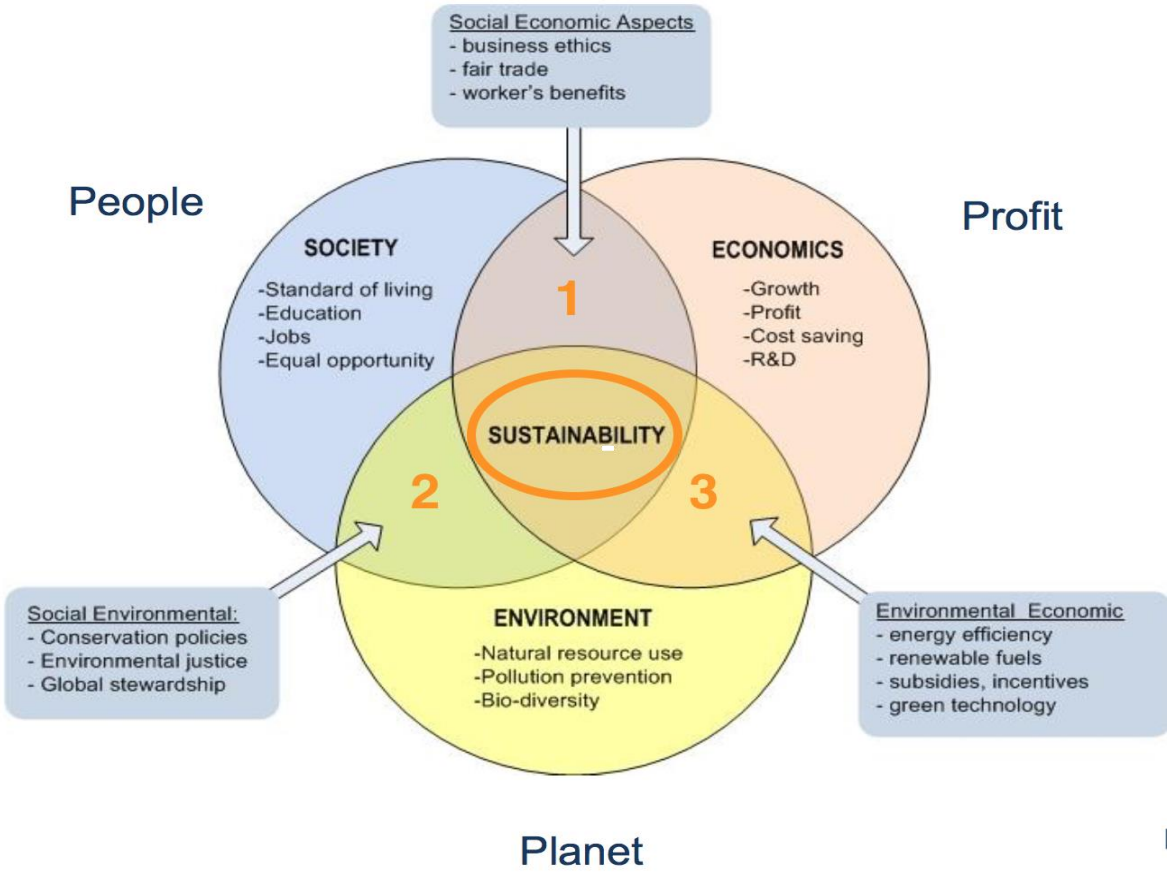


Figure 10.1: Schematic representation of sustainable development

10.1 Sustainability Aspects

The primary requirement for any urban regeneration project, which is stressed by rapid urbanisation is to assure that the infrastructure developments proposed are sustainable. Sustainable infrastructure enhances the quality of life of citizens, increases positive impacts, helps protect our vital natural resources

and environment, and promotes a more effective and efficient use of financial resources. Major considerations for sustainable development is as shown **Figure 10.2**.

Figure 10.2: Factors for sustainable development

10.1.1 Issues relating to Sustainability

Key attributes for infrastructure planning that are considered in the design of this project components are the following:

- Sustainability as a primary guiding concept.
- An integrated plan for infrastructure development across sectors.
- Independent, but cannot be removed from political decision-making.
- Anchored in clearly defined and long-term objectives.
- Open and collaborative, seeking stakeholder engagement from the outset of the process.

The sustainability criterions proposed for this project is provided in **Table 10.1**.

Table 10.1: Sustainability criterions proposed for the project

Sustainability Criterion	Criterion Details
1. Architectural Planning and Design	Accessibility in built environment provided in the design
	Availability of integrated Civil and landscape drawings before invitation of bids
	Layout/ site planning prepared during design
	New and innovative approach followed
2. Quality and Safety	Availability of safety plan before award of work
	Availability of quality assurance plan before award of work
	Availability of Structural drawings before award of work
3. Sustainable Building Materials	Options for recycle C&D waste products
	Use of waste products/alternatives to natural timber in woodwork
	Use of cement manufactured from waste products
	Use of local materials
	Use of recycled materials
	Adherence to Make in India Policy
	Use of nontoxic and non-hazardous materials
4. Green Construction Measures	Air pollution and noise control measures
	Trenches for integrated services
	New construction technologies for green construction
	Use of equipment to avoid generation of C&D waste
	New construction technologies for speedy construction
5. Water Conservation Measures	Recycling water
	Rainwater harvesting
	Use of water efficient fixtures
6. Energy efficiency and conservation	Energy efficient building design
	Energy efficient lighting, fans, air conditioners and controls
	Energy efficient pumps, lifts, and other equipment
	Integration of controls with sensors for lighting fixtures
	Generation of renewable energy
	Innovation in energy efficiency
7. Waste Management	Waste management plan

Sustainability Criterion	Criterion Details
	Organic waste converter/compost pits
	Waste segregation facilities
8. Welfare Measures	Toilet facilities during construction
	Welfare measures during construction
9. Landscape and horticulture	Trees protection and transplantation
	Irrigation features

10.2 Environmental Aspects

The global community has grown increasingly more environmentally conscious in every aspect of life. Proper conservation of the environment should be attempted by creating awareness among people and ensuring their active participation.

10.2.1 Benefits Of Waterway Restoration

Envisioned holistic Canal Oriented Development (COD), urban regeneration and alternative revenue streams that will bring the following expected outcome and create mixed use development.

1) Canal development will create beautifully landscaped canal spaces for leisure and tourism, cute shops, and eateries for creating an illusion of urban vitality along the canal banks and enhanced livelihood opportunities. This would further improve the city's image.
2) Enhanced utility of the canal waterfront as a natural attraction for social and economic activity for locals and tourists.
3) A hassle-free inland water navigation system along the canals to enhance urban mobility and tourism with environmentally friendly ferry vessels, comfort, and innovative jetty terminal facilities.
4) Sanitation facilities and sewage disposal system integrated to serve the inhabitants of the project command.
5) Canal facing revenue stream models to add attraction and increase the open areas and parks with schemes like echo-island, mini India, innovative wellness centre for the higher end aged, and a corporate training centre to the international standards.
6) Adaptation to climate change, carbon credits, flood mitigation, boosting of regional economy by tourism, etc.

10.3 Environmental Management Plan (EMP)

The environmental impacts due to the project will be identified during the EIA study of the project. The Environmental Management Plan (EMP) is an important integration document between the various approvals, authorizations and permits issued for specific components and/ or activities of the project. This EMP outlines the contents of construction and operational phases both. It constitutes a contract document for use in the field by the contractor(s) and their personnel during construction as well as by the personnel of SPV and Antea Group during operations.

All necessary mitigation and enhancement costs will be part of the BOQ. Various measures listed in the EMP shall be made mandatory in the Tender Specifications for construction of the project. The project contractor while preparing the estimate shall include the cost and above measures while preparing the plan and cost estimate for the project. Major factors identified for EMP for this project is as listed in **Table 10.2**.

Table 10.2: Identified Parameters for IURWTS

• Establishment of Construction Camp and site office • Tree Cutting • Construction water • Natural Habitats/ Wetlands • Storage sites • Disposal sites • Noise pollution • Air Pollution	• Waste disposal • Construction Camps • Site Restoration • Occupational Health & Safety • Disposal of dredge spoil • Storage of construction material • Land acquisition

CHAPTER 11

STATUTORY CLEARANCES

11 STATUTORY CLEARANCES

11.1 Analysis of Statutory Framework

A detailed review of the existing legislations and policies prevalent at the national and state level was carried out and assessed their applicability in relation to this project. The general approach adopted in this analysis includes the following:

1. Preliminary reconnaissance and identify environmentally sensitive issues relating to the project and baseline conditions.
2. Evaluation of applicability of environmental regulations for the project.
3. Applicability of Municipal/corporation building rules, firefighting requirements, and regulations.

There are several complex legislative and administrative frameworks governing a project in the realm of urban infrastructure development and urban management. The Acts, Rules and Regulations formulated by the Central and State Governments, their applicability, specific objectives, and the monitoring agency of environmental related legalisations in, The IURWTS Project is summarised in the **Table 11.1.**

Table 11.1: Applicable Environmental legislations

Sl. No.	Act/ Regulations	Objectives	Monitoring Agency	Applicability	Stage	Implementing / Responsible Agency
1	National Environmental Appellate Authority Act, 1997	For environmental Related grievance redress	MoEF&CC	**Applicable**	In all stages of the project	SPV & Contractor
2	Environment Protection Act, 1986	To protect and improve the overall environment	Department of Environment and Climate Change and Kerala State Pollution	**Applicable**	In all stages of the project	SPV & Contractor

Sl. No.	Act/ Regulations	Objectives	Monitoring Agency	Applicability	Stage	Implementing / Responsible Agency
			Control Board (SPCB)			
3	National Forest Policy, 1988	To preserve and restore biological diversity	Forest Department, GOI and Government of Kerala	**Applicable**	In all stages of the project	SPV & Contractor
4	EIA Notification 2006	For all Development Projects whose activities are listed in EIA Notification 2006	MoEF&CC - and KSPCB	**Applicable**	Design	SPV & Contractor
5	Wildlife Clearance under Wildlife (Protection) Act, 1972	To protect wildlife through creation of Wildlife Sanctuaries and National Parks	National Board for Wildlife, MoEF&CC & Supreme Court	**Applicable**	Design	SPV & Contractor
6	CRZ Notification, 2011/2019	Protection of CRZ areas/Zones	KCZMA/ MoEF&CC	**Applicable**	Design	SPV & Contractor
7	Wetlands (Conservation and Management) Rules, 2017	To protect wetlands	State Wetland Authority, Kerala(SWAK)	**Applicable**	Design	SPV & Contractor
8	The Right to Fair Compensation and	set out rules for fair compensation	The Revenue Department, GoK	**Applicable**	Design and Pre-construction Stage	SPV

Sl. No.	Act/ Regulations	Objectives	Monitoring Agency	Applicability	Stage	Implementing / Responsible Agency
	Transparency in Land Acquisition Rehabilitation and Resettlement Act, 2013 (Act 30 of 2013) (LARR)	and acquisition of land				
9	Fire safety standards - Site NOC and Final NOC	Ensure conformity to the requirements of fire safety	Fire and Rescue Services, GoK	**Applicable** (For building above 16 meters in height)	Design and Pre-construction Stage	SPV & Contractor
10	Kerala Panchayat / Municipality Building Rules	Ensure conformity as per the regulations laid down	LSGD ,GoK	**Applicable** (For all the buildings)	Pre-construction Stage	SPV & Contractor
11	Tree Cutting permission	Protection of trees, Restriction on felling of trees	Forest Department, GoK	**Applicable**	Pre-Construction Stage	SPV & Contractor
12	Kerala conservation of Paddy and wetland Act, 2008	To regulate conversion of wetlands/paddy lands	Agricultural Production Commissioner, GoK	**Applicable**	Design	SPV

Sl. No.	Act/ Regulations	Objectives	Monitoring Agency	Applicability	Stage	Implementing / Responsible Agency
13	Indian Electricity Rules,1956 Electricity Act 2003	Regulations to be followed for Electrical Supply	Electrical Inspectorate, GoK	**Applicable**	Pre-construction and Operation Stage	SPV & Contractor
14	KIV Rules,2010 for Boats	Regulations to be followed for the construction and operation of Inland Vessels	DoP, GoK	**Applicable**	Pre-construction and Operation Stage	SPV & Contractor
15	CFE & CFO under Air (Prevention and Control of Pollution) Act, 1981	To control and monitor air pollution as per prescribed limits set by CPCB	KSPCB	**Applicable**	Construction (Prior to work initiation)	SPV & Contractor
16	CFE & CFO under The Water (prevention and Control of Pollution) Act, 1977	To control and monitor water pollution as per prescribed limits	KSPCB	**Applicable**	Construction (Prior to work initiation)	SPV & Contractor
17	Noise Pollution (Regulation and Control) Rules, 2000	To control and monitor Noise pollution as per prescribed limits set by CPCB	KSPCB	**Applicable**	Construction (Prior to work initiation)	SPV & Contractor

Sl. No.	Act/ Regulations	Objectives	Monitoring Agency	Applicability	Stage	Implementing / Responsible Agency
18	Environmental Clearance under EIA Notification, 2006	To regulate the extraction of minor minerals	DEIAA – For area less the 5 ha. SEIAA – For area more than 5 ha and cluster mining	**Applicable**	Construction (Prior to work initiation)	SPV & Contractor
19	Construction and Demolition Waste Management Rules, 2016	It regulates and monitor the roles and accountability of waste generators and stipulate the duties of regulatory agencies to segregation, recovery, reuse, recycle at source and its management	MoUD, MoEF&CC, State Pollution Control Board (SPCB), District Collector & Local Bodies	**Applicable**	Pre-construction & Construction Stages	SPV & Contractor
20	Hazardous & Other Wastes (Managements & Transboundary Movement) Rules, 2016	It regulates and monitors the handling, generation, collection, storage, packaging, transportation, use, treatment,	MoEF&CC, Central & State Pollution Control Board (CPCB & SPCB), State Govt.	**Applicable**	Construction Stage	SPV & Contractor

Sl. No.	Act/ Regulations	Objectives	Monitoring Agency	Applicability	Stage	Implementing / Responsible Agency
		processing, recycling, recovery, and final disposal of Hazardous & other wastes.				
21	Indian Motor Vehicles Act, 1988 (1989)	To check vehicular air and noise pollution	Motor Vehicles Department, Govt. of Kerala	**Applicable**	Construction Stage	SPV & Contractor
22	The Public Liability Insurance Act & Rules, 1991	Imposes liability on the owner to provide immediate relief in respect of death/injury or damage to any person/property arising out of accident/activity implementation.	All project proponents including the State Public Works Department (PWD), GoK	**Applicable**	Construction Stage	SPV & Contractor

Sl. No.	Act/ Regulations	Objectives	Monitoring Agency	Applicability	Stage	Implementing / Responsible Agency
23	The Explosives Act & Rules), 1884 (revised in 2008)	Regulations regarding the use of explosives and precautionary measures while blasting and quarrying	State Revenue Department, GoK	**Applicable**	Construction Stage	SPV & Contractor
24	The National Environment Tribunal Act, 1992	Liability for damages due to any accident while handling hazardous substances	Chairman, National Environmental Tribunal	**Applicable**	Construction Stage	SPV & Contractor
25	NoC for Extraction of Groundwater under Environment Protection Act, 1986	Regulate and control of groundwater development and management	Central Groundwater Board (CGWB)	**Applicable**	Construction Stage	SPV & Contractor
26	The Building and Other Construction Workers. (Regulation of Employment and Conditions of Service) Act, 1996	Regulate the employment and conditions of service of construction workers and to provide for their safety, health, and welfare measures and	Labor Department, GoK	**Applicable**	Construction Stage	Contractor

Sl. No.	Act/ Regulations	Objectives	Monitoring Agency	Applicability	Stage	Implementing / Responsible Agency
		for other matters connected therewith or incidental thereto.				
27	Solid Waste Management Rules, 2016	Governing collection, segregation, transportation, and disposal of types of solid wastes	MoEF&CC, State Pollution Control Board (SPCB), District Collector & Local Bodies	**Applicable**	Construction & Operation Stages	SPV/Antea Group & Contractor
28	E-Waste (Management) Rules, 2016	This rule regulates and monitors the generation, segregation, handling, Transportations, and disposal of E- wastes	Central & State Pollution Control Boards (CPCB & SPCB)	**Applicable**	Construction & Operation Stages	SPV / Antea Group & Contractor
29	Batteries (Management & Handling) Rules, 2001	This rule regulates and monitors the generation, segregation, handled and disposal of Battery waste	Central & State Pollution Control Boards (CPCB & SPCB)	**Applicable**	Construction & Operation Stages	SPV / Antea Group & Contractor

Sl. No.	Act/ Regulations	Objectives	Monitoring Agency	Applicability	Stage	Implementing / Responsible Agency
30	Plastic Waste Management Rules, 2016	It regulates & monitors the roles and accountability of waste generators & stipulates the duties of regulatory agencies to segregation, recovery, reuse, recycle at source its management	Central & State Pollution Control Boards (CPCB & SPCB), Urban Development Department of the State, District Collector & Local Bodies	**Applicable**	Construction & Operation Stages	SPV / Antea Group & Contractor
31	Ancient Monuments and Archaeological Sites and Remains Act, 1958 and amendments	Preservation of culture and historical remains	Archaeological Survey of India/ State Archaeological Department	**Not Applicable** as No ASI sites are falling within the project area	NA	NA
32	The Forest Conservation Act, 1980&1988	To check deforestation by restricting conversion of forested areas into non-forested areas	Regional Office, MoEF&CC - up to 40 ha	**Not Applicable,** as no forest diversion is required	NA	NA

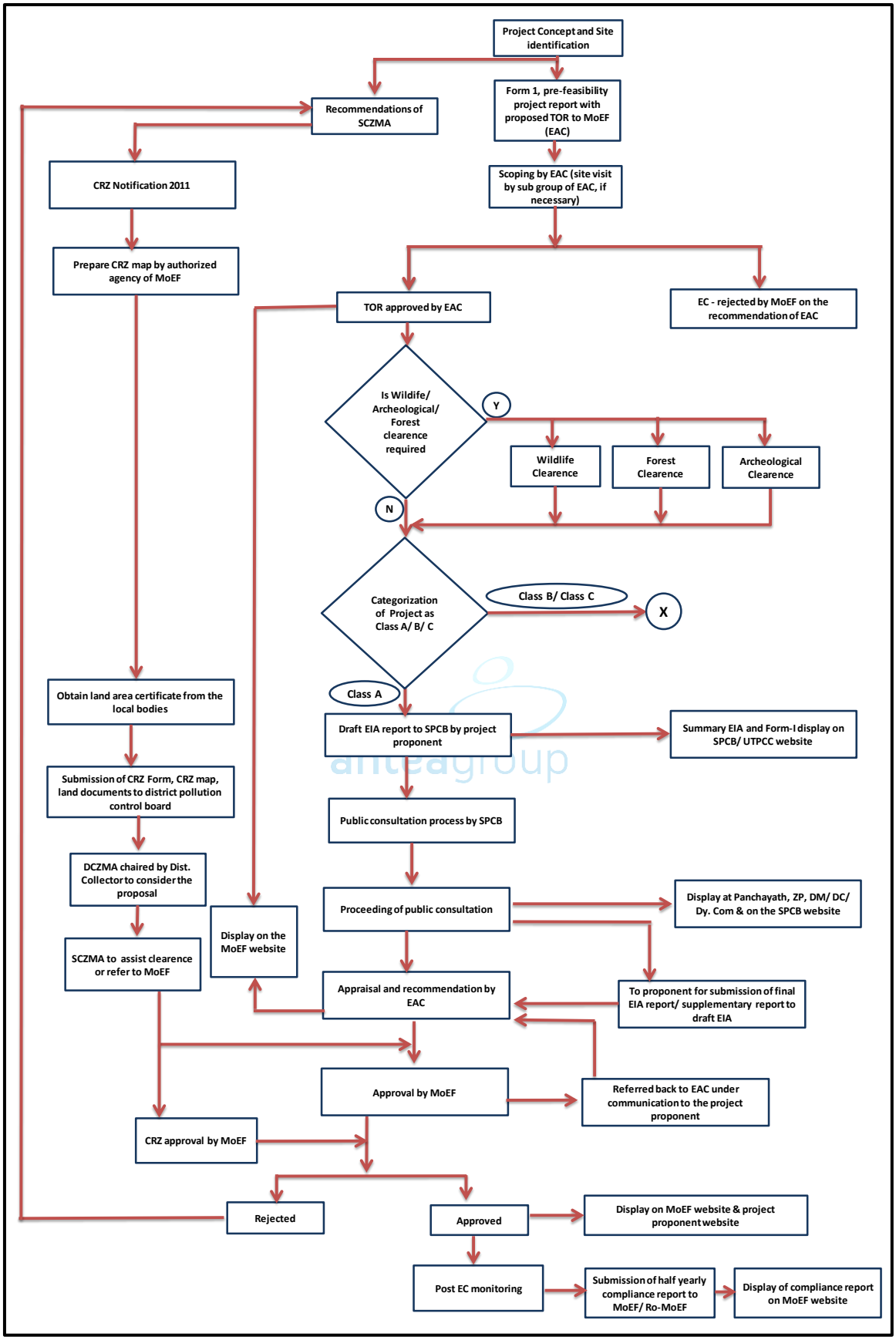


Figure 11.1: Flowchart for Environmental clearance

11.2 Other Legislation applicable to Construction stage

Environmental issues during the construction stage of this project generally involve equity, safety, and public health issues. The construction contractor/agency require complying with laws of the land, which include *inter alia*, the following.

- **Workmen's Compensation Act 1923** (the Act provides for compensation in case of injury by accident arising out of and during the course of employment).
- **Payment of Gratuity Act, 1972** (gratuity is payable to an employee under the Act on satisfaction of certain conditions on separation if an employee has completed 5 years).
- **Employees PF and Miscellaneous Provision Act, 1952** (the Act provides for monthly contributions by the employer plus workers).
- **Maternity Benefit Act, 1951** (the Act provides for leave and some other benefits to women employees in case of confinement or miscarriage, etc.).
- **Contact Labor (Regulation and Abolition) Act, 1970** (the Act provides for certain welfare measures to be provided by the contractor to contract labour).
- **Minimum Wages Act, 1948** (the employer is supposed to pay not less than the Minimum Wages fixed by appropriate Government as per provisions of the Act).
- **Payment of Wages Act, 1936** (it lays down as to by what date the wages are to be paid, when it will' be paid and what deductions can be made from the wages of the workers).
- **Equal Remuneration Act, 1979** (the Act provides for payment of equal wages for work of equal nature to Male and Female workers and not for making discrimination against Female employees).
- **Payment of Bonus Act, 1965** (the Act provides for payments of annual bonus subject to a minimum of 83.3% of wages and maximum of 20% of wages).
- **Industrial Disputes Act, 1947** (the Act lays down the machinery and procedure for resolution of industrial disputes, in what situations a strike or lock-out becomes illegal and what are the requirements for laying off or retrenching the employees or closing down the establishment).
- **Industrial Employment (Standing Orders) Act; 1946** (the Act provides for laying down rules governing the conditions of employment).
- **Trade Unions Act, 1926** (the Act lays down the procedure for registration of trade unions of workers and employers. The trade unions registered under the Act have been given certain immunities from civil and criminal liabilities).
- **Child Labour (Prohibition and Regulation) Act; 1986** (the Act prohibits employment of children below 14 years of age in certain occupations and processes and provides for regulation of

employment of children in all other occupations and processes. Employment of child labour is prohibited in Building and Construction Industry).

- **Inter-State Migrant Workmen's (Regulation of Employment and Conditions of Service) Act, 1979** (the inter-state migrant workers, in an establishment to which this Act becomes applicable, are required to be provided certain facilities such as housing, medical aid, traveling expenses from home to the establishment and back, etc.).
- **The Building and Other Construction Workers (Regulation of Employment and Conditions of Service) Act, 1996 and the Cess Act of 1996** (all the establishments who carry on any building or other construction work and employs 10 or more workers are covered under this Act; the employer of the establishment is required to provide safety measures at the building or construction work and

  other welfare measures, such as canteens, first-aid facilities, ambulance, housing accommodation for Workers near the workplace, etc.).
- **The Factories Act, 1948** (the Act lays down the procedure for approval of plans before setting up a factory, health and safety provisions, welfare provisions, working hours and rendering information-regarding accidents or dangerous occurrences to designated authorities)

11.3 Environmental and Social safeguard policies

KMRL will follow the environmental and social safeguard policies to protect the environment and interest of project affected families within the framework of MoEF&CC and State government R&R policies.

CHAPTER 12

IMPLEMENTATION SCHEDULE

AND

WORK BREAK DOWN STRUCTURE

12 IMPLEMENTATION SCHEDULE AND WORK BREAKDOWN STRUCTURE

The IURWTS Project is a large size multi-disciplinary project and involves wide ranging activities and various institutions and contracting agencies. Therefore, it is important to develop a detailed work breakdown structure and implementation schedule which can be used to monitor various activities during implementation. This chapter is broadly divided into two sub sections, Project Implementation Schedule (PIS) in section 12.1 and Work Breakdown Structure (WBS) in section 12.2.

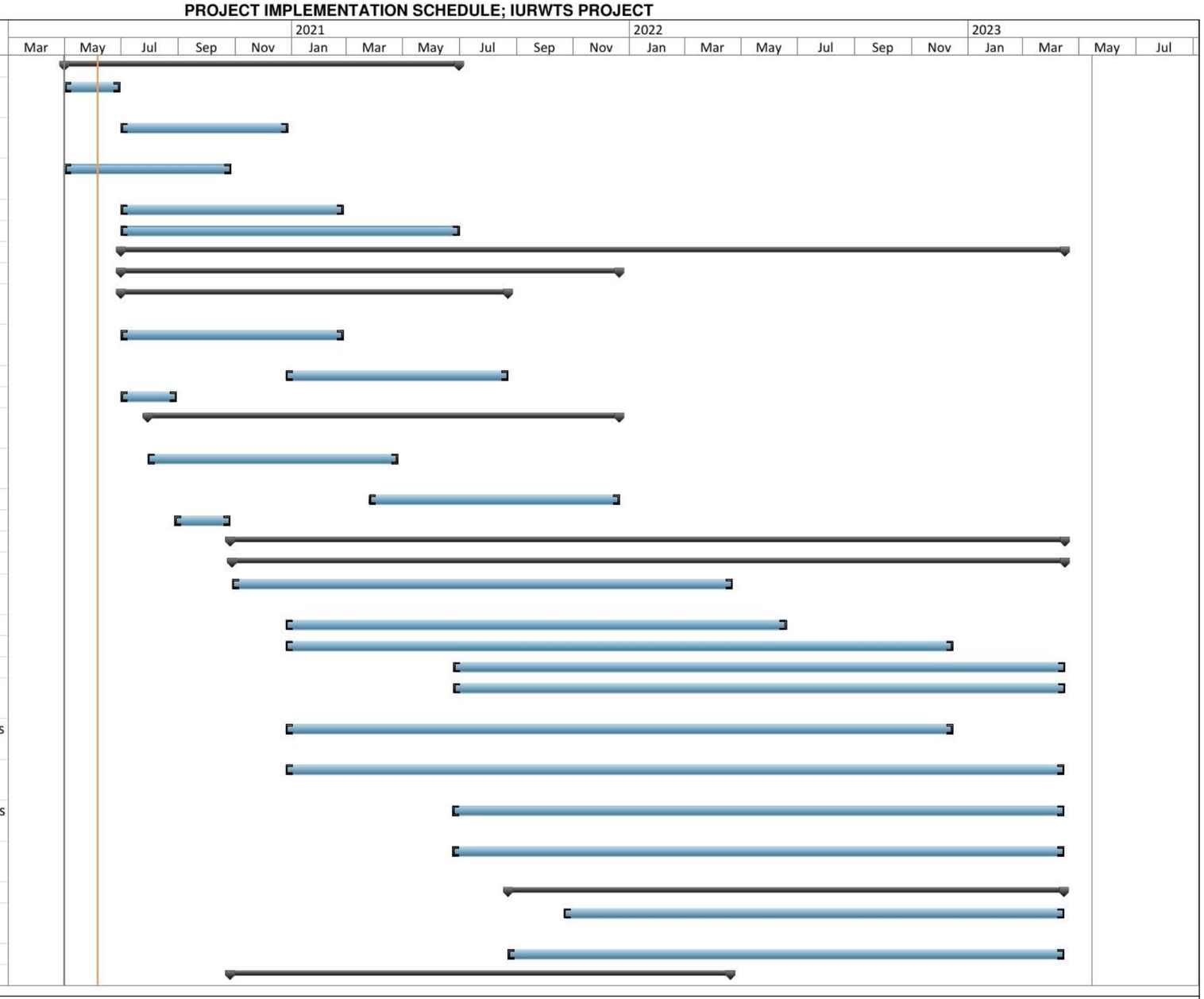
12.1 Project Implementation Schedule

In this section the activities related to all project components are provided. A full overview of all activities is provided in **Figure 12.1** Project Implementation Schedule.

The project implementation schedule will provide more details with respect to timeline and is subject to changes as work progress and can be implemented through MS project.

PROJECT IMPLEMENTATION SCHEDULE; IURWTS PROJECT

ID	Task Name
1	**PREPARATORY PHASE**
2	Submission of DPR by KMRL and Approval of DPR by KIIFB
3	EIA report preparation and public consultation and Environmental and CRZ clearance
4	Survey & Geotechnical Investigation and Bathymetry surveys
5	Land Acquisition and Building compensation
6	Relocation of utilities including bridges/culverts
7	**CANAL AND CANAL FRONT DEVELOPMENT**
8	**Design, Tendering process & Award of Work**
9	**Preparation of Detailed Design, BOQ and Tender documents for:**
10	All 5 Canals Development, Canals front infrastructure development
11	Ancillary Infrastructure Development
12	Rehabilitation & Resettlement Package
13	**Invitation of Tender, Selection of Contractor and Award of work for :**
14	All 5 Canals Development, Canals front infrastructure development
15	Ancillary Infrastructure Development
16	Rehabilitation & Resettlement
17	**Construction / Supply & Installation**
18	**Canal & Canal Front Infrastructure Development**
19	Preparatory works including cleaning and water hyacinth removal
20	Deepening & widening of Canal
21	Shore Protection
22	Reconstruction of roads along the canal
23	Regulatory arrangements with automatic operations and pumping arrangements
24	Construction of FOB, Pipeline bridges, Road bridges & access road to Road Bridges
25	Canal Beautification in canal with landscaping, walkways & promenade development
26	Construction of Jetties, Terminal Buildings & Access roads to terminals
27	Construction of Corporate office of SPV with Operation Control Room and testing lab
28	**Other Ancillary Infrastructure**
29	Solar Installations, EV chargers and electrical systems, Navigation Aids, Sign boards, Lights etc
30	Vessels/Boats for navigation
31	**Rehabilitation & Resettlement**



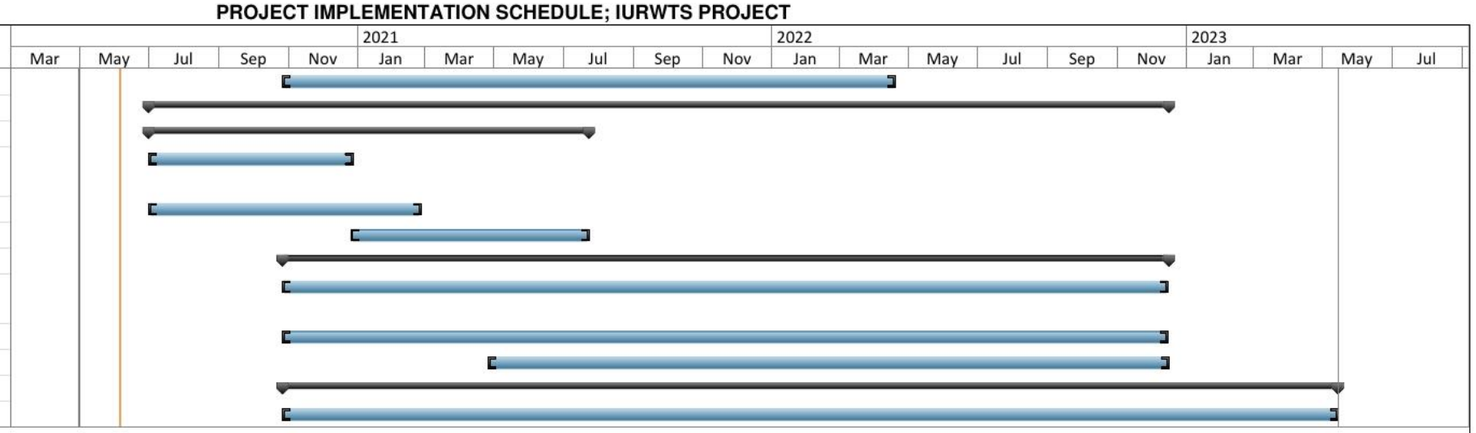
Project: BLUE RHAPSODY (IURWTS
Date: Sat 06-06-20

Task	Project Summary	Inactive Milestone	Manual Summary Rollup	Deadline
Split	External Tasks	Inactive Summary	Manual Summary	Progress
Milestone	External Milestone	Manual Task	Start-only	
Summary	Inactive Task	Duration-only	Finish-only	

Page 1

PROJECT IMPLEMENTATION SCHEDULE; IURWTS PROJECT

ID	Task Name
32	**Rehabilitation & Resettlement**
33	**URBAN REGENERATION**
34	**Design, Tendering process & Award of Work**
35	STP & Sewerage Network including interceptor, pumping station, manholes etc.,
36	Sanitation facilities in catchment area
37	Solid Waste Management
38	**Detailed Design, Construction Supply & Installation**
39	STP & Sewerage Network including interceptor, pumping station, manholes etc.,
40	Sanitation facilities in catchment area
41	Solid Waste Management
42	**ENVIRONMENTAL MONITORING**
43	Environmental Monitoring (Air, Noise, Water, etc.)



Project: BLUE RHAPSODY (IURWTS
Date: Sat 06-06-20

Task | Project Summary | Inactive Milestone | Manual Summary Rollup | Deadline
Split | External Tasks | Inactive Summary | Manual Summary | Progress
Milestone | External Milestone | Manual Task | Start-only
Summary | Inactive Task | Duration-only | Finish-only

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Figure 12.1: Project Implementation Schedule (PIS)

12.2 Work Breakdown Structure (WBS)

WBS is developed to establish a common understanding of project tasks and activities to frame the timeline of project implementation schedule. It is a hierarchical description of the work that was prepared to showcase the path of completion of the project activities. Each descending level in the WBS represents an increasingly detailed description of the project activities. Work packages form the lowest level of planning and consist of activities which are assigned and awarded to different agencies for implementation. Implementation of several work packages together will result in execution of project within a given time frame and it also forms the partial completion of works which will be put together to make up the results of the project.

The WBS for the IURWTS project and proposed work packages are presented in **Figure 12.2**.

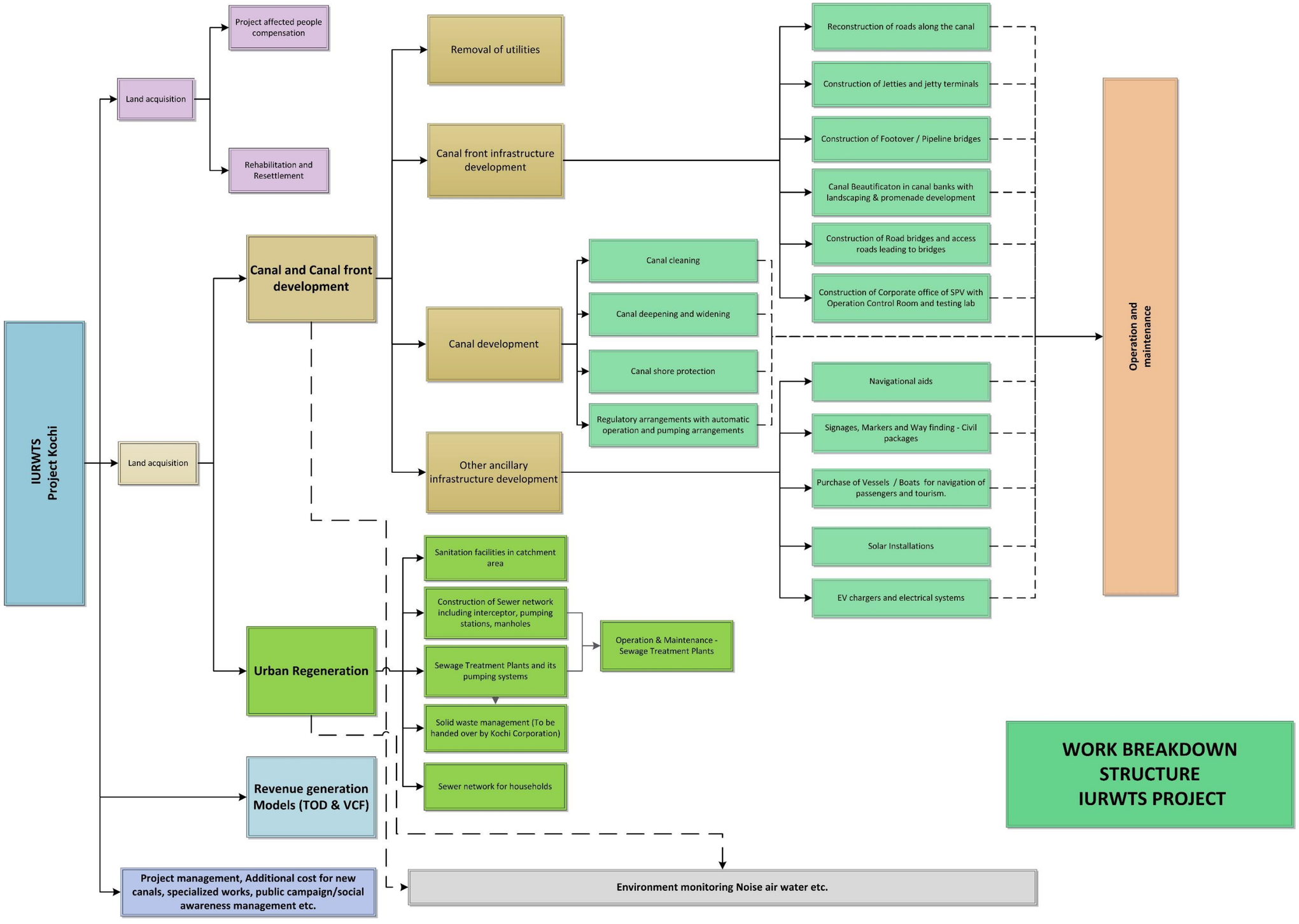

Figure 12.2: Work Breakdown Structure (WBS)

CHAPTER 13

PROJECT MANAGEMENT ORGANIZATION

13 PROJECT MANAGEMENT ORGANISATION

13.1 Introduction

Formulation of Project Management Organization is an important aspect for successful implementation of the project. This defines the responsibility of various stakeholders for planning, control, and coordination of the project from inception to completion of the project. This will also help in meeting the project requirements and ensuring timely and successful completion of project components strictly adhering to the required quality standards. Project management organization of the IURWTS Project has been evolved with the single consideration of deploying experts where and when needed and to permit quick and quality decision making in order to complete the project within the designated timeframe.

13.2 Project Management Organization – IURWTS Project

The organization structure for this project is given in **Figure 13.1**. KMRL shall be the Project Executing Agency (PEA) and nodal implementing agency for this project with overall control of the project and obtain support from various other government agencies and stakeholders as may be required. During the implementation of project, it is proposed that the KMRL in consultation with Government of Kerala (GoK) shall evolve an organization structure for the operation and management of the project components.

PROJECT MANAGEMENT ORGANIZATION STRUCTURE

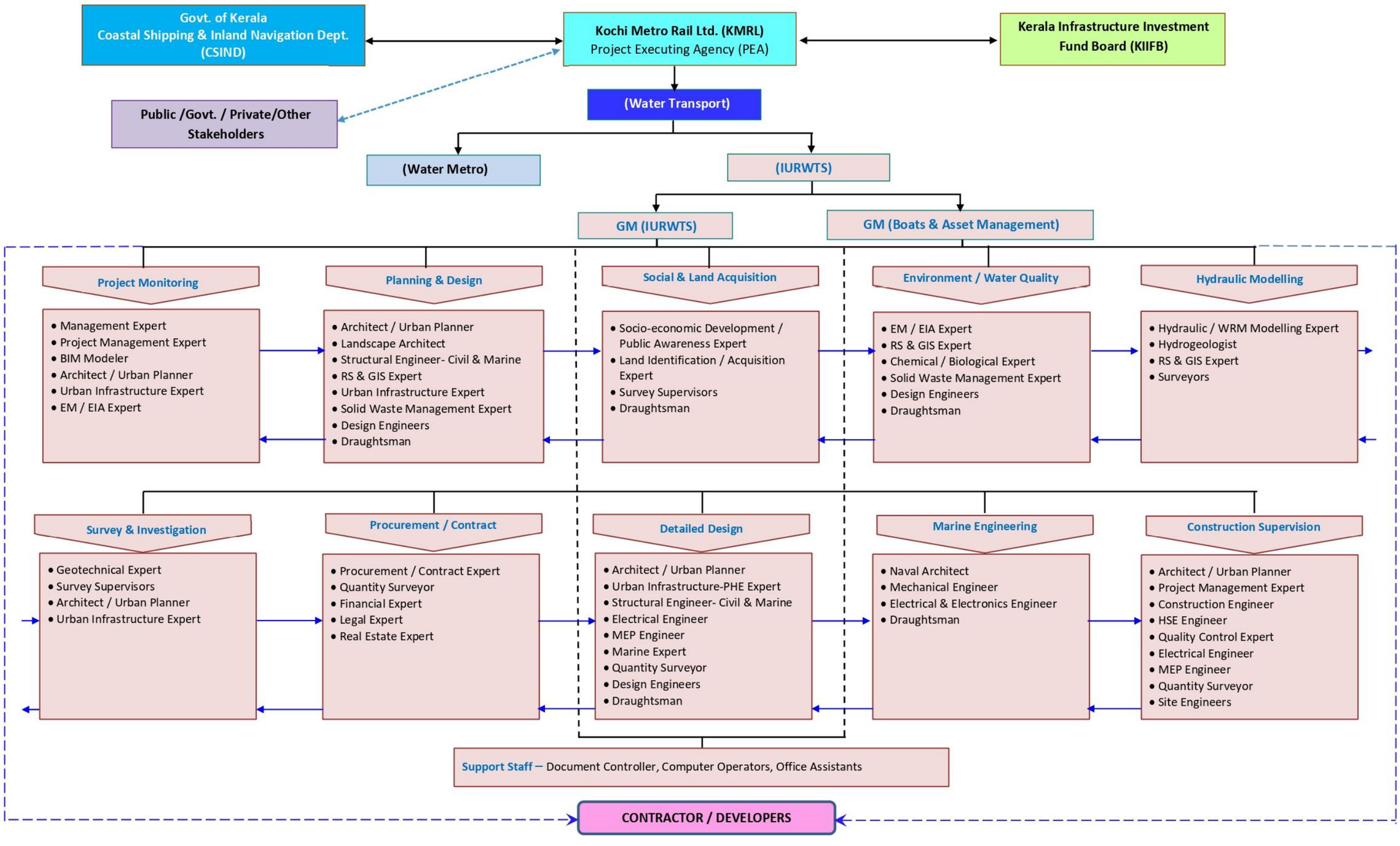

Figure 13.1: Flow Diagram for Project Organization Structure for IURWTS

13.3 Role of different Institutions involved in the project

13.3.1 Govt. of Kerala, Coastal Shipping, and Inland Navigation Department

Coastal Shipping and Inland Navigation Dept. (CSIND) is the Administrative Department (AD) under the direct administrative control of the Hon'ble Chief Minister, Govt. of Kerala and is responsible for all the activities related to coastal shipping and inland navigation. This project will be under the overall administrative control of this agency under Government of Kerala.

The Government of Kerala shall facilitate the linkages between various departments like LSGD, Revenue, PWD, Water Resources department (KWA & Irrigation), at the ministry level and also with other stakeholders department as detailed in **Chapter 2** of this report as required for the smooth implementation of project. The responsibility for the operation and maintenance of the project on the completion of its implementation shall be agreed upon between the Administrative Department and KMRL and the terms shall be agreed upon at the time of Agreement.

13.3.2 Kerala Infrastructure Investment Fund Board (KIIFB) - Funding agency for the IURWTS Project

The Executive Committee of KIIFB chaired by the Finance Minister shall periodically review the progress of the project (duly sanctioned by the KIIF Board chaired by the Hon'ble Chief Minister) and oversee the release of funds through an Inspection Authority constituted under Section 17A of the KIIF Act 1999 (amended by KIIF (Amendment) Act, 2016).

The Inspection Authority has the powers to inspect the progress of the work and the documents of KMRL implementing the project that has been financed by the Board. The Inspection Authority shall have the powers to call for documents from KMRL and inspect its office, site and premises of the projects implemented by it. The Inspection Authority in KIIFB will monitor the execution of the project at various stages and its variation from agreed scope, design, timelines, cost, quality, contract, etc.

After verifying the invoices, authorized by the SPV - KMRL, KIIFB shall release the payment through a direct payment transfer mechanism to the designated bank/treasury accounts of the Project Executing Agency / Contractor as may be registered with KIIFB.

13.3.3 Kochi Metro Rail Limited (KMRL) – Special Purpose Vehicle (SPV) appointed as Project Execution Agency (PEA)

KMRL shall constitute a Project Management Unit (PMU) as shown in **Figure 13.2**, which shall be responsible for the entire management of the project including planning, execution and monitoring the project and act as the nodal unit of KMRL for coordinating with KIIFB.

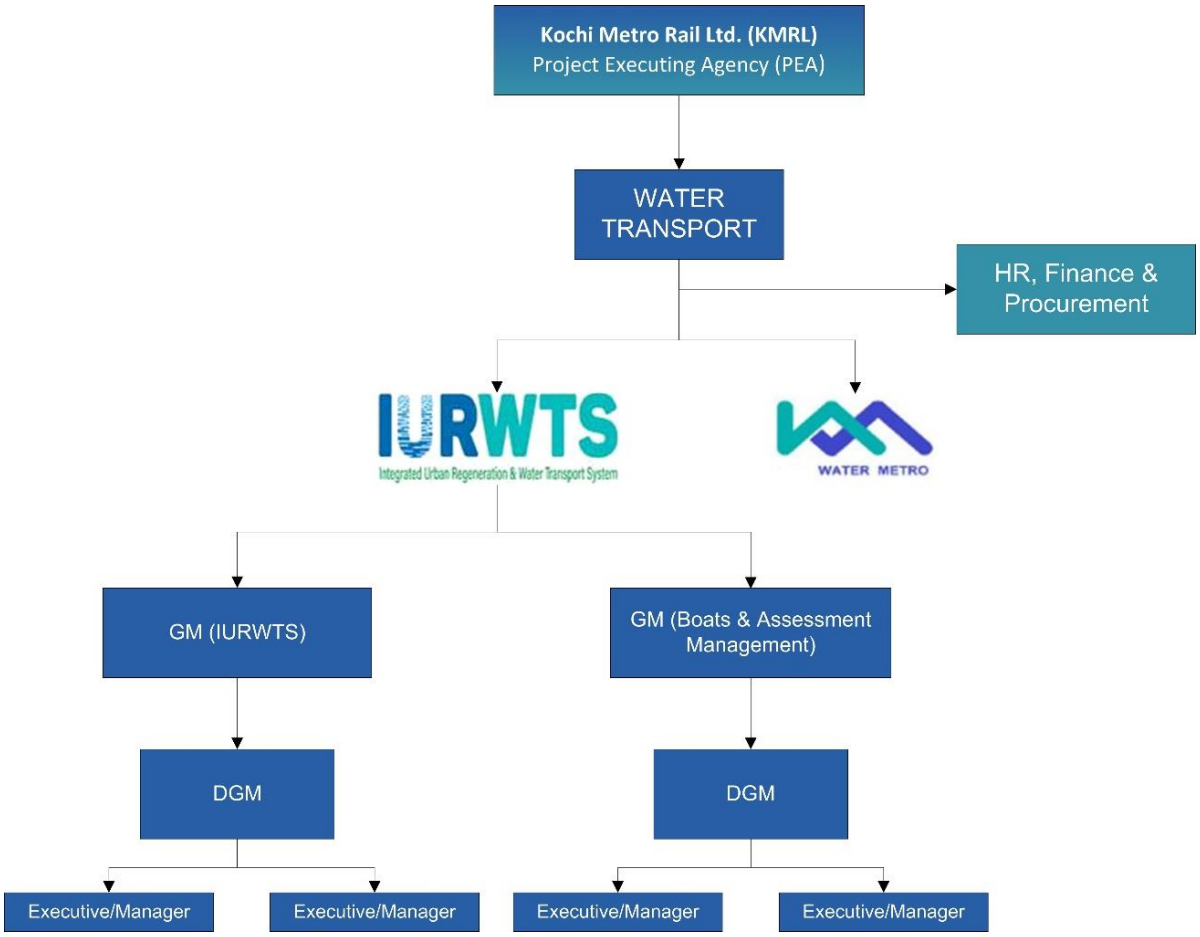

Figure 13.2: Organogram for the PMU

Once the tender is accepted by KMRL as per the norms specified by KIIFB, the work contract agreement shall be signed between KMRL and successful tenderer.

The responsibilities are broadly detailed as below:

- Handing over of the site to the contractor / developer for commencing construction activities.
- Shifting / relocation of existing utilities which hinder the construction activities shall be performed as per the Finance (Infrastructure) department (GoK) G.O. in co-ordination with the concerned stake holder departments.

- Review of contractor's resources and schedules.
- Identify the risks associated with the project and their mitigation plans.
- KMRL shall assess and update the progress in the online software platform of KIIFB and submit relevant progress reports as mandated in the KIIFB guidelines.
- Review and approval of relevant designs, drawings, and other requisite submissions such as Field Quality Plan, Construction Methodology etc.
- Supervision of quality of workmanship, QA/QC during construction in order to maintain required quality during construction period as per the Field Quality Plan (FQP).
- Deviations, extra items, substituted items arising during the execution of the contract shall be duly put up for approval with the TS Committee and KIIFB as per the norms of KIIFB.
- Verification and certification of the Contractor's M-sheets, RA bills and uploading of the recommendations for payment in the Online Project Portal as per KIIFB norms.
- Co-ordinating/management of the different contractors engaged in the execution of the work in order to ensure a seamless interfacing of the sub-project activities in line with the overall project schedule.
- Closure of contracts with the approval of the TS committee.
- Completion and taking over the work/site from the contractor.

KMRL may opt to appoint a Project Management Consultant for various activities like planning, concept design, tendering, detailed design, procurement, construction supervision, management, and advisory services in line with KIIFB guidelines, in order to reduce the long-term expenditures on personnel for a short term project.

13.3.4 Contractors / Developers

The contractor involved in various activities will depend on the contract mode envisaged in the contract management module detailed in **Chapter 14** of this report. The Contractor / Developers will be appointed through tendering process as per KIIFB procurement norms for this project.

The contractor shall execute the works as per the detailed specification and drawings issued by KMRL. The contractor shall be responsible for the quality of workmanship and the materials incorporated in the finished structure in line with the technical specifications and shall adhere to complete the works within the project schedule.

The contractor shall be responsible for any defects and shall promptly rectify such defects arising in the structure till the duration of the Defects Liability Period specified in the contract without any additional cost to KMRL.

13.3.5 Stakeholder line departments involved

KMRL will coordinate with the stakeholder line departments for smooth implementation of the project components and removing hindrance or shifting utilities through consultative process. In case of any disputes with the stake holders the issue will be timely addressed and resolved. KMRL will inform stakeholder departments about the proposals involved in each activity and also update them periodically when changes are encountered. This will help the stake holders at the O&M stage after the activity is completed.

CHAPTER 14

CONTRACT MANAGEMENT STRATEGY

14 CONTRACT MANAGEMENT METHODOLOGY

14.1 Introduction

The IURWTS Project is a complex project with lot of specialized components, hence the contract strategy needs to be devised keeping in mind the complexities of the project and the level of specialization required for each of the component of the project.

This document gives an account of the project strategy with respect to division into contracts, choice of business forms including forms of procurement, forms of contract, and management of contracts. The procurement strategy that this chapter results in, has been chosen on the basis of the overall strategies and goals of this project.

The different tools for effective contract management strategy are brought out below in an encapsulated form in **Figure 14.1**.

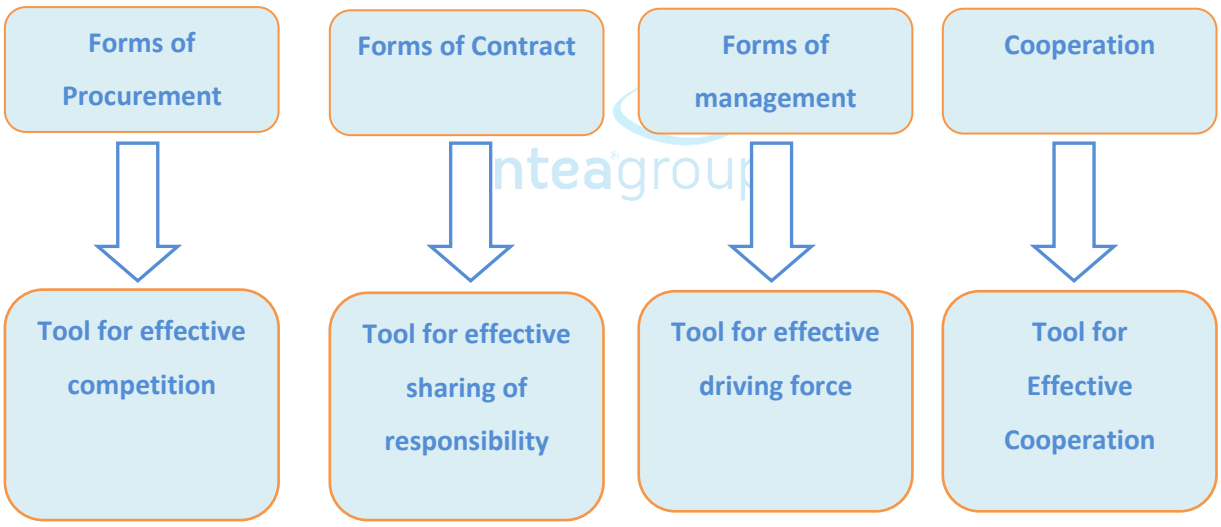

Figure 14.1: Contract management strategy

The most complex feature of this project is that it is being implemented in an inner city urban environment, the structure's from the structural and aesthetic point of view are extremely advanced and serious consideration has to be given to the immediate surroundings, the environment and also the cultural and heritage monument nearness. The excavation, dredging, bridges of the narrow canals with much lesser manoeuvring space in a very congested urban environment will require considerable experience and competence from contractors.

14.2 Core Processes

The contract management includes the coordination and administration of four core processes:

1) Planning.
2) Procurement of goods or services (including complying existing laws and policies).
3) Contract formation (including scope of work, specification of contract price or rate and other relevant terms and conditions).
4) Contract Administration.

14.2.1 Planning and Objects for Procurement

14.2.1.1 Planning phase

The planning phase of procurement is primarily comprised of the following:

- Preparation of Procurement Plan: After the decision has been made to purchase goods or outsource services, the procurement team develops a plan that includes the following:

    1) Selecting the appropriate relationships and contract approaches for each type of purchased goods or outsourced service.
    2) Preparing requests for quotes (RFQs) and requests for proposals (RFPs) and evaluating partnership opportunities.
    3) Evaluating RFQs, RFPs, and partnerships
    4) Awarding and signing contracts.
    5) Managing quality and timely performance.
    6) Managing contract changes.
    7) Closing contract.

- Preparatory works like land demarcation, boundary stones, utility lines rerouting (KSEB, Telephone, Water lines), temporary works, prohibitionary hoardings against dumping of waste, relocation of facilities, etc.

- Traffic Management Strategy during the time of construction.

- Development of contract splitting strategy for individual canals.

14.2.1.2 Objectives of procurement

The Procurement for this project works can be basically sub-divided into the following parts. The contracts envisaged to be part of this project consists of following:

1) Short contracts for utility shifting and other miscellaneous preparatory works.
2) Canal widening works.
3) Bathymetric surveys and Canal Dredging works.
4) Shore protection works with conventional Random rubble and Contemporary sheet piling methods based on the cost economic benefits.
5) Sanitation and solid waste management works.
6) Sewer lines for the entire catchments and Sewage treatment plants.
7) Landscaping and promenade development.
8) Jetties and associated works.
9) Foot over bridges and highway bridges.
10) Road network.
11) Rolling stock in the form of Hybrid or electric ferries for passenger and tourism.
12) Alternate revenue streams development / property development for Sustainability / revenue sharing to the SPV for STP and Sewer lines, Revenue accruing due to COD development.
13) Navigational aids.
14) EV chargers and electrical systems.
15) Systems in the form of cameras and Operational control centre
16) Social Media Management for creating awareness among public and also to elicit public participation.
17) Miscellaneous Experts consultancy services for Concessionaire for PPP projects
18) Miscellaneous Experts consultancy services for Phase-II of the Projects i.e. Arterial canals and sub arterial canals in the project command area.

Each of the individual components of contract needs to be detailed to understand the degree of complexity and a decision on the methodology adopted for the procurement needs to be devised.

14.2.1.3 Preparatory works

This project prescribes, where possible with respect to and where permitted in accordance to the CRZ and MOEF&CC guidelines to carry out the preparatory works so as to ease the construction during the main construction activities. The major reason for carrying out the preparatory activities is:

1) The project will save time during the statutory clearance period.
2) Unforeseen obstructions or obstacles in the ground, which are common in an urban environment, will have less of an impact on other works.
3) Making public aware of the prohibitory orders against dumping of waste into the canals so as not to deteriorate the canals further .KMRL proposes to install hoardings at all locations where public gathering is constant and will be participatory in nature.
4) Smaller contracts for preparatory works will make it possible for smaller, local contractors with knowledge of local conditions to win contracts.
5) Moreover, client and the probable contractors who are vying the major works feels that project should do as much of the preparatory works as possible.
6) As part of community participation, an online monitoring of water quality of each canal, air quality and temperature on a daily basis is envisaged and projected to the public at any prominent location to make people aware about the dangers of deteriorating water quality and dangers associated with the same Traffic management during construction.

14.2.1.4 Traffic Management during construction

The traffic impact during the works will extend over a large geographical area and the accessibility questions will affect many residents and business activities.

Preconditions in the urban environment are difficult during the construction period, with a lot of public transport and people moving around. The lead-times for planning are long, above all with regard to public transport. In order to be able to safeguard accessibility, these issues need to be coordinated and planned several years in advance. The stakeholders involved are the general public and state home department in charge of policing to help find a way out to do the construction without affecting much of a traffic movement.

It is envisaged that many temporary roads needs to be developed during the cross bridge works and moreover alternate roads needs to be made ready to take the extra load of the vehicles.

14.2.2 Procurement of Goods and Services

14.2.2.1 Forms of contract

KMRL proposes primarily two forms of contract to be used in this project: Performance Contract (Item Rate) and Turnkey/EPC contracts. The forms of contract influence the risk and liability sharing between

the parties, where the contractor has a greater undertaking and a larger risk exposure for a turnkey contract than for a performance contract.

14.2.2.2 Performance Contracts (Item rate tenders)

A performance contract is characterized by the fact that client is responsible for the design work and thereafter procures a contractor who undertakes to carry out the work that is referred to in the tender documents. The standard agreement in vogue and that applies for performance contracts is FIDIC Red Book. In view of the relatively low level of independence, it is felt that Performance contract is the best form of contract.

A performance contract will also be typically an item rate contract that contains a schedule or bill of quantities with quantities that have been estimated by the employer that are presented in a schedule of quantities that is provided by the employer. The quantities are multiplied by the unit prices/unit rates and the sum total gives a tender price. Once the work has been carried out, the payment is recalculated based on actual quantities and agreed unit prices. The advantage of a quantity contract is on the one hand that it is a simple adjustment model and on the other that prices are subject to competition even if the employer does not know the magnitude of the quantities. This is an advantage when, for example, the nature of the geology means that the quantities are uncertain. The disadvantage of a quantity contract is that the size of the contract price is difficult to predict.

As regards cutting, dredging, shore protection etc is linked with major risks with respect to quantity and conditions are always difficult to judge. Therefore, difficult to specify in tender enquiry documents. The project wishes to avoid a situation in which tenders complete with an interpretation of geotechnical data, hydro morphological data and bathymetric data assessing the need for a typical shore protection or the quantity of cutting, deepening etc. At the same time, the span of possible technical solutions is heavily restricted when taking into consideration the cost economic aspects. So KMRL do not see any efficiency benefits in allowing the same party to be responsible for both design and construction.

14.2.2.3 Turnkey contracts (EPC tenders)

An EPC contract which is also known as design and construct contract, is characterized by the fact that the contractor is responsible for the design. The employer shall hand over documents to the contractor to serve as basic inputs in which requirement for the conceived function are presented and are also in practice often supplemented by probable technical solutions. The standard agreement in vogue and that applies for performance contracts is FIDIC Silver Book. The project prescribes the ferry contract, the STP contracts etc as EPC contracts.

The EPC contracts are typically fixed price, which means that the contractor receives payment in a previously agreed amount with or without indexation. The pre-conditions for being to be able to request for a fixed price contract primarily depends upon the employer's ability to provide sufficient and clear information on the scope of works and the nature of the site.

The choice of contract form for each of the component of the project is described in detail in **Table 14.1**.

Table 14.1: Summary of Forms of Contract and Forms of Payment

Sl. No	Contract	Form of Contract	Preferred Document
1	Preparatory Works	Item Rate tender	Client Standard Document/CPWD Standard Document/FIDIC Green Book/FIDIC Red Book/FIDIC Blue Book for dredging
2	Canal widening works.	Item rate Tender	
3	Bathymetric surveys and Canal Dredging works.	Item rate Tender	
4	Shore protection Works	Item rate Tender	
5	Sanitation and solid waste management works, Eco Toilets, installation of tracking systems and conducting regular laboratory tests during execution.	Item rate Tender	
6	Sewer lines and Sewage treatment plants.	Turnkey /EPC contract/Lowest life cycle cost	FIDIC Silver Book
7	Landscaping and promenade development.	Item rate Tender	Client Standard Document/CPWD Standard Document/FIDIC Green Book/ FIDIC Red Book
8	Jetties, Operation Control room, Innovation Lab, Corporate office of SPV, Regulation lock arrangements and associated works	Item rate Tender	
9	Foot over bridges and highway bridges.	EPC/ Item Rate	FIDIC Silver Book/FIDIC Red Book
10	Road network.	Item rate Tender	FIDIC Red Book

Sl. No	Contract	Form of Contract	Preferred Document
11	Rolling stock in the form of Hybrid or electric ferries for passenger and tourism.	EPC tender/Lowest life cycle cost	Norwegian standard Boat contract
12	Alternate revenue streams development /property development for Sustainability / revenue sharing to the SPV for STP and Sewer lines, Revenue accruing due to COD development	Value capture, Transit Oriented Development, Transfer of Development rights	NITI Ayog /Planning Commission Standard Documents /FIDIC Red Book
13	Navigational aids.	Shopping /Quotation	FIDIC Green Book
14	Customer Experience, Signage's and Way finding	Item Rate tender	FIDIC Red Book
15	EV chargers and electrical systems	EPC Tender	FIDIC Silver Book
16	Solar Installations	EPC tender /Custom made.	
17	Systems in the form of CCTV and Operational control centre	EPC tender /Item Rate Tender	FIDIC silver book /FIDIC Red Book
18	Water Hyacinth /weeds removal	EPC tender.	Machinery capex model, Operation on AMC model
19	Tourism, recreation, and beatification of canals.	EPC /Item Rate tender	FIDIC Red Book.
20	Rehabilitation and resettlement of slum Dwellers	EPC Tender /Item Rate Tender	FIDIC Red Book
21	Alternate revenue expert Consultancy services for identifying concessionaires for PPP projects	QCBS	FIDIC White Book/World Bank standard document
22	Consultancy services for preparation of DPR for phase –II i.e. Arterial and sub arterial canals flowing into the main canals in the project command area	QCBS	FIDIC White Book/World Bank standard bidding document

Sl. No	Contract	Form of Contract	Preferred Document
23	Social Media Management for public awareness and people engagement	QCBS	FIDIC White Book/World Bank standard bidding document.
24	Operation and Maintenance Specific Contracts. Post Project Management.	QCBS	Modality shall be decided Later.

14.2.3 Overall Procurement Schedule

The Funding Agency KIIFB has not yet announced the permissibility of the project and has directed the implementing agency, KMRL, to revise the DPR and submit for approval. In order to be able to execute the project, a legally valid Coastal regulation zone clearance, wild life clearance and Ministry of Environment & Climate Change clearances are needed. The project implementation is based on the assumption that construction of this project can start as soon as all statutory permits have been granted. The permit processes shall be handled by KMRL in consultation with the appointed Project Management consultant. Further the land acquisition and handing over to KMRL should be completed before the construction phase can start.

Based on the present circumstances, construction is planned to commence in November 2020/from MOEF&CC clearances. The construction period is calculated to be approximately 34 months from MOEF &CC clearances and Land acquisition.

14.2.4 Managing the Contracts

After the contract is awarded, the project team tracks the performance of the contractor against performance criteria in the contract and his or her contribution to the performance of the project. Usually, contractors deliver the product or service that meets the quality expectations and supports the project schedule. Typically, also one or two contractors do not perform to project expectations.

Some project managers will refer to the contract and use it to attempt to persuade the contractor to improve performance or be penalized. Other project managers will explore with the contractor creative ways to improve performance and meet project requirements. The contract management allows both approaches to deal with non-performing contractors, and the project team must assess what method is most likely to work in each situation.

The quality analysis and quality control of the works need to assess as per the approved QA/QC plan.

14.2.5 Site supervision and bill measurement

KMRL shall set up a proper supervisory plan to check the status of the work and to do bill measurements, to check whether the progress of work is as per the implementation schedule.

14.2.6 Commissioning of the project

After completing all the works and auxiliary works, KMRL shall hand over the Project to the Administrative Dept (CSIND) for inauguration or shall work out the modus operandi for the Operation and maintenance of the project.

CHAPTER 15

QUALITY MANAGEMENT PLAN

15 QUALITY MANAGEMENT PLAN

15.1 Introduction

The Quality Control and Quality Assurance is an integral task and will be part of all contracts. In order to be truly effective, it must ensure a progressively improved and uniform quality of the finished work. In order to achieve the above, there will be an inbuilt provision in the IURWTS Project contracts, clearly depicting a methodology for continuous check on quality. The Project Management Consultant (PMC) will have well equipped and provisioned quality staff for overseeing the quality aspects of various activities of the project, and periodical appraisal of quality. It also has a system of feedback to the contractor for effecting possible improvements and KMRL/Employer on a daily basis. The quality of the QA/QC implementation will be ensured through an integrated system of quality assurance performed by the Team Leader of the PMC and quality control provided by the contractors.

This project can be broken down into several stages including planning, design, tendering, construction, acceptance, close-out, and Defect Liability Period (DLP). This chapter will adapt and modify as each phase is completed and new stages begin and is based on Various Quality Assurance practices, PWD specifications, requirement of the tender document for test of materials, Field/laboratory testing and relevant IS: codes. This will provide a base document outlining policy, procedure, responsibilities, compliance acceptance criteria and documentation for carrying out tasks related to inspection, testing, and reporting on various materials, items involved for the satisfactory completion of the work. In all cases however, it is important to understand that the contract documents including the technical specifications are the basis for execution of the construction. Quality Assurance/Quality Control (QA/QC) manual provides a guideline for supervision of construction project. A QA/QC manual establishes a standard guideline for enabling supervisory staff to check different activities of construction in respect of technical specifications. Quality assurance plan serve as a road map to supervisory staff to ensure quality of project works.

15.2 Quality Definition

Quality is the totality of features and characteristics of a product for service that bears on its ability to satisfy the projects functional requirements. The quality of output is always agreed upon between the supplier and the client (in project works, Contractor and the Employer, respectively), and the quality objective is to achieve zero defects with best quality of the project works.

This is possible only by ensuring quality control at every stage during progress of planning, design, tendering, construction, acceptance, close-out and DLP.

Quality is conformity to standards and requirements to achieve excellence. The following are some definitions pertaining to quality and how to achieve it.

- **Quality control (QC):** The operational techniques or a system of maintaining standards by reviewing, checking, inspecting, and testing.
- **Quality Assurance (QA)**: The planned and systematic actions and implementations necessary to provide adequate confidence that the work will satisfy quality requirements.
- **Quality System (QS):** A set of documented processes, which seek to provide satisfaction that the project outputs will fulfil all the requirements for which it is being planned. The Quality System should fully incorporate the organization, human resources, materials, equipment, processes, inspections, testing and other parameters of the project. A key element of QS is the QA/QC Manual.
- **Quality Surveillance**: This normally covers two aspects.
  - At the project level, a review is required to ensure that the quality practices are implemented and documented to ensure in relation to the quality system.
  - At the contract package level, inspection and testing is required to ensure that the works executed meet the required quality standards.

15.3 Roles and Responsibilities

The Team Leader and the Construction Manager (QA/QC Manager) of the PMC are responsible for ensuring highest quality of the work and deliverables under the various contractors associated with the project. Responsibilities include, but not limited to, the following:

- Preparing a QMP and develop necessary QMS documents required to ensure quality and circulating and training of the team.
- Establishing a document numbering system and document control and ensuring the team is strictly adhering to it for easy reference and traceability.
- Ensuring proper peer review and design review records are followed.
- Ensuring proper document controlling records are maintained for the incoming and outgoing documents.
- Ensure all contractors providing services under this project will establish a comprehensive and effective QA/QC program approved by PMC.

- Ensuring proper checking and verification system is followed for design, drawings, and other documents.

While Project QA/QC is the responsibility of the entire PMC team, the Team Leader is responsible for the overall successful performance of this program. A Construction Manager who is responsible for the implementation of the program will support him.

15.4 Methodology

PMC is fully committed to the management principles underlying the ISO 9001 standards. PMC will emphasize the need to understand KMRL/Employer's needs and preferences and to strive to meet or exceed their requirements and expectations. This approach includes continual reassessment and improvement of the underlying processes and promotes decision-making based on factual information and data. To achieve this, QMP follows a Plan-Do-Check-Act (PDCA) process for continual improvement as illustrated in the **Figure 15.1**.

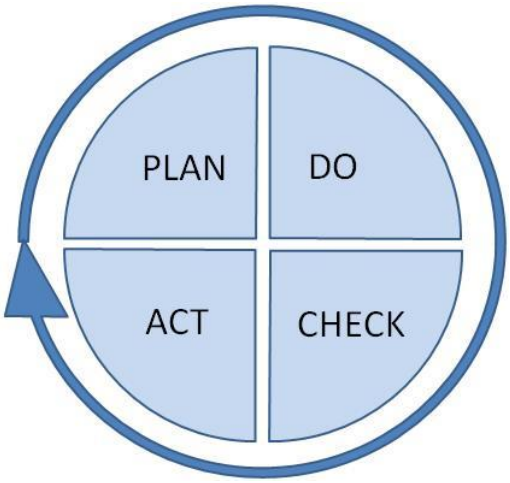

Figure 15.1: PDCA CHART

The following sections of the QMP describe the processes and procedures that shall be used as part of PMC's QA/ QC program for managing quality throughout the Project's life cycle.

This QMP will ensure Quality Control (QC) and Quality Assurance (QA) of the PMC assignment. The contractors will be required to submit their QA/QC program to PMC for review and approval before starting the work.

15.4.1 Quality Control during Design Stages

Quality Control (QC) is a process of monitoring and recording results of executing the quality activities to assess performance and recommend necessary changes. It is a way of preventing mistakes in the services provided and avoiding problems when delivering services to clients. The following is the step by step criteria to be followed as part of checking and verification procedures.

There are five main stages of design during which quality monitoring will be essential to monitor that the execution of the actual works are done in accordance with the set requirements for the design itself, the materials to be used and the specifications and building codes that are to be adhered to.

Concept design

During this stage, there will be a quality focus on compliance with the broad outline of the design on the preliminary drawings and specifications. This includes the preparation of the basis of design documents, which are discipline and subject specific documents that set the parameters for the design of the port.

Detailed design – Issued for Tender

During this stage, there will be a quality focus on the supporting technical studies and evaluation of design data, which the full development of the design including all details and material requirements as the deliverables of this phase include the 'Issued for Approval', 'Issued for Tender' drawings and the technical specifications and supporting calculations.

Detailed Design – Reviewing / Vetting by Proof Consultants

During this stage, detailed design of each component of the project shall be done as per the approved concept plans and site requirements. Accordingly, detailed GFC drawings shall be prepared and issued to the contractor.

Final Design – Issued for Construction Drawings and Technical Specifications

During this stage, there will a quality focus on the preparation of the Issued for Construction drawings and technical specifications, as these documents will be signed and stamped by the designer and issued as part of the final contract documents at contract award. Standardization aspect should be considered in the design stage.

The general procedure is illustrated in the schematic as shown in **Figure 15.2**.

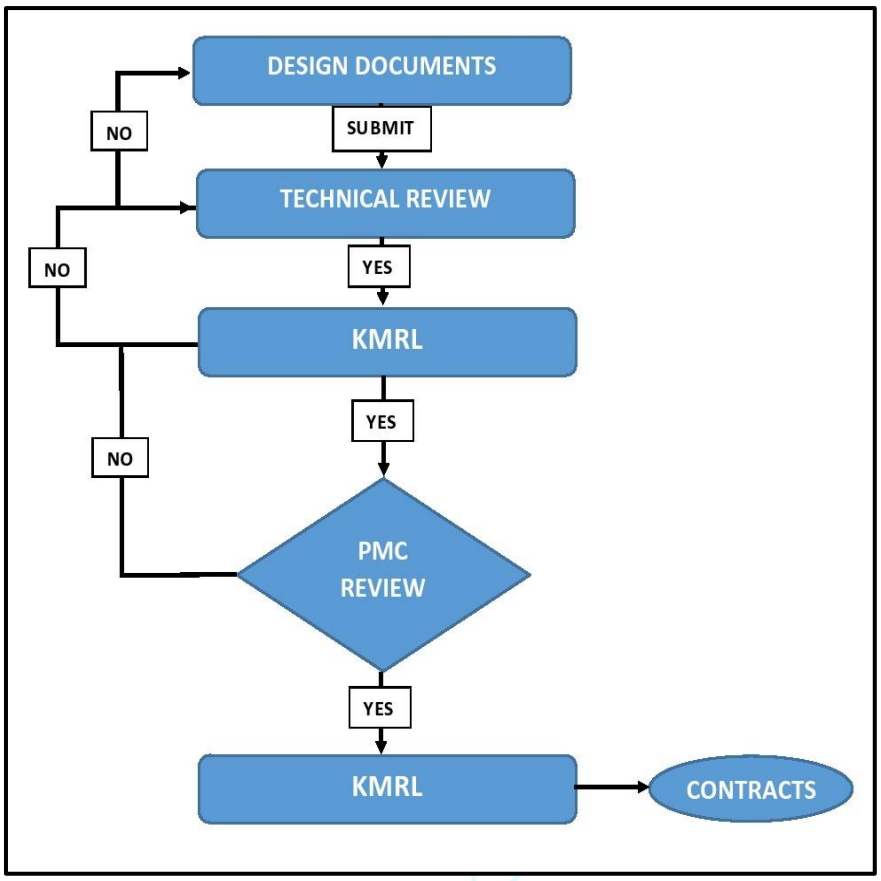

Figure 15.2: Quality Control process flow chart for contracted design

15.4.2 Quality Assurance / Quality Control during Execution Stages

This QA/QC Manual focuses on the implementation activities of the project following contract award, primarily on supervision and quality control of construction works. The QA/QC Manual is intended to be used as guide line for supervision of construction activities, primarily by the field staff of KMRL and the Design and Supervision Consultants.

It will provide a base outline towards, procedure, responsibilities, compliance acceptance criteria and documentation for carrying out inspection, testing and reporting on various materials, items involved for the satisfactory execution of the project work. In all cases, somehow, it is most important to understand that the technical specifications as specified in the contract document / agreement are the guidelines for any construction activity.

The QA/QC Manual for the Construction activity does not attempt to suggest technical specifications, since these are stated in the contract documents. Its aim is to ensure that the works are executed as per specifications to achieve best results. Test results shall be interpreted as applicable for individual package, in accordance with the technical specifications as specified in the conditions of contract.

The general procedure is illustrated in the schematic as shown in **Figure 15.3**.

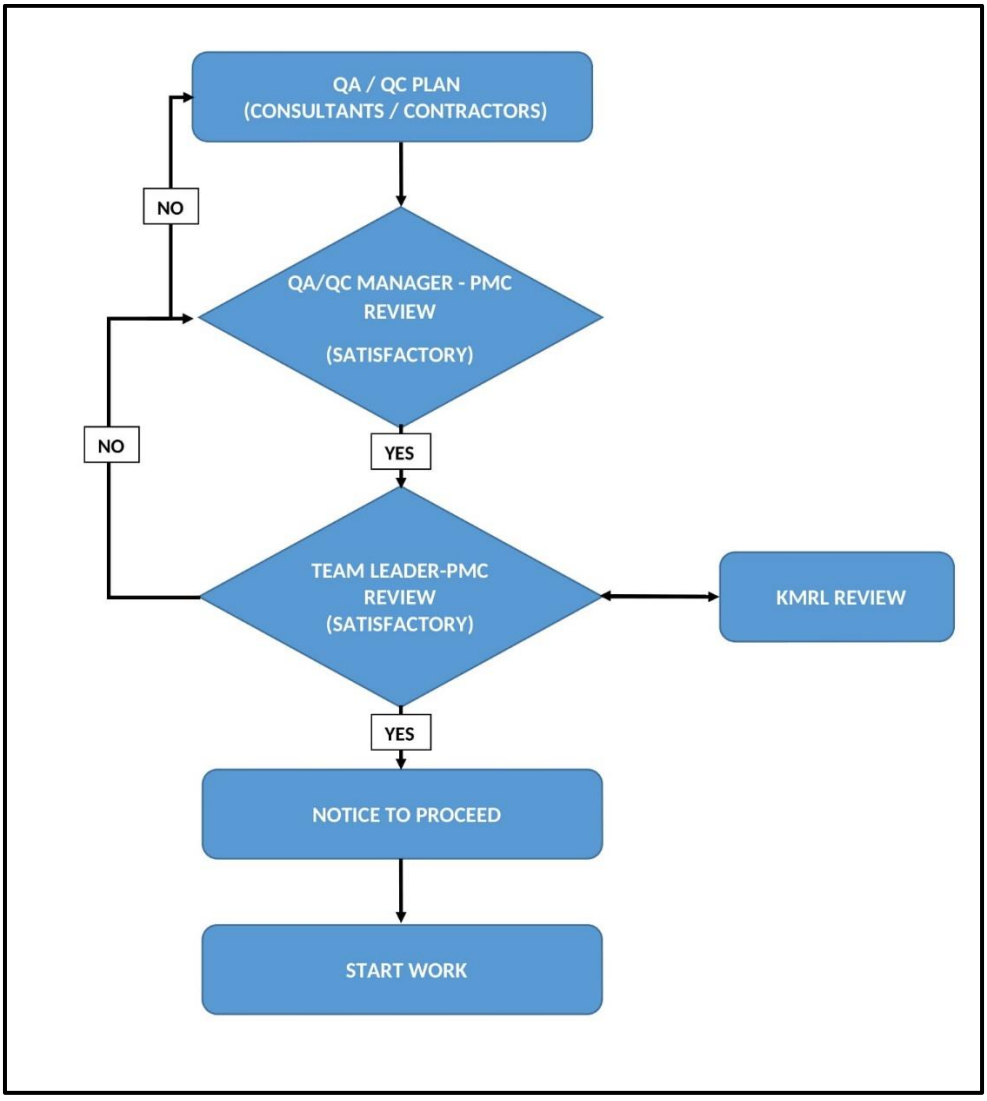

Figure 15.3: Process flow chart for QA/QC submittals of contractors

15.5 QA/QC System

QMP for this project is a collection of processes focused on achieving quality objectives by identifying quality requirements and/or standards for this Project and its deliverables and documenting how the Project will achieve compliance with KMRL / Employer's quality requirements. It, therefore, employs aggressive quality assurance and quality control methods to achieve the highest quality objectives.

15.5.1 Document Validation Procedure during Design Stage

Design Output

The output of design and development activities is to be provided in a form that enables verification against inputs and shall be approved prior to release. Such output elements will be:

- Meet the input requirements for design and development as required by KMRL / Employer and contained in the Project scope.
- Contain or address Project execution acceptance criteria.
- Contain or address all know Lessons Learned from the project.
- Contain or address all opportunities for latest technologies, best practices, and “green” building concepts.
- Contain or address all knows environmental/health/safety requirements and concerns.
- Contain or addressed all schedule requirements.
- Contain or addressed all known interface issues with adjacent contracts/work.
- Third party reviews completed where necessary.

Design Review/Check

At suitable stages, systematic reviews of design and development will be performed in accordance with the planned arrangements in order to:

- Evaluate ability of results of design and development to meet the Project’s requirements.
- Identify any problems and propose necessary actions.

Records of such reviews in consultation with concerned functions and actions arising after such consultations shall be maintained and kept in the document control system to be adopted for the Project. These reviews shall also involve third party review / vetting as required by the contract and as deemed necessary.

Verification

Verification of such design activities are to be performed in accordance with planned arrangements to ensure that design outputs meet the input requirements. Records of such verifications along with any actions taken are to be taken are maintained.

Approval

Design validation shall be performed in accordance with planned arrangements to ensure that the resulting product or service is capable of meeting the specified intended use. Records of such validations are maintained as required.

A Design verification record, design verification register and a review log are always maintained for each and every design submittal.

Revision

Whenever any changes to design take place, such changes are identified, and records maintained. Such changes will be reviewed, verified, and validated by identified responsible people, before its submission to KMRL / Employer. For some major deliverables, technical peer review shall also be conducted.

15.5.2 Document Validation Procedure during Execution Stage

This procedure provide specific details for the management of the identified quality issues at the project level, including any relevant forms or checklists. Subject to project requirements Inspection and Test Plans (ITP) are prepared to identify, plan, and provide a record of project specific inspections and tests from project commencement to completion. Although ITP's are a control mechanism for the activity being undertaken to ensure quality of product is met, this quality control function will form part of the standard of evidence required to fulfil KMRL / Employers confidence in service provision.

The quality assurance system should have the following basic parameters.

- Site Documents
- Mandatory and Optional Testing
- Availability of Field and Departmental Laboratories
- Manufacturing Test Certificates
- Departmental Team Inspections
- Checklist Guide for Works
- Site Inspections
- Post Quality Testing of Finished Works
- Quality Certification
- Monthly Reporting and Review Meetings
- Electrical works installation and testing/certification; and
- Mechanical works installation and testing/certification.

15.6 Health Safety and Environment

The Health and Safety of any project site also plays an important role and is also a part of the quality control of any project work. The Project Safety and Environmental Management Plans are an integral part of the quality management system and will ensure that this project is executed within a safe working environment and in an environmentally responsible manner in accordance with standard policies and as required by the relevant Acts and Regulations and customer requirements. The HSE audits has to be conducted at the Project Sites for the various work areas generally encountered in the projects being executed. The following activities are to be maintained under HSE.

- Display of Notices.
- Warning tape, lighting arrangement at location of any excavated trench, electrical installation, or mechanical erection.
- Fire Prevention and Protection.
- Environment & Health.
- House Keeping.
- Lighting.
- Monsoon Precaution.
- Noise and Vibration.
- Personnel protective equipment (PPE) for field staff.

CHAPTER 16

OPERATION AND MAINTENANCE STRATEGY

16 OPERATION AND MAINTENANCE STRATEGY

16.1 Introduction

This chapter deals with the operation and maintenance aspects of canals and other systems proposed to be created under the IURWTS Project. After reconstruction, the canals need to be maintained to keep them functional for navigation, water conveyance as well as keep the water quality at the desired level.

The Kochi Metro Rail Ltd. (KMRL) is already having a prestigious project, the Water Metro, which shall be commissioned within this year. On perusal, it was found that most of the components like boat yards, dredging etc. is similar to the one in this project. It would not be worthwhile to duplicate both structures and systems as it may involve doubling of operational expenditures. Since KMRL is already planning to have an organization specific for the operation and maintenance of its Water Metro project, the same SPV shall serve the purpose of Operation and Maintenance of this project.

This chapter gives an overview of the activities the SPV needs to take up and gives guidelines for the execution of the plan and frequency of those activities. Based on the guidelines suggested in this chapter and before completion and commissioning of project assets, the operation and maintenance plan will be finalized by KMRL considering the provisions of various contracts and SPV's mandate.

16.2 Organization Structure

The structure of this vertical shall be taking into consideration the operational aspects of the fleet, asset management, maintenance of the civil structures like Sewerage systems, gates, and sewer lines etc. and also the overview of the revenue streams. Irrespective of the size of the vertical, its structure should be designed to permit good and fast decision-making.

The important departments in O&M phase and their general functions is given below:

1) Operations Department: This is the most important department of a Navigation company. The main Job of this department is to maximize the economic and safe deployment of the ferry fleets via a number of activities including planning and scheduling i.e. the routes and tourist centric operations. A significant level of coordination shall be done by this department other internal departments in achieving the schedules and ferry maintenance.
2) Technical department: This departments main responsibility is to keep the ferry canal worthy and good maintenance conditions and also to see that all the civil structures are in good condition.

Typical organization structure for the O&M of this project is given in **Figure 16.1**.

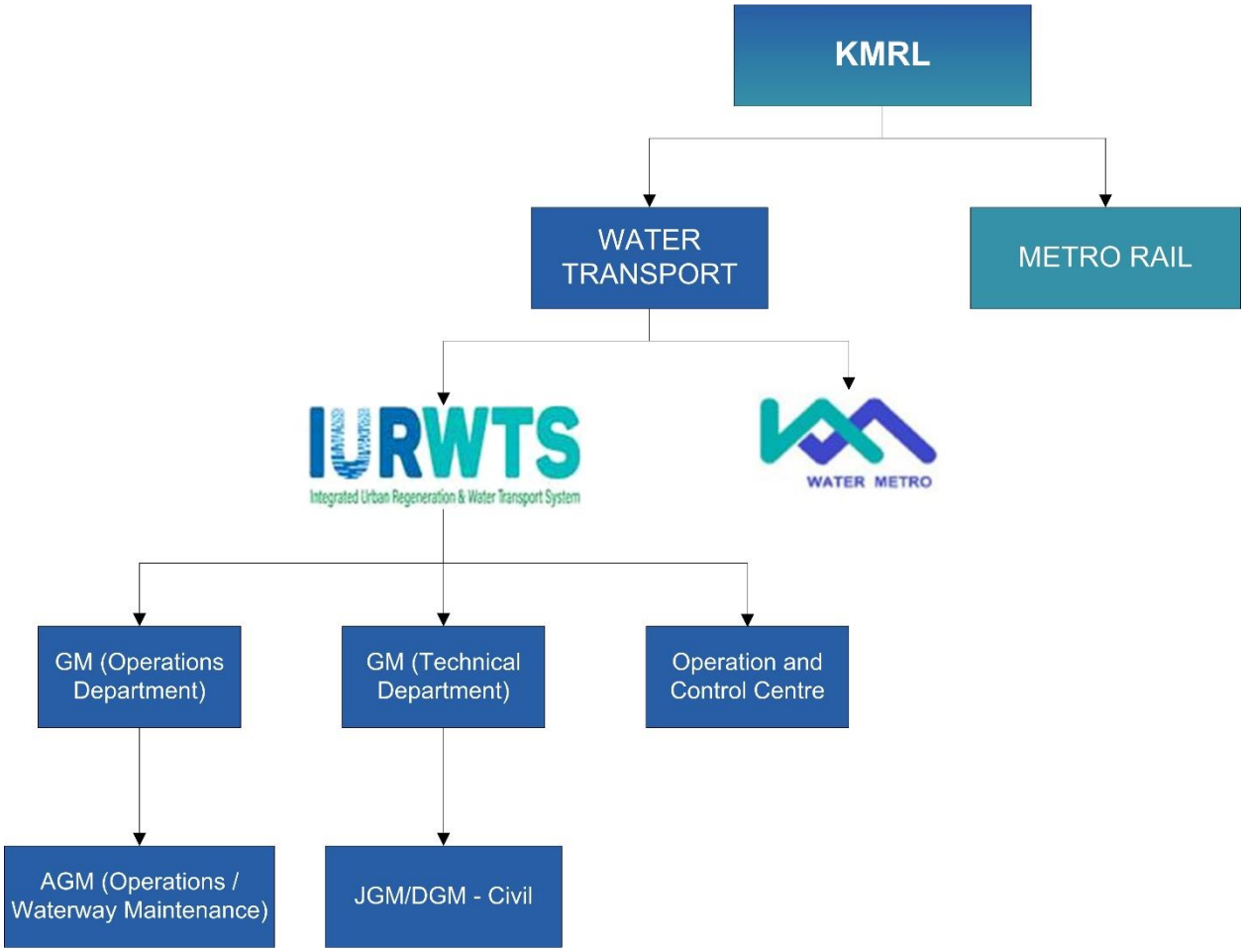

Figure 16.1: O&M organization structure

16.3 Programming Maintenance

Maintenance activities are most commonly planned in multiyear programs. A common duration for a canal maintenance plan is 5 years. The activities can be planned based on a prediction of the necessary maintenance and can be optimized based on the results of inspections. A good way to incorporate the inspection results in multiyear programs is to review the planned maintenance activities on periodic basis (weekly, monthly, quarterly, yearly) and see if any adjustment is necessary based on the inspection results. This frequency can be rescheduled based on the performance of the system or to meet any special requirement.

16.4 Operation and maintenance aspects

The following maintenance and operational aspects are identified:

- Monitoring water levels & water quality.
- Maintenance of canal infrastructure:
  - Maintenance desilting.
  - Shore / Bank protection.
  - Jetties.
- Canal cleaning &hyacinth and pest removal.
- Maintenance and repair of ferry including repairs, overhauls, and routine maintenance.
- Flood & storm water protection.
- Communication & Informing.
- Permitting supervision & enforcement.
- Calamity management.
- Data collection & storage.

It is assumed that the conveyance, operation and maintenance for the solid waste infrastructure and cross-structures will come under the already existing authorities.

16.5 Sewerage Systems and Treatment Plants

Currently there are already sewer systems and sewerage treatment plant in parts of Kochi. At present Kerala Water Authority (KWA), Government of Kerala, is responsible for O&M of the sewer systems in Kochi. After the completion of this project, the modality for the O&M of the additional 5 STPs with clear mandates and responsibilities will be finalised by the SPV constituted and will be directly under the functional control of SPV (SPV details explained in section 2.4 **Chapter 2**, of this DPR). However, proposed 5 STPs of total 31 MLD will be executed on DBOT basis and the O&M cost for maintenance of the systems is also included in the estimate framed.

16.5.1 Financial aspects

Internationally (a part of) the cost for maintaining the sewerage system and wastewater treatments plants are paid for by the users. For example, in the Netherlands the sewerage systems are managed and maintained by the municipalities whereas separate water boards manage the wastewater treatment plants. The municipality levy taxes on all the users of the sewerage system to acquire the necessary funds for management, maintenance, and replacement of the system. The taxes are determined based on the

predicted cost for the management, maintenance, and replacement over the life cycle of the system. The costs are typically reviewed every 5 years.

The funds for the treatment of wastewater are acquired by taxation by the water board. How much tax is paid for the wastewater treatment differs per household or business depends on the situation (e.g. number of registered household members). The amount of tax for wastewater treatment in the Netherlands is calculated on a standardized “units of pollution”:

- A 1-person household pays for 1 “unit of pollution”.
- A multi person household pays for 3 “units of pollution”.
- A business that produces less than 5 “units of pollution” pays for 3 units.
- A business that produces more than 5 “units of pollution” pays based on the amount of produced wastewater.

A similar system is suggested to be set up for Kochi and the international practices suitably modified in view of the prevailing policies of the Government of Kerala.

16.5.2 Maintenance of COD

Ticketed entry to the eco sensitive edge of the Edappally canal (near Eroor bridge) towards Chitrapuzha for bird watching, and passive recreational activities will be a major revenue generation source. Other facilities like Commercial kiosks, cycle lending, recreational fishing facility, open theatres, open exhibition pavilions and panels, and billboards are also proposed along the canal banks for revenue generation, this will ensure the revenue required to meet the maintenance cost of the canal bank oriented development.

16.5.3 Inspection of sewerage systems

Inspection of sewerage systems is done visually and can be done either manually or by camera (on a pole or with CCTV). Typical return periods for inspection vary between 2 – 8 years depending on the amount of debris/sludge that washes into the system and on the risk that a failure of (a part of) the system causes to the local environment. For example: a failure in a sewerage pipe under an important road connection causes more damage than that same failure causes under a small and not often used road.

There is no prevailing systematic practice by Kerala Water Authority, Govt of Kerala for periodic inspection of the sewer networks. Hence it is suggested that after the implementation of the sewerage network of this project is complete periodic inspection as per CPHEEO guidelines are followed under the supervision of SPV.

Objects such as pumps, culverts, manholes, spillways, solar panels, switch boards, etc need to be inspected once a year, or as may be required. Pumping stations and waste water treatment plants are tailor made and should be inspected and maintained according to the specifications for that asset. Water samples will be collected to assess inflow and outflow parameters of water quality and monitored at regular interval to the assess the performance of STPs run by the O&M agency. These parameters will be displayed in STP and in the operation control centre of SPV and signed copy reported to the SPV. More details on water quality aspects are discussed in subsequent section 16.5.2.

Health and safety are especially important for inspection of sewerage systems as the combination of build-up of toxic gasses and small spaces is a potentially deadly combination. The Standard Operating Procedure (SOP) for Cleaning of Sewers and Septic Tanks, issued by Central Public Health and Environmental Engineering Organization (CPHEEO), Ministry of Housing and Urban affairs, Govt. of India (2018) is recommended to be followed.

16.5.4 Water quality

The quality of the water in the canals is divided in chemical quality and biological quality. The chemical quality is determined based on the concentration of micro pollutions (e.g., heavy metals, PCB's, and PAH's) and nutrients (e.g., phosphates, nitrogen, and organic components). The chemical quality of city canals in the Netherlands is monitored on a daily basis. To determine the chemical water quality water samples are taken and analysed in a laboratory. Water samples need to be taken at the start of a canal and at confluences with sub-canals or sub drains. In this way the origin and the spread of toxins can be traced. However, it is recommended that the toxins/substances which will be monitored in Kochi are based on Indian regulation.

Besides determining the chemical components with water samples, it is also possible to monitor parameters like oxygen, chloride, and water temperature with sensors, which can monitor continuously and send the data by mobile phone or IoT. This can give a global overview of the water quality.

Sewage and wastewater are currently being discharged into the (sub-)canals, thereby polluting the water (see **Chapter 2** of this report). Diminishing the amount of wastewater outlets will improve the quality of the water. Regular inspection of the canals for unregistered wastewater spills can help decrease the number of outlets. Monitoring the quality of the water can also indicate wastewater spills.

The biological quality of the water relates to the amount and species of plants, algae, fish, birds, and bacteria living in the canals. For plants, fish and birds, population research is normally done with a frequency between once a year and every 5 years.

16.6 Monitoring Water Levels & Water Quality

Water level monitoring

- Water level measurement through sensors.
- Frequency of measurement will depend on the site-specific requirement.

Water quality monitoring

The sewage disposal into the sub canals of the catchment needs to be monitored continuously for which it is suggested to install optical sensors in the sub drains so to provide,

- Information on location and timing of wastewater contamination in canal waters. This will help to understand the magnitude of the problem sub canal wise of the catchment.
- To assess the seasonal and hydrologic variability for tracking contamination sources.
- Detect differences within catchment to direct water quality improvement efforts for focusing on the highest priority sub canals.
- Initiate legal action against the offenders:
  - to identify the sources and timing of human sewage contamination in the canal water, the use of optical sensors technology is recommended .The frequency of measurement will be based on the canal wise requirement.
  - Monitoring of bird and fish population is recommended once every 1 to 5 years.

16.6.1 Water levels

To assure that boats and other vessels can maneuver through the canal metro , the water depth needs to be maintained. To know the water level and maintain the water depth, monitoring is proposed visually, by placing water level indicators along the canals route.

The other option suggested is to is to install electronic sensors that can register the water level at every specified period. Because the canals are connected to the Kochi lagoon, a tidal movement is present in the canals. Therefore, a relatively high frequent measurement is advised at the entrance point of the canals , at least to map out the tidal cycles. The water levels in the larger rivers and canals in the Netherlands are measured every 10 minutes. It is suggested that in order to get an accurate picture of the tidal movement, a 20 minutes interval is proposed. would suffice as well (**Figure 16.1**)

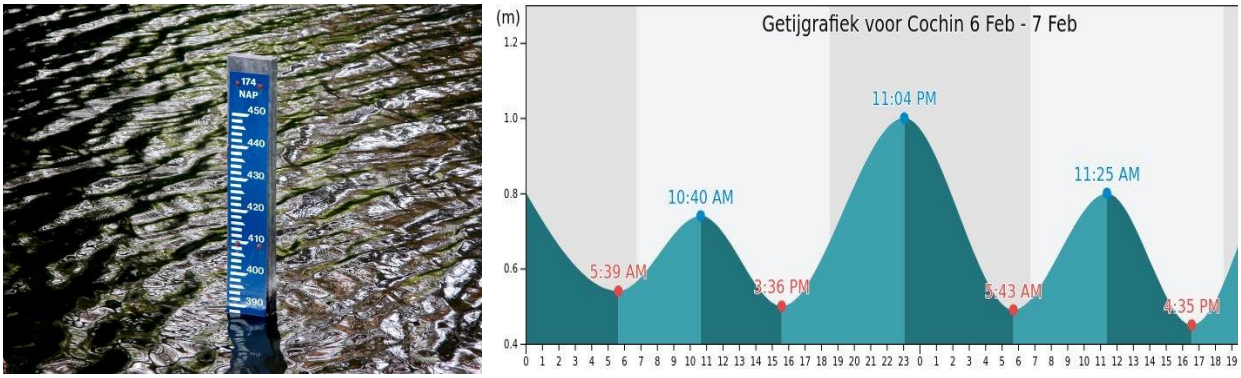

Figure 16.2: Measuring water levels manually or by sensor and tidal wave curve of Cochin Port

16.7 Maintenance of Infrastructure

- The frequency of maintenance dredging depends on the magnitude of the sedimentation. For now, it is set to once per 5 years. As the canals of the project command are of shallow depth appropriate echo sounders will give Multibeam measurements an indication of the dredging frequency. The frequency of dredging can be adjusted considering navigation transport requirements.
- Wooden jetties if any need to be stained every 3-5 years.
- Embankments along the Kochi canals are visually inspected once a year and if damaged, reparations will be planned.

16.7.1 Maintenance deepening

Maintenance deepening is necessary to maintain a sufficient water depth to keep the navigation transport in the canals running. Next to a mobility purpose, desilting the canals also has a purpose for the water quality. Silt layers can be polluted which can cause stench, unwanted growth of algae, fish mortality and botulism.

To plan the frequency of the maintenance desilting insight in the annual sediment deposit is necessary. The sediment deposit will be monitored by echo sounders wherein a vessel measures the under-waterbed profile. By executing these measurements, one can determine the amount of sediment deposit by subtracting consecutive measurements. As a rule of thumb maintenance, deepening once per 5 years is usually sufficient. If measurements show that a smaller interval is required (e.g. as a result of tidal influences), the deepening frequency can be adjusted. It is strongly recommended to build a track record of the measurements, and the maintenance dredging cycles. This can be used to optimize the dredging frequency (**Figure 16.3**).

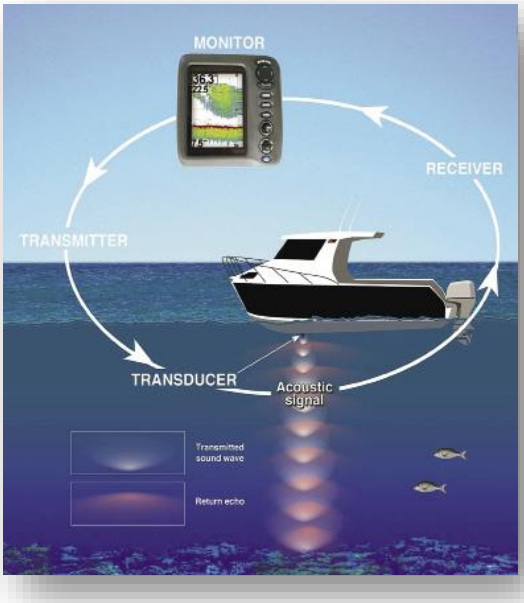

Figure 16.3: Measuring bathymetry using GPS enabled using multibeam eco-sounder

16.7.2 Jetties

The jetties are used as a boarding area for the planned public transport (PT) vessels. Jetties can be either constructed as floating jetties or as jetties with a fixed height depending on the expected changes in water levels/ tidal range (**Figure 16.4**). In case of damaged concrete jetties, it is key to prevent the reinforcement (rebar) from being exposed to water and air as this will cause corrosion. Wooden parts of jetties need to be checked for wood rot, cracks, etc. Applying stain every 3-5 years improves the lifetime of the wooden elements.

For the jetties, two types of inspection are necessary:

1. Inspection of structural aspects like damaged concrete, corrosion of the rebar, wood rot, etc. A visual inspection of the structural aspects should be conducted once a year. A more detailed inspection, e.g. to examine the amount of corrosion, can be planned adhoc based on the results of the visual inspection or on reported incidents.
2. Inspection of navigational aids such as fenders, signs, etc. It is recommended to visually inspect this at least once every 3 months or based on reported incidents.

Figure 16.4: Examples of jetties in vogue

16.7.3 Bank protection

The embankments in Kochi can primarily be subdivided into three types: quay walls consisting of masonry, pile and slab systems, sheet piles, grass covered banks and embankments with a slope covered with rubble stone or revetments (placed stones).

The existing condition of bank protection in the project canal is as shown in **Figure 16.5**.

It is recommended to inspect quay walls consisting of masonry or sheet piles once every 5 year for cracks, rust, missing stones, and damages. If the damages become too severe, maintenance is required.

The grass covered banks need to be annually checked for caving in and instability. Also, if present at the grass covered banks, the camp shedding needs to be visually checked once a year. If the banks are collapsing, the camp shedding needs to be reinforced. Also, if pits and holes emerge behind the camp shedding, filling these pits and holes with soil improves safety.

It is recommended to visually inspect embankments with rubble stones or revetments once a year or at shorter intervals as may be required.

Figure 16.5: Exiting condition of bank protection in project canals in Kochi

16.8 Water Taxis and Public Transport Vessels

The water taxis and the public transport vessels will need to adhere to the local regulations for water transport and health and safety. It is advised to inspect the safety equipment (life jackets, etc.) on board at least once a year or at random inspection by SPV. If vessels have cooking installations on board, they should also be inspected once a year. A typical period for an overall inspection on the state and safety of a vessel is once every 5 years which is bit longer.

The maintenance schedule of the vessels depends on the specifications for that specific type of vessel. However, it is advised to check it at every six months initially to ensure that all safety measures are in place

16.9 Canal Cleaning, Water Hyacinth and Pest Removal

- It is suggested that a maintenance contract on a yearly basis is arranged so that the full length of the canals is cleaned every two weeks, depending on the amount of debris. Any hot spots in the canals with regard to debris and garbage will be identified during maintenance and that will be cleaned more often.
- In the seasons wherein the pests or water hyacinth grow, mowing once or twice a week is sufficient, if extraordinary growth occurs, the frequency can be increased.

16.9.1 Canal cleaning

To keep the canals in Kochi free from debris and water pest, frequent removal of these matters will benefit the (navigational)safety and flow through of the canals. To assure this, removal vessels executed with a

claw bucket need to remove debris and other obstacles from the water. The intervals of the removal depend on the garbage disposal in the Kochi canals. As a reference, the Amsterdam canals, which are in total approximately 75 km long, are cleaned daily and annually 60,000 kg plastic, 7,000 dead animals and 12,000 bicycles are removed from the Amsterdam canals. The total amount of canals is cleaned during a 1 or 2 week cycle. Depending on the amount of debris and garbage, it is recommended that the Kochi canals are cleaned with a similar interval.

16.9.2 Water pest or water hyacinth removal

Another problem to take into account is preventing the canals from becoming overgrown with rampant water pests or hyacinth. These water plants have, in large quantities, an alkaline effect on the water, which affects other aquatic vegetation and aquatic animals. It also causes propulsion problems when it tangles around the vessel's propellers. To counter this problem, the vessels provided with cutting gears will mow the water plants to keep the canals clean and proper. Also, removal of the plant residues is necessary. Leaving cutting leftovers in the canals can cause a decrease of the oxygen level. Depending on the growing velocity of the plant species and the season, maintenance once or twice during the growing seasons is a normal frequency to keep the canals flowing. To mitigate the growth of rampant and invasive water plants, dumping exotic water plants from e.g., aquariums in the canals should be prohibited and the illegal dumping of invasive plant species need to be monitored (**Figure 16.6**).

Figure 16.6: Debris removal using mechanized vessels and canal mowing

16.10 Flood & Storm Water Protection

To prevent the city of Kochi from flooding two types of measures are possible:

- Storm water drainage from the city to the canals.
- Sealing of the canals from the river and the lagoon with locks or barriers as given in **Figure 16.7**.

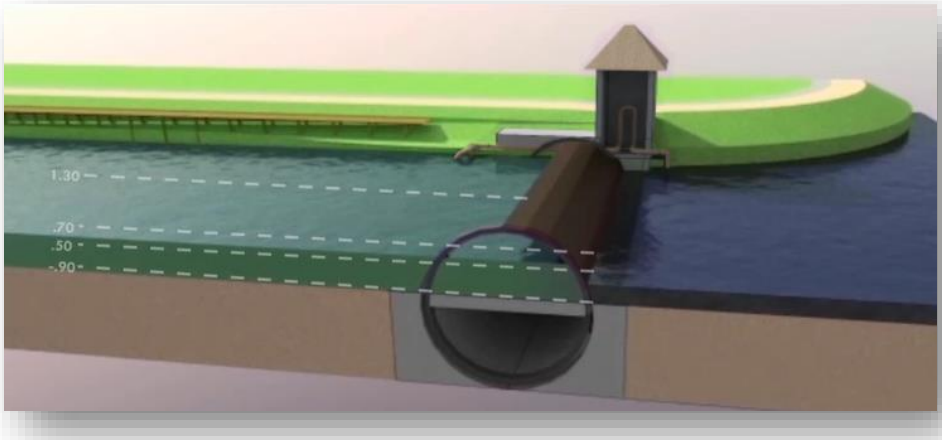

Figure 16.7: Regulatory mechanism for sealing the canals from preventing floods and tidal fluctuation

The storm water drains run from the city through the embankment into the canals. They will need some sort of valve or construction to prevent water from the canals to flood into the city during high water on the canals. Both the drains and the valves/constructions should be inspected regularly. It is recommended that they are visually inspected every three months and that the closure of the valves is tested.

Locks and barriers are larger and more complicated construction which will need tailor made maintenance. The maintenance will include at least the following aspects:

- Hydraulics and electro-technical,
- ICT
- Structural.
- Navigational.
- Safety.

The maintenance intervals will be tailor-made. If locks or barriers are installed it is recommended to use similar construction with similar closing mechanism and similar ICT. This will make the maintenance far more efficient. It is highly recommended to test the closure of the locks or barriers at least twice a year.

Another way to mitigate high water levels is to intentionally inundate specific parts of the land in so called retention basins. These retention basins are inundated through spillways or canal locks (**Figure 16.8**). It is recommended that the spillway or lock gates are inspected for damages and/or the closing mechanism is tested at least once a year.

Figure 16.8: Examples of spillway and closing locks

16.11 Communication & Informing

As the operation of the canals will introduce new regulations & permits and the maintenance activities can affect people, it will be necessary to set up some form of communication to local residents, companies, other authorities, etc. At least the following forms of communication are necessary.

- Introducing the permitting to the residents, companies, and other authorities.
- Creating awareness among citizens and corporate authorities by informing them what activities have negative influences on the canals and what activities do not.
- Informing affected people, companies, and authorities of maintenance activities.

16.12 Permitting Supervision &Enforcement

Construction or other activities near the canal and spills into the canals have an influence on the condition and functioning of the canals. To prevent effects on the canals and their infrastructure, a permitting system is needed where activities near the canals are announced by any other local or state agency and the requirements to the activities can only be permitted or enforced by the dedicated SPV. However, this can be done in consultation with municipal corporation or any other relevant agencies. A permit is granted by the SPV/ local authority depending on their jurisdictions to execute the request after investigating the consequences. Also, inspection of the canals to monitor the presence of unregistered activities or activities that do not coincide with the requested permit is required to maintain the Kochi canals.

16.13 Incident Management

Regardless of all the prevention measures, incidents will happen. It is paramount that the SPV or any local authority can react adequately to incidents. For adequate incident management several aspects required:

1. Incidents can be reported to the canal authority. This can be done by either phone or internet. It will require a 24/7 incident desk which can relay the reports to the department involved in mitigating the incident.
2. A number of employees need to be assigned to incident management. This can be done on a rotating basis, but the incident management organization needs to be active 24/7.
3. If necessary, warnings need to be put out. This can, for example, be done by SMS-message or via internet, depending on the seriousness of the incident.
4. Incident plans need to be drafted beforehand to adequately react to incidents.

16.14 Data Collection &Storage

The monitoring, inspections and permits will yield a large amount of data and reports. These will need to be stored and back upped. This requires sufficient server and ICT capacity at proposed operation control centre of SPV for this project.

Also, some of the monitoring will be done with automatic sensors. This will require dedicated communication, applications, and dashboards to receive and interpret the collected data at operation control centre of SPV.

16.15 Budget Provision

To continue with smooth operation and maintenance of the assets proposed to be created under this project, various O&M activities discussed earlier in this chapter are summarized in **Table 16.1** along with budgetary provisions made in the revised DPR under the SPV.

Table 16.1: Summary of operation and maintenance activities with budgetary provision

Sl. No.	Project Components	Period (years)	Budget (Rs. In Crores)	Agency responsible	Proposed activities
1	Environmental monitoring (air, noise, water)	5	3	Antea Group/SPV	Environmental parameters
2	Maintenance of Solar installations and EV chargers	5	By Service Provider	SPV with intermittent IT and AMC support services	Continuous monitoring with 3 periodic month maintenance during defect liability period and AMC support.
3	Maintenance of Vessels / Boats	5	By Service provider	SPV through specialized service provider or supplier	Periodic maintenance and replacements including maintenance support during defect liability period (DLP).
4	STP (5 nos. of total 31 MLD)	15	31.65	Executing DBOT Contractor	Included O&M in Tender document.
5	Solid waste management	3 years	3.83	Kochi Corporation.	Daily Collection, transportation, treatment, recycling, disposal.
Total excluding Service provider cost			**45.37**		

About Antea Group

From city to countryside, from air to water: Antea Group's engineers and consultants have been contributing to our living environment in the Netherlands for years now. We design bridges and roadways, and create residential neighborhoods and water structures. But we are also involved in areas such as the environment, safety, asset management and energy. Under the name Oranjewoud, we expanded into an all-round, independent partner for companies and government bodies. As the Antea Group, we also apply this knowledge at a global level. By combining valuable knowledge, including on technical matters, with a pragmatic approach, we make solutions attainable and workable. Goal-oriented, with an eye for sustainability. In this way, we anticipate today's questions and tomorrow's answers. Just as we have been for over 60 years now.

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Detailed Project Report Annexures

Integrated Urban Regeneration and Water Transport System (IURWTS) in Kochi

project number#: WT/2024
Revision #: R0

June 08 2020

IURWTS
Integrated Urban Regeneration & Water Transport System

Antea Group

Antea Nederland. Antea India

Understanding today.
Improving tomorrow.

Detailed Project Report - Annexures

Integrated Urban Regeneration and Water Transport System (IURWTS) in Kochi

Project #: WT/2024

Revision #: R0

June 08, 2020

General Consultant - IURWTS:

Antea Nederland B.V. and Antea India Pvt. Ltd.

Client:

Kochi Metro Rail Limited, (A Joint Venture of Govt. of Kerala and Govt. of India)

ANNEXURE 3A.1

100 years design flood derived from SUH method (CWC 2001)

1 in 100yr Design flood Edappally canal		1 in 100yr Design flood Chilavanoor canal		1 in 100yr Design flood T-P canal	
Time in hrs	Total flow in Cumecs	Time in hrs	Total flow in Cumecs	Time in hrs	Total flow in Cumecs
0.00	2.70	0.00	2.18	0.00	1.55
1.00	4.42	1.00	2.37	1.00	2.05
2.00	11.29	2.00	3.03	2.00	4.87
3.00	30.15	3.00	4.82	3.00	14.72
4.00	57.39	4.00	9.48	4.00	25.82
5.00	84.93	5.00	16.90	5.00	35.90
6.00	106.71	6.00	27.12	5.50	43.51
7.00	**115.62**	6.30	39.85	6.00	51.53
8.00	110.14	7.00	53.34	7.00	**55.74**
9.00	94.39	8.00	64.45	8.00	54.92
10.00	89.25	9.00	**68.71**	9.00	49.05
11.00	78.12	10.00	65.51	10.00	41.48
12.00	72.45	11.00	58.15	11.00	33.88
13.00	45.09	12.00	51.55	12.00	27.45
14.00	27.37	13.00	46.23	13.00	22.25
15.00	15.01	14.00	41.99	14.00	17.50
16.00	9.62	15.00	38.71	15.00	12.76
17.00	7.27	16.00	34.96	16.00	9.43
18.00	6.37	17.00	30.93	17.00	7.50
19.00	5.53	18.00	26.80	18.00	5.81
20.00	5.03	19.00	22.80	19.00	4.88
21.00	4.72	20.00	19.55	20.00	4.36
22.00	4.35	21.00	16.95	21.00	3.98
23.00	3.81	22.00	15.15	22.00	3.61
24.00	3.01	23.00	13.71	23.00	3.30
25.00	2.80	24.00	12.33	24.00	3.07
26.00	2.70	25.00	10.86	25.00	2.88
27.00	2.70	26.00	9.34	26.00	2.77
		27.00	7.83	27.00	2.54
		28.00	6.21	28.00	1.97

1 in 100yr Design flood Edappally canal		1 in 100yr Design flood Chilavanoor canal		1 in 100yr Design flood T-P canal	
Time in hrs	Total flow in Cumecs	Time in hrs	Total flow in Cumecs	Time in hrs	Total flow in Cumecs
		28.50	4.70	29.00	1.72
		29.00	3.57	30.00	1.61
		30.00	2.81	31.00	1.55
		32.00	2.40		
		33.00	2.24		
		34.00	2.19		
		35.00	2.18		

ANNEXURE 3A.2

Inflow -Out flow hydrograph design flood computed values for 3 canal catchments

Chilavanoor canal Inflow - Outflow hydrograph				Edappally canal Inflow -Outflow hydrograph				T-P canal Inflow -Outflow hydrograph			
Time in hrs	Inflow Hydrograph Cumecs	Outflow Hydrograph Cumecs 1st stretch	Outflow Hydrograph Cumecs 2nd stretch	Time in hrs	Inflow hydrograph Cumecs	Outflow Hydrograph Cumecs 1st stretch	Outflow Hydrograph Cumecs 2nd stretch	Time in hrs	Inflow hydrograph Cumecs	Outflow Hydrograph Cumecs 1st stretch	Outflow Hydrograph Cumecs 2nd stretch
0.00	2.18	2.18	2.18	0	2.70	2.70	2.70	0	1.55	1.55	1.55
1.00	2.37	2.27	2.18	1	4.42	3.18	2.79	1	2.05	1.95	1.86
2.00	3.03	2.66	2.32	2	11.29	6.07	3.64	2	4.87	4.24	3.66
3.00	4.82	3.78	2.81	3	30.15	15.42	7.63	3	14.72	12.33	10.67
4.00	9.48	6.74	4.20	4	57.39	34.53	18.86	4	25.82	21.89	18.35
5.00	16.90	12.25	7.31	5	84.93	60.07	39.67	5	35.90	31.06	29.11
6.00	27.12	20.47	12.75	6	106.71	85.56	65.79	5.5	43.51	38.49	35.14
7.00	39.85	31.34	20.74	7	115.62	104.55	90.53	6	51.53	46.29	41.64
8.00	53.34	43.92	31.10	8	110.14	111.65	107.53	7	55.74	51.10	45.94
9.00	64.45	56.03	42.79	9	94.39	106.06	**112.10**	8	**54.92**	51.70	**47.00**
10.00	68.71	64.17	53.66	10	89.25	95.52	104.94	9	49.05	47.86	44.54
11.00	65.51	65.95	60.93	11	78.12	87.51	94.39	10	41.48	42.10	40.41
12.00	58.15	62.14	62.88	12	72.45	78.60	86.40	11	33.88	35.83	39.89
13.00	51.55	56.11	60.23	13	45.09	66.14	76.85	12	27.45	30.13	34.96
14.00	46.23	50.27	55.29	14	27.37	44.76	62.80	13	22.25	25.23	29.20
15.00	41.99	45.32	49.99	15	15.01	27.73	41.25	14	17.50	20.60	25.12
16.00	38.71	41.35	45.23	16	9.62	16.30	25.25	15	12.76	15.96	20.96
18.00	34.96	37.66	41.14	17	7.27	10.43	14.87	16	9.43	12.41	17.61
19.00	30.93	33.79	37.32	18	6.37	7.71	9.77	17	7.50	10.05	15.17
20.00	26.80	29.75	33.47	19	5.53	6.43	7.43	18	5.81	8.00	12.98
21.00	22.80	25.71	29.52	20	5.03	5.59	6.28	19	4.88	6.66	11.35
22.00	19.55	22.06	25.64	21	4.72	5.07	5.51	20	4.36	5.75	10.10
23.00	16.95	19.00	22.11	22	4.35	4.69	5.02	21	3.98	5.07	9.07
24.00	15.15	16.66	19.13	23	3.81	4.28	4.65	22	3.61	4.47	8.14
25.00	13.71	14.88	16.76	24	3.01	3.69	4.20	23	3.30	3.99	7.34
26.00	12.33	13.37	14.90	25	2.80	3.10	3.60	24	3.07	3.62	6.66
27.00	10.86	11.92	13.32	26	2.70	2.84	3.05	25	2.88	3.32	6.08
28.00	9.34	10.43	11.83	27.00	2.70	2.73	2.83	26	2.77	3.11	5.60
28.50	7.83	8.92	10.35					27	2.54	2.83	5.09
29.00	6.21	7.36	8.86					28	1.97	2.30	4.41
30.00	4.70	5.81	7.33					29	1.72	2.00	3.94

Chilavanoor canal Inflow - Outflow hydrograph				Edappally canal Inflow -Outflow hydrograph				T-P canal Inflow -Outflow hydrograph			
Time in hrs	Inflow Hydrograph Cumecs	Outflow Hydrograph Cumecs 1st stretch	Outflow Hydrograph Cumecs 2nd stretch	Time in hrs	Inflow hydrograph Cumecs	Outflow Hydrograph Cumecs 1st stretch	Outflow Hydrograph Cumecs 2nd stretch	Time in hrs	Inflow hydrograph Cumecs	Outflow Hydrograph Cumecs 1st stretch	Outflow Hydrograph Cumecs 2nd stretch
31.00	3.57	4.47	5.86					30	1.61	1.84	3.59
32.00	2.81	3.46	4.57					31	1.55	1.73	3.30
33.00	2.40	2.80	3.58								
34.00	2.24	2.44	2.91								
35.00	2.19	2.27	2.51								
36.00	2.18	1.65	1.56								

ANNEXURE 3A.2a

Name of Catchment	Area Km2	LC (Km)	Slope	qp (m3/Sq.m	tp (hr)	Rounded tp (hr)	W50 (hr)	WR50 (hr)	WR75 (hr)	TB (hr)	Tm (hr)	TD (hrs) (1.1*tp)
Thevara-Perndoor &Thevara	10.35	4.484	0.779	0.307389744	5.588974685	2.5	6.960924981	2.13677527	1.202478275	26.11128462	3	6.14787215
Chilavanoor	14.5	4.692	0.676	0.275334198	6.295854131	4.5	7.848409732	2.413878226	1.3504536	28.49758655	5	6.92543954
Edapally	18	7.663	1.32	0.365646937	4.632594091	2.5	5.761572148	1.763219349	1.001496943	22.74976907	3	5.0958535

Name of Catchment	Area Km2	TD=TB	Point rainfall for 24hrs	Conversion factor for shorter duration interval	100hr TD rainfall	point to areal rainfall ratio in %	Area reduction factor	100hrs-TD areal rainfall
Thevara-Perndoor &Thevara	10.35	6	32	0.61	19.52	95	0.99	19.32
Chilavanoor	14.5	7	32	0.64	20.48	95.33	0.9855	20.18
Edapally	18	5	32	0.57	18.24	94	0.982	17.91

Time distribution coefficient of Areal rainfall for TD- 5hrs	storm rainfall	Rainfall increment	Design loss (cm/hr)	Effective rainfall
0.45	8.694	8.69	0.19	8.5
0.66	12.7512	4.0572	0.19	3.8672
0.81	15.6492	2.898	0.19	2.708
0.9	17.388	1.7388	0.19	1.5488
0.96	18.5472	1.1592	0.19	0.9692

Time distribution coefficient of Areal rainfall for TD- 7hrs	storm rainfall	Rainfall increment	Design loss (cm/hr)	Effective rainfall
0.45	8.694	8.69	0.19	8.5
0.66	12.7512	4.0572	0.19	3.8672
0.81	15.6492	2.898	0.19	2.708
0.9	17.388	1.7388	0.19	1.5488
0.96	18.5472	1.1592	0.19	0.9692
1	19.32	0.7728	0.19	0.5828

Time distribution coefficient of Areal rainfall for TD- 7hrs	storm rainfall	Rainfall increment	Design loss (cm/hr)	Effective rainfall
0.36	7.26	7.26	0.19	7.07
0.56	11.30	4.04	0.19	3.85
0.71	14.33	3.03	0.19	2.84
0.82	16.55	2.22	0.19	2.03
0.89	17.96	1.41	0.19	1.22
0.96	19.37	1.41	0.19	1.22
1	20.18	0.81	0.19	0.62

Time distribution coefficient of Areal rainfall for TD- 7hrs	storm rainfall	Rainfall increment	Design loss (cm/hr)	Effective rainfall
0.5	8.96	8.96	0.19	8.77
0.73	13.07	4.12	0.19	3.93
0.87	15.58	2.51	0.19	2.32
0.95	17.01	1.43	0.19	1.24
1	17.91	0.90	0.19	0.71

Edappally canal		Chilavannor canal		Thevara-Perandoor canal	
Time in hrs	SUH ordinates in Cumecs	Time in hrs	SUH ordinates in Cumecs	Time in hrs	SUH ordinates in Cumecs
0	0	0	0	0	0
1	1	1	0.32	1	0.9
2	2.71	2	0.75	2	1.59
3	4.34	3	1.32	3	2.2
4	5.83	4	2.1	4	2.38
5	6.57	5	3.03	5	3
6	6.03	6	3.89	5.5	3.18
7	5.24	6.3	4	6	3.08
8	4.72	7	3.45	7	2.51
9	4.25	8	2.68	8	2.04
10	3.59	9	2.42	9	1.59
11	2.45	10	2.24	10	1.28
12	1.29	11	2.05	11	1.04
13	0.5	12	1.94	12	0.81
14	0.31	13	1.71	13	0.49
15	0.23	14	1.48	14	0.33
16	0.21	15	1.24	15	0.297
18	0.15	16	1	16	0.19
19	0.12	17	0.85	17	0.16
20	0.11	18	0.71	18	0.14
21	0.1	19	0.66	19	0.13
22	0.08	20	0.6	20	0.11
23	0	21	0.533	21	0.09
		22	0.44	22	0.08
		23	0.36	23	0.07
		24	0.29	24	0.066
		25	0.19	25	0.064
		26	0.09	26	0
		27	0.04		
		28	0.01		
		28.5	0		

1 in 100yr Design flood Edapally canal		1 in 100yr Design flood Chilavanoor canal		1 in 100yr Design flood T-P canal	
Time in hrs	Total flow in Cumecs	Time in hrs	Total flow in Cumecs	Time in hrs	Total flow in Cumecs
0.00	2.70	0.00	2.18	0.00	1.55
1.00	4.42	1.00	2.37	1.00	2.05
2.00	11.29	2.00	3.03	2.00	4.87
3.00	30.15	3.00	4.82	3.00	14.72
4.00	57.39	4.00	9.48	4.00	25.82
5.00	84.93	5.00	16.90	5.00	35.90
6.00	106.71	6.00	27.12	5.50	43.51
7.00	115.62	6.30	39.85	6.00	51.53
8.00	110.14	7.00	53.34	7.00	55.74
9.00	94.39	8.00	64.45	8.00	54.92
10.00	89.25	9.00	68.71	9.00	49.05
11.00	78.12	10.00	65.51	10.00	41.48
12.00	72.45	11.00	58.15	11.00	33.88
13.00	45.09	12.00	51.55	12.00	27.45
14.00	27.37	13.00	46.23	13.00	22.25
15.00	15.01	14.00	41.99	14.00	17.50
16.00	9.62	15.00	38.71	15.00	12.76
17.00	7.27	16.00	34.96	16.00	9.43
18.00	6.37	17.00	30.93	17.00	7.50
19.00	5.53	18.00	26.80	18.00	5.81
20.00	5.03	19.00	22.80	19.00	4.88
21.00	4.72	20.00	19.55	20.00	4.36
22.00	4.35	21.00	16.95	21.00	3.98
23.00	3.81	22.00	15.15	22.00	3.61
24.00	3.01	23.00	13.71	23.00	3.30
25.00	2.80	24.00	12.33	24.00	3.07
26.00	2.70	25.00	10.86	25.00	2.88
27.00	2.70	26.00	9.34	26.00	2.77
		27.00	7.83	27.00	2.54
		28.00	6.21	28.00	1.97
		28.50	4.70	29.00	1.72
		29.00	3.57	30.00	1.61
		30.00	2.81	31.00	1.55
		32.00	2.40		
		33.00	2.24		
		34.00	2.19		
		35.00	2.18		

Edapally canal SUH derived Inflow Hydrograph (Cumecs)									
		Rainfall excess in cms							
Time in hrs	SUH ordinates in Cumecs	0.72	3.93	8.77	2.32	1.24	Total D.S.R.O in cumecs	Base flow in cumecs	Total flow in Cumecs
1	2	3	4	5	6		8	9	10
0	0.00	0.00					0.00	2.70	2.70
1	1.00	0.72	0.00				1.72	2.70	4.42
2	2.71	1.95	3.93	0.00			8.59	2.70	11.29
3	4.34	3.12	10.65	9.33	0.00		27.45	2.70	30.15
4	5.83	4.20	17.06	25.28	2.32	0.00	54.69	2.70	57.39
5	6.57	4.73	22.91	40.49	6.29	1.24	82.23	2.70	84.93
6	6.03	4.34	25.82	54.39	10.07	3.36	104.01	2.70	106.71
7	5.24	3.77	23.70	61.30	13.53	5.38	112.92	2.70	**115.62**
8	4.72	3.40	20.59	56.26	15.24	7.23	107.44	2.70	110.14
9	4.25	3.06	13.36	48.89	13.99	8.15	91.69	2.70	94.39
10	3.59	2.58	16.70	44.04	12.16	7.48	86.55	2.70	89.25
11	2.45	1.76	14.11	39.65	10.95	6.50	75.42	2.70	78.12
12	1.29	9.63	9.63	33.49	9.86	5.85	69.75	2.70	72.45
13	0.50	0.36	5.07	22.86	8.33	5.27	42.39	2.70	45.09
14	0.31	0.22	1.97	12.04	5.68	4.45	24.67	2.70	27.37
15	0.23	0.17	1.22	4.67	2.99	3.04	12.31	2.70	15.01
16	0.21	0.15	0.90	2.89	1.16	1.60	6.92	2.70	9.62
18	0.15	0.11	0.83	2.15	0.72	0.62	4.57	2.70	7.27
19	0.12	0.09	0.59	1.96	0.53	0.38	3.67	2.70	6.37
20	0.11	0.08	0.47	1.40	0.49	0.29	2.83	2.70	5.53
21	0.10	0.07	0.43	1.12	0.35	0.26	2.33	2.70	5.03
22	0.08	0.06	0.39	1.03	0.28	0.19	2.02	2.70	4.72
23	0.00	0.00	0.31	0.93	0.26	0.15	1.65	2.70	4.35
24			0.00	0.75	0.23	0.14	1.11	2.70	3.81
25				0.00	0.19	0.12	0.31	2.70	3.01
26				0.00	0.00	0.10	0.10	2.70	2.80
27					0.00	0.00	0.00	2.70	2.70
28						0.00	0.00	2.70	2.70

Chilavanoor canal SUH derived inflow hydrograph (Cumecs)											
		Rainfall excess in cms									
Time in hrs	SUH ordinates in Cumecs	0.62	1.22	2.84	7.07	3.85	2.03	1.22	Total D.S.R.O in cumecs	Base flow in cumecs	Total flow in Cumecs
1		3	4	5	6	7	8	9	10	11	12
0.00	0.00	0.00							0.00	2.18	2.18
1.00	0.32	0.20	0.00						0.20	2.18	2.37
2.00	0.75	0.47	0.39	0.00					0.86	2.18	3.03
3.00	1.32	0.82	0.92	0.91	0.00				2.64	2.18	4.82
4.00	2.10	1.30	1.61	2.13	2.26	0.00			7.30	2.18	9.48
5.00	3.03	1.88	2.56	3.75	5.30	1.23	0.00		14.72	2.18	16.90
6.00	3.89	2.41	3.70	5.96	9.33	2.89	0.65	0.00	24.94	2.18	27.12
6.30	4.00	2.48	4.75	8.61	14.85	5.08	1.52	0.39	37.67	2.18	39.85
7.00	3.45	2.14	4.88	11.05	21.42	8.09	2.68	0.92	51.17	2.18	53.34
8.00	2.68	1.66	4.21	11.36	27.50	11.67	4.26	1.61	62.27	2.18	64.45
9.00	2.42	1.50	3.27	9.80	28.28	14.98	6.15	2.56	66.54	2.18	**68.71**
10.00	2.24	1.39	2.95	7.61	24.39	15.40	7.90	3.70	63.34	2.18	65.51
11.00	2.05	1.27	2.73	6.87	18.95	13.28	8.12	4.75	55.97	2.18	58.15
12.00	1.94	1.20	2.50	6.36	17.11	10.32	7.00	4.88	49.38	2.18	51.55
13.00	1.71	1.06	2.37	5.82	15.84	9.32	5.44	4.21	44.05	2.18	46.23
14.00	1.48	0.92	2.09	5.51	14.49	8.62	4.91	3.27	39.81	2.18	41.99
15.00	1.24	0.77	1.81	4.86	13.72	7.89	4.55	2.95	36.54	2.18	38.71
16.00	1.00	0.62	1.51	4.20	12.09	7.47	4.16	2.73	32.79	2.18	34.96
17.00	0.85	0.53	1.22	3.52	10.46	6.58	3.94	2.50	28.75	2.18	30.93
18.00	0.71	0.44	1.04	2.84	8.77	5.70	3.47	2.37	24.62	2.18	26.80
19.00	0.66	0.41	0.87	2.41	7.07	4.77	3.00	2.09	20.62	2.18	22.80
20.00	0.60	0.37	0.81	2.02	6.01	3.85	2.52	1.81	17.38	2.18	19.55
21.00	0.53	0.33	0.73	1.87	5.02	3.27	2.03	1.51	14.77	2.18	16.95
22.00	0.44	0.27	0.65	1.70	4.67	2.73	1.73	1.22	12.97	2.18	15.15
23.00	0.36	0.22	0.54	1.51	4.24	2.54	1.44	1.04	11.54	2.18	13.71
24.00	0.29	0.18	0.44	1.25	3.77	2.31	1.34	0.87	10.15	2.18	12.33
25.00	0.19	0.12	0.35	1.02	3.11	2.05	1.22	0.81	8.68	2.18	10.86
26.00	0.09	0.06	0.23	0.82	2.55	1.69	1.08	0.73	7.16	2.18	9.34
27.00	0.04	0.02	0.11	0.54	2.05	1.39	0.89	0.65	5.65	2.18	7.83
28.00	0.01	0.01	0.05	0.26	1.34	1.12	0.73	0.54	4.04	2.18	6.21
28.50	0.00	0.00	0.01	0.11	0.64	0.73	0.59	0.44	2.52	2.18	4.70
29.00			0.00	0.03	0.28	0.35	0.39	0.35	1.40	2.18	3.57
30.00				0.00	0.07	0.15	0.18	0.23	0.64	2.18	2.81
32.00					0.00	0.04	0.08	0.11	0.23	2.18	2.40
33.00						0.00	0.02	0.05	0.07	2.18	2.24
34.00							0.00	0.01	0.01	2.18	2.19
35.00								0.00	0.00	2.18	2.18

Thevara-Perandoor canal Inflow -outflow hydrograph (Cumecs)

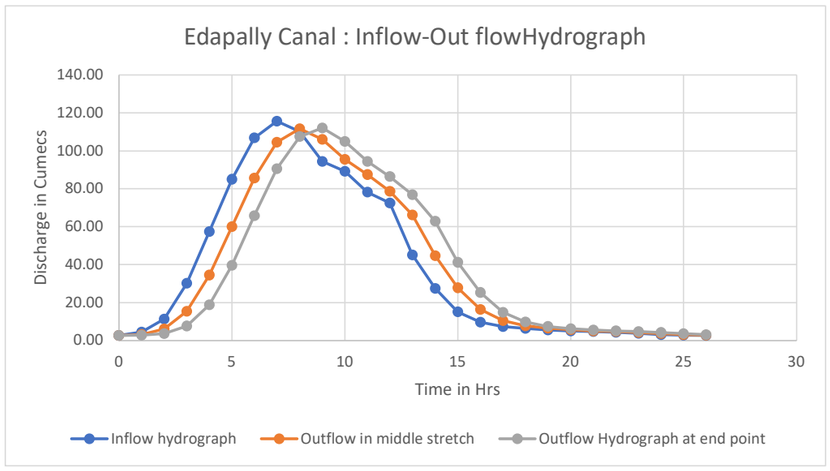
Time in hrs	SUH ordinates in Cumecs	0.55	2.71	8.50	3.87	1.55	0.97	Total D.S.R.O in cumecs	Base flow in cumecs	Total flow in Cumecs
1		3	4	5	6	7	8	9	10	11
0	0.000	0.00						0.00	1.55	1.55
1	0.900	0.50	0.00					0.50	1.55	2.05
2	1.590	0.87	2.44	0.00				3.31	1.55	4.87
3	2.200	1.21	4.31	7.65	0.00			13.17	1.55	14.72
4	2.380	1.31	5.96	13.52	3.48	0.00		24.27	1.55	25.82
5	3.000	1.65	6.45	18.70	6.15	1.40	0.00	34.35	1.55	35.90
5.5	3.180	1.75	8.13	20.23	8.51	2.46	0.87	41.96	1.55	43.51
6	3.080	1.69	8.62	25.50	9.21	3.41	1.54	49.97	1.55	51.53
7	2.510	1.38	8.35	27.03	11.61	3.69	2.13	54.19	1.55	**55.74**
8	2.040	1.12	6.80	26.18	12.31	4.65	2.31	53.37	1.55	54.92
9	1.590	0.87	5.53	21.34	11.92	4.93	2.91	47.50	1.55	49.05
10	1.280	0.70	4.31	17.34	9.71	4.77	3.08	39.93	1.55	41.48
11	1.040	0.57	3.47	13.52	7.89	3.89	2.99	32.33	1.55	33.88
12	0.810	0.45	2.82	10.88	6.15	3.16	2.43	25.89	1.55	27.45
13	0.490	0.27	2.20	8.84	4.95	2.46	1.98	20.70	1.55	22.25
14	0.330	0.18	1.33	6.89	4.02	1.98	1.54	15.95	1.55	17.50
15	0.297	0.16	0.89	4.17	3.13	1.61	1.24	11.21	1.55	12.76
16	0.190	0.10	0.80	2.81	1.90	1.26	1.01	7.87	1.55	9.43
17	0.160	0.09	0.51	2.52	1.28	0.76	0.79	5.95	1.55	7.50
18	0.140	0.08	0.43	1.62	1.15	0.51	0.48	4.26	1.55	5.81
19	0.130	0.07	0.38	1.36	0.74	0.46	0.32	3.33	1.55	4.88
20	0.110	0.06	0.35	1.19	0.62	0.29	0.29	2.80	1.55	4.36
21	0.090	0.05	0.30	1.11	0.54	0.25	0.18	2.43	1.55	3.98
22	0.080		0.24	0.94	0.50	0.22	0.16	2.05	1.55	3.61
23	0.070		0.22	0.77	0.43	0.20	0.14	1.74	1.55	3.30
24	0.066		0.19	0.68	0.35	0.17	0.13	1.51	1.55	3.07
25	0.064		0.18	0.60	0.31	0.14	0.11	1.33	1.55	2.88
26	0.00		0.17	0.56	0.27	0.12	0.09	1.22	1.55	2.77
27			0.00	0.54	0.26	0.11	0.08	0.99	1.55	2.54
28				0.00	0.25	0.10	0.07	0.42	1.55	1.97
29					0.00	0.10	0.06	0.16	1.55	1.72
30						0.00	0.06	0.06	1.55	1.61
31							0.00	0.00	1.55	1.55

1 in 100yr Design flood Edapally canal	
Time in hrs	Total flow in Cumecs
0	2.70
1	4.42
2	11.29
3	30.15
4	57.39
5	84.93
6	106.71
7	**115.62**
8	110.14
9	94.39
10	89.25
11	78.12
12	72.45
13	45.09
14	27.37
15	15.01
16	9.62
17	7.27
18	6.37
19	5.53
20	5.03
21	4.72
22	4.35
23	3.81
24	3.01
25	2.80
26	2.70
27	2.7

1 in 100yr Design flood Chilavanoor canal	
Time in hrs	Total flow in Cumecs
0	2.18
1	2.37
2	3.03
3	4.82
4	8.29
5	14.88
6	23.57
7	33.42
8	50.57
9	54.00
10	**57.97**
11	56.24
12	57.64
13	45.05
14	43.57
15	36.48
16	33.50
18	35.96
19	26.95
20	23.96
21	20.11
22	17.27
23	15.04
24	13.37
25	12.10
26	10.90
27	9.67
28	8.37
29	7.05
29	5.70
30	4.45
31	3.46
32	2.79
33	2.40
34	2.24
35	2.19
36	2.18

1 in 100yr Design flood T-P canal	
Time in hrs	Total flow in Cumecs
0	1.55
1	2.05
2	4.87
3	14.72
4	25.82
5	35.90
5.5	43.51
6	51.53
7	**55.74**
8	54.92
9	49.05
10	41.48
11	33.88
12	27.45
13	22.25
14	17.50
15	12.76
16	9.43
17	7.50
18	5.81
19	4.88
20	4.36
21	3.98
22	3.61
23	3.30
24	3.07
25	2.88
26	2.77
27	2.54
28	1.97
29	1.72
30	1.61
31	1.55

Edapally canal: Inflow -Out flow Hydrograph		
Q_0 = Qb + 0.5(Qp - Qb)	93.415	92.965
n=0.020 (loam & clay)	0.02	0.02
Slope	0.0002	0.0002
K= ΔL/Vw	3297.32	2872.77
ΔL = Wave travel length (m)	6000	5230
Vw = celerity = 5/3 Vav(wide rectangular channel)		
Vav=1/n * $R^{2/3}$* $S^{1/2}$		
Vw = celerity = 5/3 Vav		
A= l*w*h	41.25	41.25
P	21.5	21.5
A/P	1.92	1.92
Vav	1.09	1.09
Vw	1.82	1.82
X= (1/2-((0.3*Q_0^0.3*n^0.6)/(S^1.3*c^0.8*L)))	0.152	0.4684
C0 =(-kx +0.5Δt)/k(1-x)+0.5Δt	0.2823	0.1366
C1=(kx +0.5Δt)/k(1-x)+0.5Δt	0.5012	0.9454
C2= (k(1-x)-0.5Δt)/k(1-x)+0.5Δt	0.2165	-0.0820

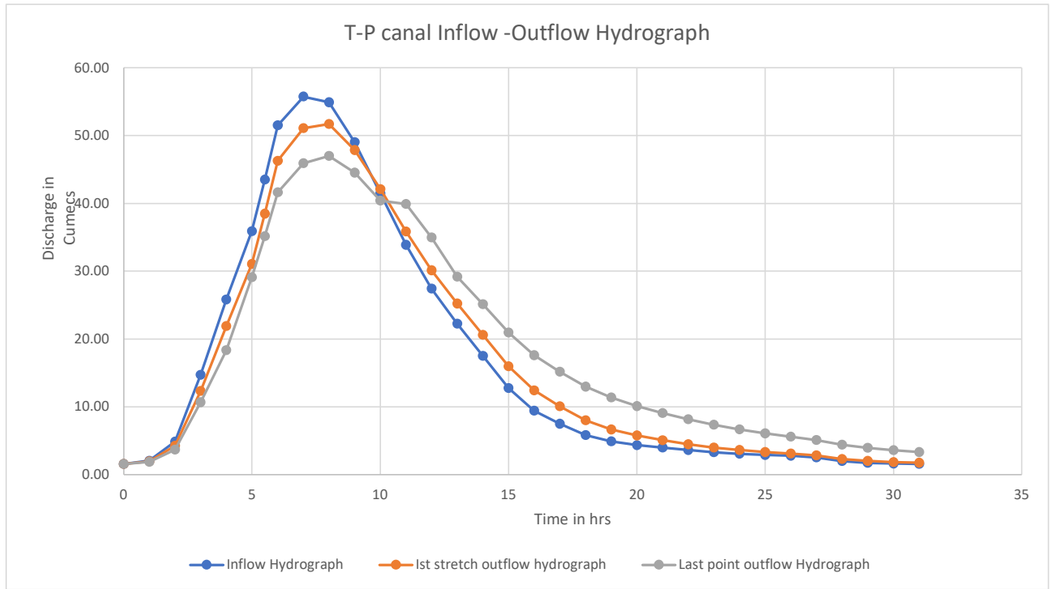


	Ist Stretch				2nd Stretch			
C0	1297.17	4594.48	0.282		C0	454.396	3327.163	0.137
C1	2302.83	4594.48	0.501		C1	3145.604	3327.163	0.945
C2	994.48	4594.48	0.216		C2	-272.837	3327.163	-0.082
			1					1.000

	Q0	n	S	c	L		X
0.3	3.90	0.10	1.5536E-05	3.454751	6000	0.35	0.15
0.3	0.31	0.10	1.5536E-05	3.454751	5230	0.03	0.47

		0.28	0.50	0.22		0.14	0.95	-0.082003	
Time in hrs	Inflow hydrograph Cumecs	C0*I(i+1)	C1 *I	C2*O1	outflow	C0*I(i+1)	C1 *I	C2*O1	outflow
0	2.70	0.00	0.00	0.00	2.70	0.00	0.00	0.00	2.70
1	4.42	1.24	1.35	0.59	3.18	0.45	2.57	-0.22	2.79
2	11.29	3.16	2.21	0.70	6.07	0.85	3.02	-0.23	3.64
3	30.15	8.44	5.65	1.34	15.42	2.16	5.77	-0.30	7.63
4	57.39	16.07	15.07	3.39	34.53	4.83	14.65	-0.63	18.86
5	84.93	23.78	28.69	7.60	60.07	8.41	32.81	-1.55	39.67
6	106.71	29.88	42.47	13.22	85.56	11.98	57.07	-3.25	65.79
7	**115.62**	32.37	53.36	18.82	104.55	14.64	81.28	-5.40	90.53
8	110.14	30.84	57.81	23.00	**111.65**	15.63	99.33	-7.42	107.53
9	94.39	26.43	55.07	24.56	106.06	14.85	106.07	-8.82	**112.10**
10	89.25	24.99	47.20	23.33	95.52	13.37	100.76	-9.19	104.94
11	78.12	21.87	44.62	21.01	87.51	12.25	90.74	-8.61	94.39
12	72.45	20.29	39.06	19.25	78.60	11.00	83.14	-7.74	86.40
13	45.09	12.62	36.23	17.29	66.14	9.26	74.67	-7.08	76.85
14	27.37	7.66	22.54	14.55	44.76	6.27	62.84	-6.30	62.80
15	15.01	4.20	13.68	9.85	27.73	3.88	42.52	-5.15	41.25
16	9.62	2.69	7.50	6.10	16.30	2.28	26.35	-3.38	25.25
17	7.27	2.04	4.81	3.59	10.43	1.46	15.48	-2.07	14.87
18	6.37	1.78	3.63	2.29	7.71	1.08	9.91	-1.22	9.77
19	5.53	1.55	3.19	1.70	6.43	0.90	7.33	-0.80	7.43
20	5.03	1.41	2.77	1.42	5.59	0.78	6.11	-0.61	6.28
21	4.72	1.32	2.52	1.23	5.07	0.71	5.31	-0.52	5.51
22	4.35	1.22	2.36	1.11	4.69	0.66	4.81	-0.45	5.02
23	3.81	1.07	2.18	1.03	4.28	0.60	4.46	-0.41	4.65
24	3.01	0.84	1.91	0.94	3.69	0.52	4.06	-0.38	4.20
25	2.80	0.78	1.50	0.81	3.10	0.43	3.51	-0.34	3.60
26	2.70	0.76	1.40	0.68	2.84	0.40	2.95	-0.29	3.05
27	2.7	0.76	1.35	0.62	2.73	0.38	2.70	-0.25	2.83

Thevara Perandoor: Inflow -Out flow Hydrograph		
Q0 = Qb + 0.5(Qp - Qb)	61.6175	58.635
n=0.020 (loam & clay)	0.02	0.02
Slope	0.0000326	0.0000326
K= ΔL/Vw	7486.49	6802.600
ΔL = Wave travel length (m)	5500	5000
Vw = celerity = 5/3 Vav(wide rectangular channel)		
Vav=1/n * R2/3* S1/2	0.44	0.44
Vw = celerity = 5/3 Vav	0.73	0.74
A= l*w*h	41.25	41.25
P	21.5	21.5
A/P	1.92	1.92
X= (1/2-((0.3*Q_o^0.3*n^0.6)/(S^1.3*c^0.8*L)))	-3.03	-3.333
C0 =(-kx +0.5Δt)/k(1-x)+0.5Δt	0.8032	0.7825
C1=(kx +0.5Δt)/k(1-x)+0.5Δt	-0.5313	-0.6674
C2= (k(1-x)-0.5Δt)/k(1-x)+0.5Δt	0.7281	0.8849

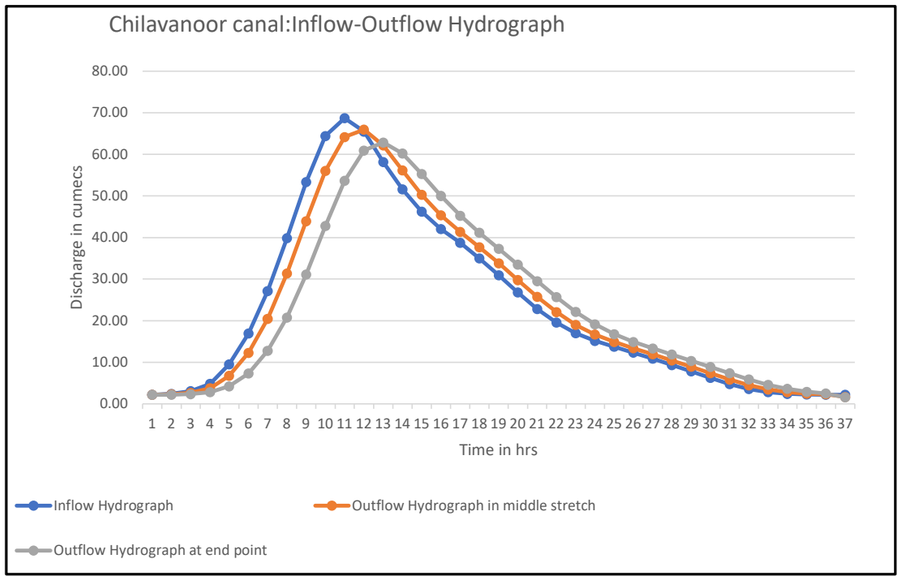


		Qo	n	S	c	L		X
X=	0.3	3.442795	0.095635	1.46954E-06	3.454751	5500	3.537433	**-3.03743**
X=	0.3	3.391932	0.095635	1.46954E-06	3.454751	5000	3.833688	**-3.33369**

			Ist stretch			2nd stretch
Co	24484.06	31970.55	**0.765832**	24473.07	31275.67	**0.782**
C1	-20884.059	31970.55	**-0.65323**	-20873.1	31275.67	**-0.667**
C2	28370.54715	31970.55	**0.887396**	27675.67	31275.67	**0.885**
			1			1.000

		0.8032	-0.5313	0.7281		0.7825	-0.6674	0.8849	
Time in hrs	Total flow in Cumecs	C_o*I(i+1)	C_1 *I	C_2*O1	outflow	C0*I(i+1)	C1 *I	C2*O1	
0	1.55	0.000	0.000	0.000	1.550	0.000	0.000	0.000	1.550
1	2.05	1.645	-0.825	1.129	1.948	1.524	-1.034	1.372	1.862
2	4.87	3.908	-1.088	1.419	4.239	3.317	-1.300	1.647	3.664
3	14.72	11.824	-2.585	3.086	12.325	9.644	-2.214	3.242	10.673
4	25.82	20.739	-7.821	8.974	21.892	17.130	-8.226	9.444	18.349
5	35.90	28.835	-13.719	15.940	31.056	24.301	-11.433	16.237	29.105
5.5	43.51	34.949	-19.073	22.612	38.487	30.116	-20.726	25.755	35.145
6	51.53	41.385	-23.118	28.023	46.290	36.222	-25.686	31.100	41.636
7	55.74	44.771	-27.376	33.704	51.100	39.986	-30.894	36.843	45.935
8	**54.92**	44.112	-29.615	37.206	**51.703**	40.457	-34.104	40.648	**47.001**
9	49.05	39.395	-29.179	37.645	47.861	37.451	-34.506	41.591	44.536
10	41.48	33.314	-26.059	34.848	42.103	32.945	-31.942	39.410	40.413
11	33.88	27.213	-22.037	30.656	35.832	28.038	-23.914	35.762	39.886
12	27.45	22.044	-18.001	26.089	30.133	23.579	-23.914	35.295	34.960
13	22.25	17.874	-14.582	21.940	25.232	18.372	-20.111	30.936	29.197
14	17.50	14.054	-11.823	18.372	20.603	16.121	-16.840	25.837	25.118
15	12.76	10.251	-9.296	15.001	15.956	12.485	-13.750	22.227	20.962
16	9.43	7.572	-6.781	11.618	12.408	9.710	-10.649	18.549	17.610
17	7.50	6.026	-5.009	9.035	10.052	7.865	-8.281	15.583	15.167
18	5.81	4.670	-3.986	7.319	8.003	6.262	-6.708	13.421	12.975
19	4.88	3.919	-3.089	5.827	6.657	5.209	-5.341	11.482	11.350
20	4.36	3.500	-2.592	4.847	5.754	4.503	-4.443	10.043	10.103
21	3.98	3.196	-2.315	4.190	5.071	3.968	-3.840	8.940	9.068
22	3.61	2.897	-2.114	3.692	4.475	3.501	-3.384	8.024	8.141
23	3.30	2.648	-1.916	3.258	3.990	3.122	-2.986	7.204	7.340
24	3.07	2.463	-1.752	2.905	3.617	2.830	-2.663	6.495	6.663
25	2.88	2.315	-1.630	2.634	3.319	2.597	-2.414	5.896	6.079
26	2.77	2.224	-1.531	2.417	3.109	2.433	-2.215	5.379	5.597
27	2.54	2.038	-1.471	2.264	2.831	2.215	-2.075	4.953	5.093
28	1.97	1.583	-1.348	2.061	2.296	1.796	-1.890	4.507	4.414
29	1.72	1.378	-1.047	1.671	2.003	1.567	-1.532	3.906	3.941
30	1.61	1.297	-0.912	1.458	1.843	1.442	-1.337	3.487	3.593
31	1.55	1.247	-0.858	1.342	1.731	1.355	-1.230	3.179	3.304

Chilavanoor canal: Inflow -Out flow Hydrograph		
Q0 = Qb + 0.5(Qp - Qb)	36.7125	36.6275
n=0.020 (loam & clay)	0.02	0.02
Slope	0.0001	0.0001
K= ΔL/Vw	2606.06	3790.8237
ΔL = Wave travel length (m)	5000	4880
Vw = celerity = 5/3 Vav(wide rectangular channel)		
Vav=1/n * R2/3* S1/2	0.77	0.77
Vw = celerity = 5/3 Vav	1.29	1.29
A= l*w*h	41.25	41.25
P	21.5	21.5
A/P	1.92	1.92
X= (1/2-((0.3*Q_o^0.3*n^0.6)/(S^1.3*c^0.8*L)))	-0.211	0.134
C0 =(-kx +0.5Δt)/k(1-x)+0.5Δt	0.3539	0.3266
C1=(kx +0.5Δt)/k(1-x)+0.5Δt	0.5387	0.5071
C2= (k(1-x)-0.5Δt)/k(1-x)+0.5Δt	0.1075	0.1662



	Qo	n	S	c	L		X
0.3	2.947435	0.095635	6.31E-06	3.768	5000	0.71	-0.21138
0.3	2.945386	0.095635	1.26E-05	3.768	4880	0.37	0.134601
Co	2349.879	4955.939	0.47	1292.03	5082.853287	0.25	
C1	1250.121	4955.939	0.25	2307.97	5082.853	0.45	
C2	1355.939	4955.939	0.27	1482.853	5082.853	0.29	
			1.00			1.00	

		0.47	0.25	0.27		0.25	0.45	0.29	
Time in hrs	Total flow in Cumecs	C0*I(i+1)	C1 *I	C2*O1	outflow	C0*I(i+1)	C1 *I	C2*O1	outflow
0	2.18	0	0	0	2.175	0	0	0	2.175
1	2.37	1.13	0.55	0.60	2.27	0.57	0.98	0.63	2.18
2	3.03	1.44	0.60	0.62	2.66	0.66	1.02	0.63	2.32
3	4.82	2.28	0.76	0.73	3.78	0.94	1.20	0.67	2.81
4	9.48	4.49	1.22	1.03	6.74	1.69	1.70	0.82	4.20
5	16.90	8.01	2.39	1.84	12.25	3.06	3.03	1.22	7.31
6	27.12	12.86	4.26	3.35	20.47	5.12	5.51	2.12	12.75
7	39.85	18.89	6.84	5.60	31.34	7.83	9.21	3.70	20.74
8	53.34	25.29	10.05	8.57	43.92	10.98	14.10	6.02	31.10
9	64.45	30.56	13.46	12.02	56.03	14.01	19.76	9.02	42.79
10	**68.71**	32.58	16.26	15.33	**64.17**	16.04	25.21	12.41	53.66
11	65.51	31.06	17.33	17.56	65.95	16.49	28.87	15.56	60.93
12	58.15	27.57	16.53	18.04	62.14	15.54	29.68	17.67	**62.88**
13	51.55	24.44	14.67	17.00	56.11	14.03	27.96	18.24	60.23
14	46.23	21.92	13.00	15.35	50.27	12.57	25.25	17.47	55.29
15	41.99	19.91	11.66	13.76	45.32	11.33	22.62	16.03	49.99
16	38.71	18.36	10.59	12.40	41.35	10.34	20.40	14.50	45.23
18	34.96	16.58	9.77	11.31	37.66	9.41	18.61	13.12	41.14
19	30.93	14.67	8.82	10.30	33.79	8.45	16.95	11.93	37.32
20	26.80	12.71	7.80	9.24	29.75	7.44	15.20	10.82	33.47
21	22.80	10.81	6.76	8.14	25.71	6.43	13.39	9.71	29.52
22	19.55	9.27	5.75	7.03	22.06	5.51	11.57	8.56	25.64
23	16.95	8.04	4.93	6.03	19.00	4.75	9.92	7.44	22.11
24	15.15	7.18	4.27	5.20	16.66	4.16	8.55	6.41	19.13
25	13.71	6.50	3.82	4.56	14.88	3.72	7.50	5.55	16.76
26	12.33	5.85	3.46	4.07	13.37	3.34	6.70	4.86	14.90
27	10.86	5.15	3.11	3.66	11.92	2.98	6.02	4.32	13.32
28	9.34	4.43	2.74	3.26	10.43	2.61	5.36	3.86	11.83
29	7.83	3.71	2.36	2.85	8.92	2.23	4.69	3.43	10.35
29	6.21	2.95	1.97	2.44	7.36	1.84	4.01	3.00	8.86
30	4.70	2.23	1.57	2.01	5.81	1.45	3.31	2.57	7.33
31	3.57	1.69	1.18	1.59	4.47	1.12	2.61	2.13	5.86
32	2.81	1.33	0.90	1.22	3.46	0.86	2.01	1.70	4.57
33	2.40	1.14	0.71	0.95	2.80	0.70	1.56	1.33	3.58
34	2.24	1.06	0.61	0.76	2.44	0.61	1.26	1.04	2.91
35	2.19	1.04	0.57	0.67	2.27	0.57	1.10	0.84	2.51
36	2.18	0.47	0.55	0.62	1.65	0.25	1.02	0.29	1.56

27.91915 Chilavanoor
57.39928 Edappally
24.27565 TP

Chilavanoor canal Infow -Outflow hydrograph

Time in hrs	Inflow Hydrograph Cumecs	outflow Hydrograph Cumecs 1st stretch	outflow Hydrograph Cumecs 2nd stretch
0.00	2.18	2.18	2.18
1.00	2.37	2.27	2.18
2.00	3.03	2.66	2.32
3.00	4.82	3.78	2.81
4.00	9.48	6.74	4.20
5.00	16.90	12.25	7.31
6.00	27.12	20.47	12.75
7.00	39.85	31.34	20.74
8.00	53.34	43.92	31.10
9.00	64.45	56.03	42.79
10.00	**68.71**	64.17	53.66
11.00	65.51	65.95	60.93
12.00	58.15	62.14	62.88
13.00	51.55	56.11	60.23
14.00	46.23	50.27	55.29
15.00	41.99	45.32	49.99
16.00	38.71	41.35	45.23
18.00	34.96	37.66	41.14
19.00	30.93	33.79	37.32
20.00	26.80	29.75	33.47
21.00	22.80	25.71	29.52
22.00	19.55	22.06	25.64
23.00	16.95	19.00	22.11
24.00	15.15	16.66	19.13
25.00	13.71	14.88	16.76
26.00	12.33	13.37	14.90
27.00	10.86	11.92	13.32
28.00	9.34	10.43	11.83
28.50	7.83	8.92	10.35
29.00	6.21	7.36	8.86
30.00	4.70	5.81	7.33
31.00	3.57	4.47	5.86
32.00	2.81	3.46	4.57
33.00	2.40	2.80	3.58
34.00	2.24	2.44	2.91
35.00	2.19	2.27	2.51
36.00	2.18	1.65	1.56

reference Discharge in cumecs **32.53**

Edapally canal Infow -Outflow hydrograph

Time in hrs	Inflow hydrograph Cumecs	outflow Hydrograph Cumecs 1st stretch	outflow Hydrograph Cumecs 2nd stretch
0	2.70	2.70	2.70
1	4.42	3.18	2.79
2	11.29	6.07	3.64
3	30.15	15.42	7.63
4	57.39	34.53	18.86
5	84.93	60.07	39.67
6	106.71	85.56	65.79
7	115.62	104.55	90.53
8	110.14	111.65	107.53
9	94.39	106.06	112.10
10	89.25	95.52	104.94
11	78.12	87.51	94.39
12	72.45	78.60	86.40
13	45.09	66.14	76.85
14	27.37	44.76	62.80
15	15.01	27.73	41.25
16	9.62	16.30	25.25
17	7.27	10.43	14.87
18	6.37	7.71	9.77
19	5.53	6.43	7.43
20	5.03	5.59	6.28
21	4.72	5.07	5.51
22	4.35	4.69	5.02
23	3.81	4.28	4.65
24	3.01	3.69	4.20
25	2.80	3.10	3.60
26	2.70	2.84	3.05
27.00	2.70	2.73	2.83

reference Discharge in cumecs **57.40**

T-P canal Infow -Outflow hydrograph

Time in hrs	Inflow hydrograph Cumecs	outflow Hydrograph Cumecs 1st stretch	outflow Hydrograph Cumecs 2nd stretch
0	1.55	1.55	1.55
1	2.05	1.95	1.86
2	4.87	4.24	3.66
3	14.72	12.33	10.67
4	25.82	21.89	18.35
5	35.90	31.06	29.11
5.5	43.51	38.49	35.14
6	51.53	46.29	41.64
7	55.74	51.10	45.94
8	**54.92**	51.70	47.00
9	49.05	47.86	44.54
10	41.48	42.10	40.41
11	33.88	35.83	39.89
12	27.45	30.13	34.96
13	22.25	25.23	29.20
14	17.50	20.60	25.12
15	12.76	15.96	20.96
16	9.43	12.41	17.61
17	7.50	10.05	15.17
18	5.81	8.00	12.98
19	4.88	6.66	11.35
20	4.36	5.75	10.10
21	3.98	5.07	9.07
22	3.61	4.47	8.14
23	3.30	3.99	7.34
24	3.07	3.62	6.66
25	2.88	3.32	6.08
26	2.77	3.11	5.60
27	2.54	2.83	5.09
28	1.97	2.30	4.41
29	1.72	2.00	3.94
30	1.61	1.84	3.59
31	1.55	1.73	3.30

reference Discharge in cumecs **24.28**

Canal Bank Development

1. Estimation of canal lengths greater than 16.50m width

Table 1:Estimation of canal lengths greater than 16.50m width

Sl. No	Name of the canal	Unit	Total length (m)	Length greater than 16.50m width (m)	% of length
1	Edappally	m	11,231	7124.55	63.43
2	Chilavanoor	m	11,150	3,195.92	28.70
3	Thevara_Perandoor	m	9,885	3,697.14	37.50
4	Thevara	m	1,405	1,090.00	77.58
5	Market	m	664	75.00	11.30
	Total	**m**	**34,335.00**	**15,182.50**	**44.22**

1.1 Edappally Canal

Table 2: Details Width of Edappally Canal

Sl. No	Chainage	Existing Canal width (m)	Proposed width (m)	Width greater than (16.50m)	Length (m)
1	CH 000	14.9	16.50	14.9	0.00
2	CH 15	11.553	16.50	11.553	0.00
3	CH 25	12.83	16.50	12.83	0.00
4	CH 30	10.923	16.50	10.923	0.00
5	CH 45	7.14	16.50	7.14	0.00
6	CH 60	6.96	16.50	6.96	0.00
7	CH 68	9.5	16.50	9.5	0.00
8	CH 75	5.97	16.50	5.97	0.00
9	CH 90	7.08	16.50	7.08	0.00
10	CH 105	6.92	16.50	6.92	0.00
11	CH 120	7.98	16.50	7.98	0.00
12	CH 131	5.78	16.50	5.78	0.00
13	CH 135	7.55	16.50	7.55	0.00
14	CH 150	7.84	16.50	7.84	0.00
15	CH 165	10.9	16.50	10.9	0.00
16	CH 172	11.85	16.50	11.85	0.00
17	CH 180	8.3	16.50	8.3	0.00
18	CH 195	7.02	16.50	7.02	0.00
19	CH 210	7.15	16.50	7.15	0.00
20	CH 221	8.49	16.50	8.49	0.00
21	CH 225	7.15	16.50	7.15	0.00

Sl. No	Chainage	Existing Canal width (m)	Proposed width (m)	Width greater than (16.50m)	Length (m)
22	CH 240	7.16	16.50	7.16	0.00
23	CH 255	13.55	16.50	13.55	0.00
24	CH266	18.04	16.50	18.04	7.5
25	CH 270	14.91	16.50	14.91	7.5
26	CH 285	7.29	16.50	7.29	0.00
27	CH 300	5.16	16.50	5.16	0.00
28	CH 315	6.82	16.50	6.82	0.00
29	CH 330	5.85	16.50	5.85	0.00
30	CH 345	6.4	16.50	6.4	0.00
31	CH 360	6.26	16.50	6.26	0.00
32	CH 375	6.09	16.50	6.09	0.00
33	CH 390	6.21	16.50	6.21	0.00
34	CH 405	8.19	16.50	8.19	0.00
35	CH 411	8.86	16.50	8.86	0.00
36	CH 420	7.6	16.50	7.6	0.00
37	CH 435	9.4	16.50	9.4	0.00
38	CH 450	12.39	16.50	12.39	0.00
39	CH 465	11.88	16.50	11.88	0.00
40	CH 480	10.96	16.50	10.96	0.00
41	CH 495	11.21	16.50	11.21	0.00
42	CH 505	11.64	16.50	11.64	0.00
43	CH 510	10.73	16.50	10.73	0.00
44	CH 525	9.37	16.50	9.37	0.00
45	CH 540	9.31	16.50	9.31	0.00

Sl. No	Chainage	Existing Canal width (m)	Proposed width (m)	Width greater than (16.50m)	Length (m)
46	CH 551	10.2	16.50	10.2	0.00
47	CH 555	9.86	16.50	9.86	0.00
48	CH 570	10.6	16.50	10.6	0.00
49	CH 581	11.34	16.50	11.34	0.00
50	CH 585	10.9	16.50	10.9	0.00
51	CH 600	11.26	16.50	11.26	0.00
52	CH 615	12.44	16.50	12.44	0.00
53	CH 630	13.47	16.50	13.47	0.00
54	CH 645	12.7	16.50	12.7	0.00
55	CH 660	13.12	16.50	13.12	0.00
56	CH 675	13.21	16.50	13.21	0.00
57	CH 690	12.53	16.50	12.53	0.00
58	CH 705	10.87	16.50	10.87	0.00
59	CH 720	8.08	16.50	8.08	0.00
60	CH 735	7.93	16.50	7.93	0.00
61	CH 750	7.74	16.50	7.74	0.00
62	CH 765	7.05	16.50	7.05	0.00
63	CH 780	7.99	16.50	7.99	0.00
64	CH 795	8.14	16.50	8.14	0.00
65	CH 810	7.55	16.50	7.55	0.00
66	CH 825	8.49	16.50	8.49	0.00
67	CH 840	8.84	16.50	8.84	0.00
68	CH 851	10.97	16.50	10.97	0.00
69	CH 855	10.78	16.50	10.78	0.00

Sl. No	Chainage	Existing Canal width (m)	Proposed width (m)	Width greater than (16.50m)	Length (m)
70	CH 870	11.17	16.50	11.17	0.00
71	CH 885	8.89	16.50	8.89	0.00
72	CH 900	9.70	16.50	9.70	0.00
73	CH 902	10.36	16.50	10.36	0.00
74	CH 915	8.48	16.50	8.48	0.00
75	CH 930	8.07	16.50	8.07	0.00
76	CH 945	9.15	16.50	9.15	0.00
77	CH 960	8.03	16.50	8.03	0.00
78	CH 975	8.00	16.50	8.00	0.00
79	CH 988	9.3	16.50	9.3	0.00
80	CH 990	8.26	16.50	8.26	0.00
81	CH 1005	7.54	16.50	7.54	0.00
82	CH 1020	8.24	16.50	8.24	0.00
83	CH 1035	9.52	16.50	9.52	0.00
84	CH 1050	9.45	16.50	9.45	0.00
85	CH 1065	10.43	16.50	10.43	0.00
86	CH 1080	10.23	16.50	10.23	0.00
87	CH 1095	12.44	16.50	12.44	0.00
88	CH 1105	18.00	16.50	18.00	2.66
89	CH 1110	17.15	16.50	17.15	5.00
90	CH 1125	18.39	16.50	18.39	15.00
91	CH 1140	16.68	16.50	16.68	15.00
92	CH 1155	14.16	16.50	14.16	0.43
93	CH 1170	13.45	16.50	13.45	0.00

Sl. No	Chainage	Existing Canal width (m)	Proposed width (m)	Width greater than (16.50m)	Length (m)
94	CH 1185	13.1	16.50	13.1	0.00
95	CH 1200	13.71	16.50	13.71	0.00
96	CH 1215	12.15	16.50	12.15	0.00
97	CH 1230	10.16	16.50	10.16	0.00
98	CH 1245	10.73	16.50	10.73	0.00
99	CH 1260	11.59	16.50	11.59	0.00
100	CH 1275	11.62	16.50	11.62	0.00
101	CH 1290	10.23	16.50	10.23	0.00
102	CH 1305	9.81	16.50	9.81	0.00
103	CH 1320	10.77	16.50	10.77	0.00
104	CH 1323	11.49	16.50	11.49	0.00
105	CH 1335	9.85	16.50	9.85	0.00
106	CH 1350	10.56	16.50	10.56	0.00
107	CH 1365	10.17	16.50	10.17	0.00
108	CH 1380	10.88	16.50	10.88	0.00
109	CH 1395	10.67	16.50	10.67	0.00
110	CH 1410	12.09	16.50	12.09	0.00
111	CH 1425	11.23	16.50	11.23	0.00
112	CH 1440	10.16	16.50	10.16	0.00
113	CH 1455	10.78	16.50	10.78	0.00
114	CH 1462	11.26	16.50	11.26	0.00
115	CH 1470	9.5	16.50	9.5	0.00
116	CH 1485	10.11	16.50	10.11	0.00
117	CH 1500	12.28	16.50	12.28	0.00

Sl. No	Chainage	Existing Canal width (m)	Proposed width (m)	Width greater than (16.50m)	Length (m)
118	CH 1515	11.93	16.50	11.93	0.00
119	CH 1530	7.63	16.50	7.63	0.00
120	CH 1545	8.54	16.50	8.54	0.00
121	CH 1560	9.32	16.50	9.32	0.00
122	CH 1575	8.8	16.50	8.8	0.00
123	CH 1590	8.24	16.50	8.24	0.00
124	CH 1605	9.03	16.50	9.03	0.00
125	CH 1620	8.61	16.50	8.61	0.00
126	CH 1635	8.99	16.50	8.99	0.00
127	CH 1650	10.46	16.50	10.46	0.00
128	CH 1665	11.23	16.50	11.23	0.00
129	CH 1680	12.61	16.50	12.61	0.00
130	CH 1685	12.78	16.50	12.78	0.00
131	CH 1695	10.7	16.50	10.7	0.00
132	CH 1710	9.51	16.50	9.51	0.00
133	CH 1725	10.29	16.50	10.29	0.00
134	CH 1740	10.27	16.50	10.27	0.00
135	CH 1755	12.64	16.50	12.64	0.00
136	CH 1764	13.43	16.50	13.43	0.00
137	CH 1770	12.34	16.50	12.34	0.00
138	CH 1785	11.17	16.50	11.17	0.00
139	CH 1800	10.47	16.50	10.47	0.00
140	CH 1815	9.47	16.50	9.47	0.00
141	CH 1830	11.62	16.50	11.62	0.00

Sl. No	Chainage	Existing Canal width (m)	Proposed width (m)	Width greater than (16.50m)	Length (m)
142	CH 1845	11.4	16.50	11.4	0.00
143	CH 1860	13.49	16.50	13.49	0.00
144	CH 1865	13.65	16.50	13.65	0.00
145	CH 1875	11.85	16.50	11.85	0.00
146	CH 1882	13.19	16.50	13.19	0.00
147	CH 1890	11.67	16.50	11.67	0.00
148	CH 1905	13.6	16.50	13.6	0.00
149	CH 1909	13.95	16.50	13.95	0.00
150	CH 1920	11.88	16.50	11.88	0.00
151	CH 1935	10.97	16.50	10.97	0.00
152	CH 1950	10.65	16.50	10.65	0.00
153	CH 1965	11.25	16.50	11.25	0.00
154	CH 1980	10.96	16.50	10.96	0.00
155	CH 1995	10.83	16.50	10.83	0.00
156	CH 2010	10.79	16.50	10.79	0.00
157	CH 2025	11.37	16.50	11.37	0.00
158	CH 2029	13.16	16.50	13.16	0.00
159	CH 2040	11.78	16.50	11.78	0.00
160	CH 2055	14.01	16.50	14.01	0.00
161	CH 2070	15.32	16.50	15.32	0.00
162	CH 2085	16.62	16.50	16.62	1.38
163	CH 2100	18.93	16.50	18.93	15.00
164	CH 2115	22.68	16.50	22.68	15.00
165	CH 2121	24.22	16.50	24.22	6.00

Sl. No	Chainage	Existing Canal width (m)	Proposed width (m)	Width greater than (16.50m)	Length (m)
166	CH 2130	21.72	16.50	21.72	9.00
167	CH 2145	17.41	16.50	17.41	15.00
168	CH 2160	18.76	16.50	18.76	15.00
169	CH 2175	20.26	16.50	20.26	15.00
170	CH 2190	16.27	16.50	16.27	13.55
171	CH 2205	14.21	16.50	14.21	0.00
172	CH 2220	15.64	16.50	15.64	0.00
173	CH 2235	19.47	16.50	19.47	8.00
174	CH 2250	18.76	16.50	18.76	15.00
175	CH 2263	19.54	16.50	19.54	13.00
176	CH 2265	19.12	16.50	19.12	2.00
177	CH 2280	18.03	16.50	18.03	15.00
178	CH 2295	16.62	16.50	16.62	15.00
179	CH 2310	16.33	16.50	16.33	0.97
180	CH 2325	15.84	16.50	15.84	0.00
181	CH 2340	15.28	16.50	15.28	0.00
182	CH 2355	13.93	16.50	13.93	0.00
183	CH 2370	14.96	16.50	14.96	0.00
184	CH 2385	19.11	16.50	19.11	8.38
185	CH 2400	16.93	16.50	16.93	15.00
186	CH 2415	15.92	16.50	15.92	3.08
187	CH 2430	18.14	16.50	18.14	10.26
188	CH 2445	19.61	16.50	19.61	15.00
189	CH 2460	20.56	16.50	20.56	15.00

Sl. No	Chainage	Existing Canal width (m)	Proposed width (m)	Width greater than (16.50m)	Length (m)
190	CH 2475	23.57	16.50	23.57	15.00
191	CH 2490	24.09	16.50	24.09	15.00
192	CH 2498	21.94	16.50	21.94	8.00
193	CH 2505	19.7	16.50	19.7	7.00
194	CH 2520	15.32	16.50	15.32	11.00
195	CH 2535	14.44	16.50	14.44	0.00
196	CH 2550	15.8	16.50	15.8	0.00
197	CH 2565	16.52	16.50	16.52	6.44
198	CH 2580	15.77	16.50	15.77	3.86
199	CH 2595	16.61	16.50	16.61	1.92
200	CH 2610	16.65	16.50	16.53	15.00
201	CH 2625	16.13	16.50	16.13	0.93
202	CH 2640	14.84	16.50	14.84	0.00
203	CH 2655	13.75	16.50	13.75	0.00
204	CH 2670	13.11	16.50	13.11	0.00
205	CH 2685	12.92	16.50	12.92	0.00
206	CH 2700	14.83	16.50	14.83	0.00
207	CH 2715	16.55	16.50	16.55	0.20
208	CH 2719	10.86	16.50	10.86	0.47
209	CH 2730	15.00	16.50	15.00	0.00
210	CH 2745	15.05	16.50	15.05	0.00
211	CH 2760	15.57	16.50	15.57	0.00
212	CH 2775	14.85	16.50	14.85	0.00
213	CH 2790	13.23	16.50	13.23	0.00

Sl. No	Chainage	Existing Canal width (m)	Proposed width (m)	Width greater than (16.50m)	Length (m)
214	CH 2805	11.61	16.50	11.61	0.00
215	CH 2820	10.15	16.50	10.15	0.00
216	CH 2835	10.04	16.50	10.04	0.00
217	CH 2850	10.62	16.50	10.62	0.00
218	CH 2865	13.89	16.50	13.89	0.00
219	CH 2880	14.11	16.50	14.11	0.00
220	CH 2895	14.84	16.50	14.84	0.00
221	CH 2910	12.29	16.50	12.29	0.00
222	CH 2925	11.19	16.50	11.19	0.00
223	CH 2940	11.93	16.50	11.93	0.00
224	CH 2955	11.94	16.50	11.94	0.00
225	CH 2970	11.57	16.50	11.57	0.00
226	CH 2985	13.59	16.50	13.59	0.00
227	CH 3000	15.59	16.50	15.59	0.00
228	CH 3015	17.3	16.50	17.3	6.16
229	CH 3030	16.4	16.50	16.4	12.65
230	CH 3045	13.27	16.50	13.27	0.00
231	CH 3060	12.4	16.50	12.4	0.00
232	CH 3075	12.03	16.50	12.03	0.00
233	CH 3090	11.94	16.50	11.94	0.00
234	CH 3105	12.32	16.50	12.32	0.00
235	CH 3120	12.78	16.50	12.78	0.00
236	CH 3135	12.37	16.50	12.37	0.00
237	CH 3150	12.8	16.50	12.8	0.00

Sl. No	Chainage	Existing Canal width (m)	Proposed width (m)	Width greater than (16.50m)	Length (m)
238	CH 3165	13.5	16.50	13.5	0.00
239	CH 3180	13.52	16.50	13.52	0.00
240	CH 3195	11.91	16.50	11.91	0.00
241	CH 3210	11.19	16.50	11.19	0.00
242	CH 3225	9.66	16.50	9.66	0.00
243	CH 3240	9.67	16.50	9.67	0.00
244	CH 3255	10.93	16.50	10.93	0.00
245	CH 3270	11.81	16.50	11.81	0.00
246	CH 3285	11.86	16.50	11.86	0.00
247	CH 3300	14.13	16.50	14.13	0.00
248	CH 3315	16.08	16.50	16.08	0.00
249	CH 3330	17.31	16.50	17.31	6.00
250	CH 3345	17.64	16.50	17.64	15.00
251	CH 3360	17.31	16.50	17.31	15.00
252	CH 3375	17.9	16.50	17.9	15.00
253	CH 3390	17.76	16.50	17.76	15.00
254	CH 3405	17.06	16.50	17.06	15.00
255	CH 3420	16.49	16.50	16.49	15.00
256	CH 3435	16.36	16.50	16.36	0.00
257	CH 3450	15.92	16.50	15.92	0.00
258	CH 3465	15.72	16.50	15.72	0.00
259	CH 3480	15.24	16.50	15.24	0.00
260	CH 3495	17.48	16.50	17.48	4.57
261	CH 3500	18.41	16.50	18.41	5.00

Sl. No	Chainage	Existing Canal width (m)	Proposed width (m)	Width greater than (16.50m)	Length (m)
262	CH 3510	13.88	16.50	13.88	3.70
263	CH 3525	13.88	16.50	13.88	0.00
264	CH 3536	11.6	16.50	11.6	0.00
265	CH 3540	12.63	16.50	12.63	0.00
266	CH 3555	13.28	16.50	13.28	0.00
267	CH 3570	13.21	16.50	13.21	0.00
268	CH 3585	13.01	16.50	13.01	0.00
269	CH 3600	12.9	16.50	12.9	0.00
270	CH 3615	11.22	16.50	11.22	0.00
271	CH 3630	9.97	16.50	9.97	0.00
272	CH 3645	10.33	16.50	10.33	0.00
273	CH 3660	10.6	16.50	10.6	0.00
274	CH 3675	10.38	16.50	10.38	0.00
275	CH 3690	10.64	16.50	10.64	0.00
276	CH 3705	10.94	16.50	10.94	0.00
277	CH 3720	10.65	16.50	10.65	0.00
278	CH 3735	10.66	16.50	10.66	0.00
279	CH 3750	11.65	16.50	11.65	0.00
280	CH 3765	12.92	16.50	12.92	0.00
281	CH 3780	14.18	16.50	14.18	0.00
282	CH 3795	15.37	16.50	15.37	0.00
283	CH 3810	15.12	16.50	15.12	0.00
284	CH 3825	15.43	16.50	15.43	0.00
285	CH 3840	16.95	16.50	16.95	8.58

Sl. No	Chainage	Existing Canal width (m)	Proposed width (m)	Width greater than (16.50m)	Length (m)
286	CH 3855	15.46	16.50	15.46	2.93
287	CH 3870	15.63	16.50	15.63	0.00
288	CH 3885	16.83	16.50	16.83	1.11
289	CH 3900	19.18	16.50	19.18	15.00
290	CH 3915	18.74	16.50	18.74	15.00
291	CH 3930	16.46	16.50	16.46	12.63
292	CH 3945	14.18	16.50	14.18	0.00
293	CH 3960	10.81	16.50	10.81	0.00
294	CH 3975	11.57	16.50	11.57	0.00
295	CH 3990	12.55	16.50	12.55	0.00
296	CH 4005	11.73	16.50	11.73	0.00
297	CH 4020	11.13	16.50	11.13	0.00
298	CH 4035	14.36	16.50	14.36	0.00
299	CH 4050	15.37	16.50	15.37	0.00
300	CH 4065	11.7	16.50	11.7	0.00
301	CH 4080	11.24	16.50	11.24	0.00
302	CH 4095	10.96	16.50	10.96	0.00
303	CH 4110	11.19	16.50	11.19	0.00
304	CH 4125	12.61	16.50	12.61	0.00
305	CH 4134	13.75	16.50	13.75	0.00
306	CH 4140	13.52	16.50	13.52	0.00
307	CH 4155	12.89	16.50	12.89	0.00
308	CH 4170	14.05	16.50	14.05	0.00
309	CH 4185	17.18	16.50	17.18	6.65

Sl. No	Chainage	Existing Canal width (m)	Proposed width (m)	Width greater than (16.50m)	Length (m)
310	CH 4200	15.91	16.50	15.91	1.61
311	CH 4215	14.85	16.50	14.85	0.00
312	CH 4226	13.87	16.50	13.87	0.00
313	CH 4230	15.04	16.50	15.04	0.00
314	CH 4233	16.17	16.50	16.17	0.00
315	CH 4245	16.22	16.50	16.22	0.00
316	CH 4260	15.35	16.50	15.35	0.00
317	CH 4275	13.37	16.50	13.37	0.00
318	CH 4290	14.71	16.50	14.71	0.00
319	CH 4305	15.73	16.50	15.73	0.00
320	CH 4320	16.24	16.50	16.24	0.00
321	CH 4335	16.67	16.50	16.67	7.93
322	CH 4350	16.55	16.50	16.55	15.00
323	CH 4365	15.93	16.50	15.93	1.26
324	CH 4380	15.28	16.50	15.28	0.00
325	CH 4395	15.73	16.50	15.73	0.00
326	CH 4410	16.14	16.50	16.14	0.00
327	CH 4425	17.04	16.50	17.04	9.96
328	CH 4440	17.83	16.50	17.83	15.00
329	CH 4455	17.24	16.50	17.24	15.00
330	CH 4470	17.04	16.50	17.04	15.00
331	CH 4485	15.77	16.50	15.77	6.65
332	CH 4500	13.94	16.50	13.94	0.00
333	CH 4515	13.95	16.50	13.95	0.00

Sl. No	Chainage	Existing Canal width (m)	Proposed width (m)	Width greater than (16.50m)	Length (m)
334	CH 4530	15.72	16.50	15.72	0.00
335	CH 4545	17.93	16.50	17.93	10.98
336	CH 4560	17.67	16.50	17.67	15.00
337	CH 4575	19.91	16.50	19.91	15.00
338	CH 4590	20.62	16.50	20.62	15.00
339	CH 4605	19.98	16.50	19.98	15.00
340	CH 4620	16.65	16.50	16.65	15.00
341	CH 4635	16.47	16.50	16.47	15.00
342	CH 4650	16.07	16.50	16.07	0.00
343	CH 4665	16.09	16.50	16.09	0.00
344	CH 4680	15.11	16.50	15.11	0.00
345	CH 4695	16.57	16.50	16.57	1.01
346	CH 4710	15.88	16.50	15.88	5.19
347	CH 4725	13.61	16.50	13.61	0.00
348	CH 4740	14.24	16.50	14.24	0.00
349	CH 4755	15.33	16.50	15.33	0.00
350	CH 4770	16.69	16.50	16.69	2.35
351	CH 4785	18.33	16.50	18.33	15.00
352	CH 4800	18.71	16.50	18.71	15.00
353	CH 4815	17.75	16.50	17.75	15.00
354	CH 4830	16.87	16.50	16.87	15.00
355	CH 4845	16.87	16.50	16.87	15.00
356	CH 4860	17.8	16.50	17.8	15.00
357	CH 4875	18.38	16.50	18.38	15.00

Sl. No	Chainage	Existing Canal width (m)	Proposed width (m)	Width greater than (16.50m)	Length (m)
358	CH 4890	18.4	16.50	18.4	15.00
359	CH 4905	19.13	16.50	19.13	15.00
360	CH 4920	21.26	16.50	21.26	15.00
361	CH 4935	22.24	16.50	22.24	15.00
362	CH 4950	22.29	16.50	22.29	15.00
363	CH 4965	22.3	16.50	22.3	15.00
364	CH 4980	19.44	16.50	19.44	15.00
365	CH 4995	18.24	16.50	18.24	15.00
366	CH 5010	17.71	16.50	17.71	15.00
367	CH 5025	17.63	16.50	17.63	15.00
368	CH 5040	16.7	16.50	16.7	15.00
369	CH 5055	16.56	16.50	16.56	15.00
370	CH 5070	17.24	16.50	17.24	15.00
371	CH 5085	17.93	16.50	17.93	15.00
372	CH 5100	15.73	16.50	15.73	12.00
373	CH 5115	14.56	16.50	14.56	0.00
374	CH 5130	15.01	16.50	15.01	0.00
375	CH 5145	18.46	16.50	18.46	5.66
376	CH 5160	17.56	16.50	17.56	15.00
377	CH 5175	15.82	16.50	15.82	6.84
378	CH 5190	15.37	16.50	15.37	0.00
379	CH 5205	18.33	16.50	18.33	10.50
380	CH 5220	20.58	16.50	20.58	15.00
381	CH 5235	21.7	16.50	21.7	15.00

Sl. No	Chainage	Existing Canal width (m)	Proposed width (m)	Width greater than (16.50m)	Length (m)
382	CH 5250	21.23	16.50	21.23	15.00
383	CH 5265	20.78	16.50	20.78	15.00
384	CH 5280	21.42	16.50	21.42	15.00
385	CH 5295	21.7	16.50	21.7	15.00
386	CH 5310	22.19	16.50	22.19	15.00
387	CH 5325	22.73	16.50	22.73	15.00
388	CH 5340	23.04	16.50	23.04	15.00
389	CH 5355	22.99	16.50	22.99	15.00
390	CH 5370	22.07	16.50	22.07	15.00
391	CH 5385	21.15	16.50	21.15	15.00
392	CH 5400	20.1	16.50	20.1	15.00
393	CH 5415	18.91	16.50	18.91	15.00
394	CH 5430	20.34	16.50	20.34	15.00
395	CH 5445	20.78	16.50	20.78	15.00
396	CH 5460	23.52	16.50	23.52	15.00
397	CH 5475	22.93	16.50	22.93	15.00
398	CH 5490	25.58	16.50	25.58	15.00
399	CH 5505	25.14	16.50	25.14	15.00
400	CH 5520	24.46	16.50	24.46	15.00
401	CH 5535	23.59	16.50	23.59	15.00
402	CH 5550	21.27	16.50	21.27	15.00
403	CH 5565	21.12	16.50	21.12	15.00
404	CH 5580	18.3	16.50	18.3	15.00
405	CH 5595	17.64	16.50	17.64	15.00

Sl. No	Chainage	Existing Canal width (m)	Proposed width (m)	Width greater than (16.50m)	Length (m)
406	CH 5610	20	16.50	20	15.00
407	CH 5625	18.88	16.50	18.88	15.00
408	CH 5640	20.55	16.50	20.55	15.00
409	CH 5655	19.62	16.50	19.62	15.00
410	CH 5670	19.96	16.50	19.96	15.00
411	CH 5685	20.88	16.50	20.88	15.00
412	CH 5700	23.11	16.50	23.11	15.00
413	CH 5715	22.85	16.50	22.85	15.00
414	CH 5730	22.75	16.50	22.75	15.00
415	CH 5745	22.09	16.50	22.09	15.00
416	CH 5760	21.54	16.50	21.54	15.00
417	CH 5775	21.74	16.50	21.74	15.00
418	CH 5790	22.6	16.50	22.6	15.00
419	CH 5805	23.82	16.50	23.82	15.00
420	CH 5820	24.31	16.50	24.31	15.00
421	CH 5835	22.97	16.50	22.97	15.00
422	CH 5850	21.54	16.50	21.54	15.00
423	CH 5865	21.87	16.50	21.87	15.00
424	CH 5880	21.16	16.50	21.16	15.00
425	CH 5895	18.11	16.50	18.11	15.00
426	CH 5910	15.7	16.50	15.7	7.50
427	CH 5925	14.78	16.50	14.78	0.00
428	CH 5940	18.91	16.50	18.91	5.60
429	CH 5955	23.14	16.50	23.14	15.00

Sl. No	Chainage	Existing Canal width (m)	Proposed width (m)	Width greater than (16.50m)	Length (m)
430	CH 5970	22.78	16.50	22.78	15.00
431	CH 5985	25.48	16.50	25.48	15.00
432	CH 6000	25.61	16.50	25.61	15.00
433	CH 6015	25.41	16.50	25.41	15.00
434	CH 6030	26.85	16.50	26.85	15.00
435	CH 6045	27.76	16.50	27.76	15.00
436	CH 6060	26.99	16.50	26.99	15.00
437	CH 6075	25.32	16.50	25.32	15.00
438	CH 6090	25.39	16.50	25.39	15.00
439	CH 6105	27.21	16.50	27.21	15.00
440	CH 6120	29.01	16.50	29.01	15.00
441	CH 6135	33.07	16.50	33.07	15.00
442	CH 6150	33.95	16.50	33.95	15.00
443	CH 6165	30.37	16.50	30.37	15.00
444	CH 6180	27.54	16.50	27.54	15.00
445	CH 6195	28.42	16.50	28.42	15.00
446	CH 6210	26.77	16.50	26.77	15.00
447	CH 6225	23.59	16.50	23.59	15.00
448	CH 6240	21.87	16.50	21.87	15.00
449	CH 6255	20.18	16.50	20.18	15.00
450	CH 6270	20.72	16.50	20.72	15.00
451	CH 6285	22.06	16.50	22.06	15.00
452	CH 6300	23.78	16.50	23.78	15.00
453	CH 6315	26.53	16.50	26.53	15.00

Sl. No	Chainage	Existing Canal width (m)	Proposed width (m)	Width greater than (16.50m)	Length (m)
454	CH 6330	27.38	16.50	27.38	15.00
455	CH 6345	24.98	16.50	24.98	15.00
456	CH 6360	25.41	16.50	25.41	15.00
457	CH 6375	25.46	16.50	25.46	15.00
458	CH 6390	25.81	16.50	25.81	15.00
459	CH 6405	27.58	16.50	27.58	15.00
460	CH 6420	28.81	16.50	28.81	15.00
461	CH 6435	29.55	16.50	29.55	15.00
462	CH 6450	26.14	16.50	26.14	15.00
463	CH 6465	25.21	16.50	25.21	15.00
464	CH 6480	30.41	16.50	30.41	15.00
465	CH 6495	30.88	16.50	30.88	15.00
466	CH 6510	31.77	16.50	31.77	15.00
467	CH 6525	29.76	16.50	29.76	15.00
468	CH 6540	22.15	16.50	22.15	15.00
469	CH 6555	18.5	16.50	18.5	15.00
470	CH 6570	17.03	16.50	17.03	15.00
471	CH 6585	17.41	16.50	17.41	15.00
472	CH 6600	19.67	16.50	19.67	15.00
473	CH 6615	23.08	16.50	23.08	15.00
474	CH 6630	23.73	16.50	23.73	15.00
475	CH 6645	24.39	16.50	24.39	15.00
476	CH 6660	24.98	16.50	24.98	15.00
477	CH 6675	23.6	16.50	23.6	15.00

Sl. No	Chainage	Existing Canal width (m)	Proposed width (m)	Width greater than (16.50m)	Length (m)
478	CH 6690	22.21	16.50	22.21	15.00
479	CH 6705	22.42	16.50	22.42	15.00
480	CH 6720	22.74	16.50	22.74	15.00
481	CH 6735	23.02	16.50	23.02	15.00
482	CH 6750	26.82	16.50	26.82	15.00
483	CH 6765	27.34	16.50	27.34	15.00
484	CH 6780	28.06	16.50	28.06	15.00
485	CH 6795	23.9	16.50	23.9	15.00
486	CH 6810	26.95	16.50	26.95	15.00
487	CH 6825	29.3	16.50	29.3	15.00
488	CH 6840	31.25	16.50	31.25	15.00
489	CH 6855	31.44	16.50	31.44	15.00
490	CH 6870	28.87	16.50	28.87	15.00
491	CH 6885	29.77	16.50	29.77	15.00
492	CH 6900	32.21	16.50	32.21	15.00
493	CH 6915	34.58	16.50	34.58	15.00
494	CH 6930	33.54	16.50	33.54	15.00
495	CH 6945	30.83	16.50	30.83	15.00
496	CH 6960	28.74	16.50	28.74	15.00
497	CH 6975	28.08	16.50	28.08	15.00
498	CH 6990	26.41	16.50	26.41	15.00
499	CH 7005	25.62	16.50	25.62	15.00
500	CH 7020	27.11	16.50	27.11	15.00
501	CH 7035	25.25	16.50	25.25	15.00

Sl. No	Chainage	Existing Canal width (m)	Proposed width (m)	Width greater than (16.50m)	Length (m)
502	CH 7050	24.78	16.50	24.78	15.00
503	CH 7065	25.02	16.50	25.02	15.00
504	CH 7080	23.12	16.50	23.12	15.00
505	CH 7095	22.18	16.50	22.18	15.00
506	CH 7110	19.96	16.50	19.96	15.00
507	CH 7125	28.89	16.50	28.89	15.00
508	CH 7140	34.6	16.50	34.6	15.00
509	CH 7155	38.28	16.50	38.28	15.00
510	CH 7170	42.58	16.50	42.58	15.00
511	CH 7185	34.97	16.50	34.97	15.00
512	CH 7200	35.4	16.50	35.4	15.00
513	CH 7215	31.21	16.50	31.21	15.00
514	CH 7230	28.92	16.50	28.92	15.00
515	CH 7245	28.79	16.50	28.79	15.00
516	CH 7260	21.96	16.50	21.96	15.00
517	CH 7275	24.18	16.50	24.18	15.00
518	CH 7290	26.27	16.50	26.27	15.00
519	CH 7305	28.37	16.50	28.37	15.00
520	CH 7320	30.82	16.50	30.82	15.00
521	CH 7335	31.54	16.50	31.54	15.00
522	CH 7350	32.26	16.50	32.26	15.00
523	CH 7365	32.99	16.50	32.99	15.00
524	CH 7380	34.2	16.50	34.2	15.00
525	CH 7395	33.41	16.50	33.41	15.00

Sl. No	Chainage	Existing Canal width (m)	Proposed width (m)	Width greater than (16.50m)	Length (m)
526	CH 7410	32.54	16.50	32.54	15.00
527	CH 7425	31.66	16.50	31.66	15.00
528	CH 7440	31.58	16.50	31.58	15.00
529	CH 7455	31.73	16.50	31.73	15.00
530	CH 7470	32.16	16.50	32.16	15.00
531	CH 7485	32.59	16.50	32.59	15.00
532	CH 7500	33.05	16.50	33.05	15.00
533	CH 7515	34.8	16.50	34.8	15.00
534	CH 7530	37.29	16.50	37.29	15.00
535	CH 7545	37.68	16.50	37.68	15.00
536	CH 7560	37.121	16.50	37.121	15.00
537	CH 7575	37.21	16.50	37.21	15.00
538	CH 7590	34.88	16.50	34.88	15.00
539	CH 7605	33.82	16.50	33.82	15.00
540	CH 7620	32.74	16.50	32.74	15.00
541	CH 7635	32.42	16.50	32.42	15.00
542	CH 7650	28.75	16.50	28.75	15.00
543	CH 7665	27.43	16.50	27.43	15.00
544	CH 7680	27.03	16.50	27.03	15.00
545	CH 7695	31.61	16.50	31.61	15.00
546	CH 7710	37.57	16.50	37.57	15.00
547	CH 7725	41.72	16.50	41.72	15.00
548	CH 7740	38.87	16.50	38.87	15.00
549	CH 7755	32.88	16.50	32.88	15.00

Sl. No	Chainage	Existing Canal width (m)	Proposed width (m)	Width greater than (16.50m)	Length (m)
550	CH 7770	30.59	16.50	30.59	15.00
551	CH 7785	29.74	16.50	29.74	15.00
552	CH 7800	26.84	16.50	26.84	15.00
553	CH 7815	26.14	16.50	26.14	15.00
554	CH 7830	28.36	16.50	28.36	15.00
555	CH 7845	32.55	16.50	32.55	15.00
556	CH 7860	34.43	16.50	34.43	15.00
557	CH 7875	34.21	16.50	34.21	15.00
558	CH 7890	36.41	16.50	36.41	15.00
559	CH 7905	38.54	16.50	38.54	15.00
560	CH 7920	36.66	16.50	36.66	15.00
561	CH 7935	33.52	16.50	33.52	15.00
562	CH 7950	29.95	16.50	29.95	15.00
563	CH 7965	29.43	16.50	29.43	15.00
564	CH 7980	28.24	16.50	28.24	15.00
565	CH 7995	26.95	16.50	26.95	15.00
566	CH 8010	25.74	16.50	25.74	15.00
567	CH 8025	27.3	16.50	27.3	15.00
568	CH 8040	28.95	16.50	28.95	15.00
569	CH 8055	28.76	16.50	28.76	15.00
570	CH 8070	28.35	16.50	28.35	15.00
571	CH 8085	27.55	16.50	27.55	15.00
572	CH 8100	26.74	16.50	26.74	15.00
573	CH 8115	26.93	16.50	26.93	15.00

Sl. No	Chainage	Existing Canal width (m)	Proposed width (m)	Width greater than (16.50m)	Length (m)
574	CH 8130	27.44	16.50	27.44	15.00
575	CH 8145	29.13	16.50	29.13	15.00
576	CH 8160	32.14	16.50	32.14	15.00
577	CH 8175	33.36	16.50	33.36	15.00
578	CH 8190	32.12	16.50	32.12	15.00
579	CH 8205	30.85	16.50	30.85	15.00
580	CH 8220	29.66	16.50	29.66	15.00
581	CH 8235	30.24	16.50	30.24	15.00
582	CH 8250	33.88	16.50	33.88	15.00
583	CH 8265	33.41	16.50	33.41	15.00
584	CH 8280	32.85	16.50	32.85	15.00
585	CH 8295	34	16.50	34	15.00
586	CH 8310	32.24	16.50	32.24	15.00
587	CH 8325	29.98	16.50	29.98	15.00
588	CH 8340	31.67	16.50	31.67	15.00
589	CH 8355	39.41	16.50	39.41	15.00
590	CH 8370	47.62	16.50	47.62	15.00
591	CH 8385	61.18	16.50	61.18	15.00
592	CH 8400	56.92	16.50	56.92	15.00
593	CH 8415	52.23	16.50	52.23	15.00
594	CH 8430	54.4	16.50	54.4	15.00
595	CH 8445	56.81	16.50	56.81	15.00
596	CH 8460	54.42	16.50	54.42	15.00
597	CH 8475	56.82	16.50	56.82	15.00

Sl. No	Chainage	Existing Canal width (m)	Proposed width (m)	Width greater than (16.50m)	Length (m)
598	CH 8490	60.71	16.50	60.71	15.00
599	CH 8505	63.65	16.50	63.65	15.00
600	CH 8520	61.72	16.50	61.72	15.00
601	CH 8535	57.36	16.50	57.36	15.00
602	CH 8550	56.42	16.50	56.42	15.00
603	CH 8565	55.53	16.50	55.53	15.00
604	CH 8580	54.01	16.50	54.01	15.00
605	CH 8595	54.78	16.50	54.78	15.00
606	CH 8610	55.95	16.50	55.95	15.00
607	CH 8625	56.72	16.50	56.72	15.00
608	CH 8640	57.54	16.50	57.54	15.00
609	CH 8655	54.43	16.50	54.43	15.00
610	CH 8670	51.1	16.50	51.1	15.00
611	CH 8685	53.47	16.50	53.47	15.00
612	CH 8700	55.29	16.50	55.29	15.00
613	CH 8715	57.88	16.50	57.88	15.00
614	CH 8730	57.42	16.50	57.42	15.00
615	CH 8745	63.39	16.50	63.39	15.00
616	CH 8760	81.59	16.50	81.59	15.00
617	CH 8775	126.87	16.50	126.87	15.00
618	CH 8790	176.47	16.50	176.47	15.00
619	CH 8798	181.52	16.50	181.52	8.00
620	CH 8805	154.56	16.50	154.56	7.00
621	CH 8820	92.74	16.50	92.74	15.00

Sl. No	Chainage	Existing Canal width (m)	Proposed width (m)	Width greater than (16.50m)	Length (m)
622	CH 8835	78.75	16.50	78.75	15.00
623	CH 8850	75.45	16.50	75.45	15.00
624	CH 8865	75.51	16.50	75.51	15.00
625	CH 8880	76.49	16.50	76.49	15.00
626	CH 8895	77.31	16.50	77.31	15.00
627	CH 8910	74.31	16.50	74.31	15.00
628	CH 8925	72.28	16.50	72.28	15.00
629	CH 8940	71.57	16.50	71.57	15.00
630	CH 8955	68.33	16.50	68.33	15.00
631	CH 8970	63.84	16.50	63.84	15.00
632	CH 8985	56.1	16.50	56.1	15.00
633	CH 9000	52.75	16.50	52.75	15.00
634	CH 9015	62.64	16.50	62.64	15.00
635	CH 9030	72.38	16.50	72.38	15.00
636	CH 9045	90.06	16.50	90.06	15.00
637	CH 9060	128.82	16.50	128.82	15.00
638	CH 9075	132.68	16.50	132.68	15.00
639	CH 9090	135.62	16.50	135.62	15.00
640	CH 9105	135.6	16.50	135.6	15.00
641	CH 9120	138.78	16.50	138.78	15.00
642	CH 9135	100.72	16.50	100.72	15.00
643	CH 9150	81.25	16.50	81.25	15.00
644	CH 9165	72.48	16.50	72.48	15.00
645	CH 9180	66.42	16.50	66.42	15.00

Sl. No	Chainage	Existing Canal width (m)	Proposed width (m)	Width greater than (16.50m)	Length (m)
646	CH 9195	64.67	16.50	64.67	15.00
647	CH 9210	62.59	16.50	62.59	15.00
648	CH 9225	60.35	16.50	60.35	15.00
649	CH 9240	57.633	16.50	57.633	15.00
650	CH 9255	56.8	16.50	56.8	15.00
651	CH 9270	57.91	16.50	57.91	15.00
652	CH 9285	50.2	16.50	50.2	15.00
653	CH 9300	51.55	16.50	51.55	15.00
654	CH 9315	53.21	16.50	53.21	15.00
655	CH 9330	53.07	16.50	53.07	15.00
656	CH 9345	54.19	16.50	54.19	15.00
657	CH 9360	53.4	16.50	53.4	15.00
658	CH 9375	53.69	16.50	53.69	15.00
659	CH 9390	51.87	16.50	51.87	15.00
660	CH 9405	50.81	16.50	50.81	15.00
661	CH 9420	51.36	16.50	51.36	15.00
662	CH 9435	54.88	16.50	54.88	15.00
663	CH 9450	57.41	16.50	57.41	15.00
664	CH 9465	56.78	16.50	56.78	15.00
665	CH 9480	54.05	16.50	54.05	15.00
666	CH 9495	49.51	16.50	49.51	15.00
667	CH 9510	46.91	16.50	46.91	15.00
668	CH 9525	46.5	16.50	46.5	15.00
669	CH 9540	49.16	16.50	49.16	15.00

Sl. No	Chainage	Existing Canal width (m)	Proposed width (m)	Width greater than (16.50m)	Length (m)
670	CH 9555	50.03	16.50	50.03	15.00
671	CH 9570	49.4	16.50	49.4	15.00
672	CH 9585	49.61	16.50	49.61	15.00
673	CH 9600	50.71	16.50	50.71	15.00
674	CH 9615	51.59	16.50	51.59	15.00
675	CH 9630	52	16.50	52	15.00
676	CH 9645	52.76	16.50	52.76	15.00
677	CH 9660	53.07	16.50	53.07	15.00
678	CH 9675	53.76	16.50	53.76	15.00
679	CH 9690	54.03	16.50	54.03	15.00
680	CH 9705	54.29	16.50	54.29	15.00
681	CH 9720	53	16.50	53	15.00
682	CH 9735	51.97	16.50	51.97	15.00
683	CH 9750	51.39	16.50	51.39	15.00
684	CH 9765	51.65	16.50	51.65	15.00
685	CH 9780	52.48	16.50	52.48	15.00
686	CH 9795	52	16.50	52	15.00
687	CH 9810	49.52	16.50	49.52	15.00
688	CH 9825	47.21	16.50	47.21	15.00
689	CH 9840	47.8	16.50	47.8	15.00
690	CH 9855	51.66	16.50	51.66	15.00
691	CH 9870	55.25	16.50	55.25	15.00
692	CH 9885	58.58	16.50	58.58	15.00
693	CH 9893	60.97	16.50	60.97	8.00

Sl. No	Chainage	Existing Canal width (m)	Proposed width (m)	Width greater than (16.50m)	Length (m)
694	CH 9900	57.33	16.50	57.33	7.00
695	CH 9915	56.74	16.50	56.74	15.00
696	CH 9930	56.63	16.50	56.63	15.00
697	CH 9945	56.6	16.50	56.6	15.00
698	CH 9960	50.61	16.50	50.61	15.00
699	CH 9975	55.71	16.50	55.71	15.00
700	CH 9990	59.25	16.50	59.25	15.00
701	CH 10005	61.51	16.50	61.51	15.00
702	CH 10020	62.32	16.50	62.32	15.00
703	CH 10035	66.2	16.50	66.2	15.00
704	CH 10050	63.83	16.50	63.83	15.00
705	CH 10065	61.72	16.50	61.72	15.00
706	CH 10080	59.89	16.50	59.89	15.00
707	CH 10095	54.41	16.50	54.41	15.00
708	CH 10110	48.81	16.50	48.81	15.00
709	CH 10125	45.61	16.50	45.61	15.00
710	CH 10140	46.24	16.50	46.24	15.00
711	CH 10155	45.91	16.50	45.91	15.00
712	CH 10170	46.96	16.50	46.96	15.00
713	CH 10185	50.52	16.50	50.52	15.00
714	CH 10200	53.05	16.50	53.05	15.00
715	CH 10215	56.12	16.50	56.12	15.00
716	CH 10230	55.96	16.50	55.96	15.00
717	CH 10245	56.37	16.50	56.37	15.00

Sl. No	Chainage	Existing Canal width (m)	Proposed width (m)	Width greater than (16.50m)	Length (m)
718	CH 10260	59.53	16.50	59.53	15.00
719	CH 10275	50.58	16.50	50.58	15.00
720	CH 10290	55.24	16.50	55.24	15.00
721	CH 10305	53.02	16.50	53.02	15.00
722	CH 10320	52.7	16.50	52.7	15.00
723	CH 10335	52.68	16.50	52.68	15.00
724	CH 10350	51.1	16.50	51.1	15.00
725	CH 10365	53.15	16.50	53.15	15.00
726	CH 10380	54.72	16.50	54.72	15.00
727	CH 10395	54.47	16.50	54.47	15.00
728	CH 10410	53.72	16.50	53.72	15.00
729	CH 10425	50.09	16.50	50.09	15.00
730	CH 10440	52.59	16.50	52.59	15.00
731	CH 10455	52.76	16.50	52.76	15.00
732	CH 10470	54.82	16.50	54.82	15.00
733	CH 10485	56.09	16.50	56.09	15.00
734	CH 10500	55.54	16.50	55.54	15.00
735	CH 10515	54.54	16.50	54.54	15.00
736	CH 10530	56.56	16.50	56.56	15.00
737	CH 10545	54.68	16.50	54.68	15.00
738	CH 10560	55.58	16.50	55.58	15.00
739	CH 10575	62.43	16.50	62.43	15.00
740	CH 10590	57.15	16.50	57.15	15.00
741	CH 10605	53.76	16.50	53.76	15.00

Sl. No	Chainage	Existing Canal width (m)	Proposed width (m)	Width greater than (16.50m)	Length (m)
742	CH 10620	57.5	16.50	57.5	15.00
743	CH 10635	57.86	16.50	57.86	15.00
744	CH 10650	56.64	16.50	56.64	15.00
745	CH 10665	56.39	16.50	56.39	15.00
746	CH 10680	57.14	16.50	57.14	15.00
747	CH 10695	59.15	16.50	59.15	15.00
748	CH 10710	60.87	16.50	60.87	15.00
749	CH 10725	60.41	16.50	60.41	15.00
750	CH 10740	61.92	16.50	61.92	15.00
751	CH 10755	62.38	16.50	62.38	15.00
752	CH 10770	57.21	16.50	57.21	15.00
753	CH 10785	59.78	16.50	59.78	15.00
754	CH 10800	61.61	16.50	61.61	15.00
755	CH 10815	64.01	16.50	64.01	15.00
756	CH 10830	69.42	16.50	69.42	15.00
757	CH 10845	67.77	16.50	67.77	15.00
758	CH 10860	65.46	16.50	65.46	15.00
759	CH 10875	65.9	16.50	65.9	15.00
760	CH 10890	63.88	16.50	63.88	15.00
761	CH 10905	62.16	16.50	62.16	15.00
762	CH 10920	63.44	16.50	63.44	15.00
763	CH 10935	62.99	16.50	62.99	15.00
764	CH 10950	65.23	16.50	65.23	15.00
765	CH 10965	71.11	16.50	71.11	15.00

Sl. No	Chainage	Existing Canal width (m)	Proposed width (m)	Width greater than (16.50m)	Length (m)
766	CH 10980	81.78	16.50	81.78	15.00
767	CH 10995	94.29	16.50	94.29	15.00
768	CH 11010	94.83	16.50	94.83	15.00
769	CH 11025	95.79	16.50	95.79	15.00
770	CH 11040	102.96	16.50	102.96	15.00
771	CH 11055	109.03	16.50	109.03	15.00
772	CH 11070	115.25	16.50	115.25	15.00
773	CH 11085	84.05	16.50	84.05	15.00
774	CH 11100	71.92	16.50	71.92	15.00
775	CH 11115	59.42	16.50	59.42	15.00
776	CH 11130	44.41	16.50	44.41	15.00
777	CH 11145	41.58	16.50	41.58	15.00
778	CH 11160	39.74	16.50	39.74	15.00
779	CH 11175	42.6	16.50	42.6	15.00
780	CH 11190	51.94	16.50	51.94	15.00
781	CH 11205	59.72	16.50	59.72	15.00
782	CH 11220	68.37	16.50	68.37	15.00
783	CH 11231	92.83	16.50	92.83	11.00

1.2 Chilavanoor Canal

Table 3:Details of width of Chilavanoor Canal

Sl. No	Chainage	Existing Canal width (m)	Proposed width (m)	Width greater than (16.50m)	Length (m)
1	CH 00	54.67	16.50	54.67	0.00
2	CH 15	47.90	16.50	47.90	15.00
3	CH 30	36.19	16.50	36.19	15.00
4	CH 45	23.79	16.50	23.79	15.00
5	CH 60	20.99	16.50	20.99	15.00
6	CH 75	20.16	16.50	20.16	15.00
7	CH 90	23.39	16.50	23.39	15.00
8	CH 105	24.26	16.50	24.26	15.00
9	CH 120	26.36	16.50	26.36	15.00
10	CH 135	27.95	16.50	27.95	15.00
11	CH150	30.20	16.50	30.20	15.00
12	CH 165	30.63	16.50	30.63	15.00
13	CH 180	27.98	16.50	27.98	15.00
14	CH 195	20.26	16.50	20.26	15.00
15	CH 210	16.04	16.50	16.04	12.60
16	CH 225	16.95	16.50	16.95	3.47
17	CH 240	16.91	16.50	16.91	15.00
18	CH 255	17.08	16.50	17.08	15.00
19	CH 270	17.07	16.50	17.07	15.00
20	CH 285	20.88	16.50	20.88	15.00

Sl. No	Chainage	Existing Canal width (m)	Proposed width (m)	Width greater than (16.50m)	Length (m)
21	CH 300	20.20	16.50	20.20	15.00
22	CH 315	19.38	16.50	19.38	15.00
23	CH 330	18.93	16.50	18.93	15.00
24	CH 345	22.73	16.50	22.73	15.00
25	CH 349.4	24.28	16.50	24.28	4.40
26	CH 360	19.25	16.50	19.25	10.60
27	CH 375	15.71	16.50	15.71	12.54
28	CH 390	11.61	16.50	11.61	0.00
29	CH 398	8.26	16.50	8.26	0.00
30	CH 405	15.70	16.50	15.70	0.00
31	CH 420	18.65	16.50	18.65	5.83
32	CH 435	18.47	16.50	18.47	15.00
33	CH 450	19.24	16.50	19.24	15.00
34	CH 465	19.61	16.50	19.61	15.00
35	CH 480	21.14	16.50	21.14	15.00
36	CH 495	20.51	16.50	20.51	15.00
37	CH 510	16.45	16.50	16.45	15.00
38	CH 525	23.04	16.50	23.04	15.00
39	CH 540	29.70	16.50	29.70	15.00
40	CH 555	28.61	16.50	28.61	15.00
41	CH 570	28.32	16.50	28.32	15.00
42	CH 585	26.59	16.50	26.59	15.00
43	CH 600	25.80	16.50	25.80	15.00
44	CH 615	23.56	16.50	23.56	15.00

Sl. No	Chainage	Existing Canal width (m)	Proposed width (m)	Width greater than (16.50m)	Length (m)
45	CH 630	25.63	16.50	25.63	15.00
46	CH 645	23.08	16.50	23.08	15.00
47	CH 660	21.08	16.50	21.08	15.00
48	CH 675	16.50	16.50	16.50	15.00
49	CH 690	16.11	16.50	16.11	12.69
50	CH 705	15.10	16.50	15.10	0.00
51	CH 720	12.94	16.50	12.94	0.00
52	CH 735	13.53	16.50	13.53	0.00
53	CH 750	15.25	16.50	15.25	0.00
54	CH 765	15.46	16.50	15.46	0.00
55	CH 780	15.28	16.50	15.28	0.00
56	CH 795	15.75	16.50	15.75	0.00
57	CH 810	15.61	16.50	15.61	0.00
58	CH 825	15.56	16.50	15.56	0.00
59	CH 840	15.38	16.50	15.38	0.00
60	CH 855	15.37	16.50	15.37	0.00
61	CH 870	16.08	16.50	16.08	0.00
62	CH 885	17.42	16.50	17.42	8.62
63	CH 900	16.73	16.50	16.73	15.00
64	CH 915	15.77	16.50	15.77	8.43
65	CH 930	15.56	16.50	15.56	0.00
66	CH 945	15.53	16.50	15.53	0.00
67	CH 960	19.54	16.50	19.54	3.36
68	CH 975	20.36	16.50	20.36	15.00

Sl. No	Chainage	Existing Canal width (m)	Proposed width (m)	Width greater than (16.50m)	Length (m)
69	CH 990	16.62	16.50	16.62	15.00
70	CH 1005	14.62	16.50	14.62	1.02
71	CH 1020	13.10	16.50	13.10	0.00
72	CH 1035	13.93	16.50	13.93	0.00
73	CH 1050	14.51	16.50	14.51	0.00
74	CH 1065	14.19	16.50	14.19	0.00
75	CH 1080	13.36	16.50	13.36	0.00
76	CH 1095	12.72	16.50	12.72	0.00
77	CH 1110	12.28	16.50	12.28	0.00
78	CH 1125	11.77	16.50	11.77	0.00
79	CH 1140	11.05	16.50	11.05	0.00
80	CH 1155	11.86	16.50	11.86	0.00
81	CH 1170	13.34	16.50	13.34	0.00
82	CH 1185	14.73	16.50	14.73	0.00
83	CH 1200	16.02	16.50	16.02	0.00
84	CH 1215	17.76	16.50	17.76	9.68
85	CH 1230	17.89	16.50	17.89	15.00
86	CH 1245	15.55	16.50	15.55	8.78
87	CH 1260	15.04	16.50	15.04	0.00
88	CH 1275	13.42	16.50	13.42	0.00
89	CH 1290	13.38	16.50	13.38	0.00
90	CH 1305	13.80	16.50	13.80	0.00
91	CH 1320	15.00	16.50	15.00	0.00
92	CH 1335	17.71	16.50	17.71	4.04

Sl. No	Chainage	Existing Canal width (m)	Proposed width (m)	Width greater than (16.50m)	Length (m)
93	CH 1350	22.73	16.50	22.73	15.00
94	CH 1365	14.42	16.50	14.42	8.65
95	CH 1380	10.06	16.50	10.06	0.00
96	CH 1395	9.60	16.50	9.60	0.00
97	CH 1410	9.24	16.50	9.24	0.00
98	CH 1425	10.61	16.50	10.61	0.00
99	CH 1440	11.99	16.50	11.99	0.00
100	CH 1455	11.14	16.50	11.14	0.00
101	CH 1470	9.94	16.50	9.94	0.00
102	CH 1485	8.76	16.50	8.76	0.00
103	CH 1500	9.16	16.50	9.16	0.00
104	CH 1515	8.80	16.50	8.80	0.00
105	CH 1530	10.75	16.50	10.75	0.00
106	CH 1545	10.74	16.50	10.74	0.00
107	CH 1560	11.66	16.50	11.66	0.00
108	CH 1575	14.10	16.50	14.10	0.00
109	CH 1590	14.95	16.50	14.95	0.00
110	CH 1605	15.75	16.50	15.75	0.00
111	CH 1620	16.31	16.50	16.31	0.00
112	CH 1635	16.63	16.50	16.71	8.86
113	CH 1650	15.99	16.50	15.99	5.18
114	CH 1665	14.52	16.50	14.52	0.00
115	CH 1680	13.16	16.50	13.16	0.00
116	CH 1695	12.80	16.50	12.80	0.00

Sl. No	Chainage	Existing Canal width (m)	Proposed width (m)	Width greater than (16.50m)	Length (m)
117	CH 1710	12.22	16.50	12.22	0.00
118	CH 1725	10.84	16.50	10.84	0.00
119	CH 1740	11.41	16.50	11.41	0.00
120	CH 1755	11.60	16.50	11.60	0.00
121	CH 1770	11.21	16.50	11.21	0.00
122	CH 1785	11.97	16.50	11.97	0.00
123	CH 1800	12.60	16.50	12.60	0.00
124	CH 1815	12.24	16.50	12.24	0.00
125	CH 1830	11.88	16.50	11.88	0.00
126	CH 1845	10.98	16.50	10.98	0.00
127	CH 1860	10.20	16.50	10.20	0.00
128	CH 1875	9.88	16.50	9.88	0.00
129	CH 1890	8.38	16.50	8.38	0.00
130	CH 1905	8.86	16.50	8.86	0.00
131	CH 1920	8.54	16.50	8.54	0.00
132	CH 1935	8.70	16.50	8.70	0.00
133	CH 1950	8.86	16.50	8.86	0.00
134	CH 1965	9.06	16.50	9.06	0.00
135	CH 1980	8.92	16.50	8.92	0.00
136	CH 1995	8.03	16.50	8.03	0.00
137	CH 2010	7.14	16.50	7.14	0.00
138	CH 2025	6.25	16.50	6.25	0.00
139	CH 2040	5.69	16.50	5.69	0.00
140	CH 2055	6.53	16.50	6.53	0.00

Sl. No	Chainage	Existing Canal width (m)	Proposed width (m)	Width greater than (16.50m)	Length (m)
141	CH 2070	6.94	16.50	6.94	0.00
142	CH 2085	6.12	16.50	6.12	0.00
143	CH 2100	6.27	16.50	6.27	0.00
144	CH 2115	6.25	16.50	6.25	0.00
145	CH 2130	5.82	16.50	5.82	0.00
146	CH 2145	5.22	16.50	5.22	0.00
147	CH 2160	5.79	16.50	5.79	0.00
148	CH 2175	5.13	16.50	5.13	0.00
149	CH 2190	5.24	16.50	5.24	0.00
150	CH 2205	6.19	16.50	6.19	0.00
151	CH 2220	5.95	16.50	5.95	0.00
152	CH 2235	6.12	16.50	6.12	0.00
153	CH 2250	4.43	16.50	4.43	0.00
154	CH 2265	6.51	16.50	6.51	0.00
155	CH 2280	5.99	16.50	5.99	0.00
156	CH 2295	5.08	16.50	5.08	0.00
157	CH 2310	6.36	16.50	6.36	0.00
158	CH 2325	5.92	16.50	5.92	0.00
159	CH 2340	6.31	16.50	6.31	0.00
160	CH 2355	6.53	16.50	6.53	0.00
161	CH 2370	4.81	16.50	4.81	0.00
162	CH 2385	4.32	16.50	4.32	0.00
163	CH 2400	4.75	16.50	4.75	0.00
164	CH 2415	5.46	16.50	5.46	0.00

Sl. No	Chainage	Existing Canal width (m)	Proposed width (m)	Width greater than (16.50m)	Length (m)
165	CH 2430	4.75	16.50	4.75	0.00
166	CH 2445	4.11	16.50	4.11	0.00
167	CH 2460	5.31	16.50	5.31	0.00
168	CH 2475	4.74	16.50	4.74	0.00
169	CH 2490	4.27	16.50	4.27	0.00
170	CH 2505	4.56	16.50	4.56	0.00
171	CH 2520	5.79	16.50	5.79	0.00
172	CH 2535	5.04	16.50	5.04	0.00
173	CH 2550	4.60	16.50	4.60	0.00
174	CH 2565	5.04	16.50	5.04	0.00
175	CH 2580	5.53	16.50	5.53	0.00
176	CH 2595	5.44	16.50	5.44	0.00
177	CH 2610	5.27	16.50	5.27	0.00
178	CH 2625	5.28	16.50	5.28	0.00
179	CH 2640	4.73	16.50	4.73	0.00
180	CH 2655	5.11	16.50	5.11	0.00
181	CH 2670	5.78	16.50	5.78	0.00
182	CH 2685	5.10	16.50	5.10	0.00
183	CH 2700	3.92	16.50	3.92	0.00
184	CH 2715	3.93	16.50	3.93	0.00
185	CH 2730	4.30	16.50	4.30	0.00
186	CH 2745	4.19	16.50	4.19	0.00
187	CH 2760	3.66	16.50	3.66	0.00
188	CH 2775	3.43	16.50	3.43	0.00

Sl. No	Chainage	Existing Canal width (m)	Proposed width (m)	Width greater than (16.50m)	Length (m)
189	CH 2790	3.57	16.50	3.57	0.00
190	CH 2805	3.97	16.50	3.97	0.00
191	CH 2820	3.75	16.50	3.75	0.00
192	CH 2835	3.70	16.50	3.70	0.00
193	CH 2850	3.62	16.50	3.62	0.00
194	CH 2865	3.84	16.50	3.84	0.00
195	CH 2880	3.80	16.50	3.80	0.00
196	CH 2895	3.33	16.50	3.33	0.00
197	CH 2910	3.46	16.50	3.46	0.00
198	CH 2925	3.14	16.50	3.14	0.00
199	CH 2940	3.71	16.50	3.71	0.00
200	CH 2955	3.74	16.50	3.74	0.00
201	CH 2970	3.66	16.50	3.66	0.00
202	CH 2985	3.63	16.50	3.63	0.00
203	CH 3000	3.60	16.50	3.60	0.00
204	CH 3015	3.54	16.50	3.54	0.00
205	CH 3030	3.26	16.50	3.26	0.00
206	CH 3045	2.98	16.50	2.98	0.00
207	CH 3060	3.64	16.50	3.64	0.00
208	CH 3075	3.86	16.50	3.86	0.00
209	CH 3090	3.22	16.50	3.22	0.00
210	CH 3105	3.05	16.50	3.05	0.00
211	CH 3120	3.17	16.50	3.17	0.00
212	CH 3135	3.23	16.50	3.23	0.00

Sl. No	Chainage	Existing Canal width (m)	Proposed width (m)	Width greater than (16.50m)	Length (m)
213	CH 3150	2.94	16.50	2.94	0.00
214	CH 3165	3.09	16.50	3.09	0.00
215	CH 3180	3.33	16.50	3.33	0.00
216	CH 3195	3.31	16.50	3.31	0.00
217	CH 3210	2.84	16.50	2.84	0.00
218	CH 3225	3.39	16.50	3.39	0.00
219	CH 3240	2.83	16.50	2.83	0.00
220	CH 3255	3.27	16.50	3.27	0.00
221	CH 3270	2.99	16.50	2.99	0.00
222	CH 3285	3.35	16.50	3.35	0.00
223	CH 3300	3.19	16.50	3.19	0.00
224	CH 3315	3.30	16.50	3.30	0.00
225	CH 3330	2.76	16.50	2.76	0.00
226	CH 3345	3.69	16.50	3.69	0.00
227	CH 3360	3.07	16.50	3.07	0.00
228	CH 3375	2.65	16.50	2.65	0.00
229	CH 3390	2.89	16.50	2.89	0.00
230	CH 3405	3.89	16.50	3.89	0.00
231	CH 3420	3.54	16.50	3.54	0.00
232	CH 3435	2.10	16.50	2.10	0.00
233	CH 3450	2.51	16.50	2.51	0.00
234	CH 3465	2.03	16.50	2.03	0.00
235	CH 3480	2.55	16.50	2.55	0.00
236	CH 3495	2.47	16.50	2.47	0.00

Sl. No	Chainage	Existing Canal width (m)	Proposed width (m)	Width greater than (16.50m)	Length (m)
237	CH 3510	2.68	16.50	2.68	0.00
238	CH 3525	2.30	16.50	2.30	0.00
239	CH 3540	2.56	16.50	2.56	0.00
240	CH 3555	2.56	16.50	2.56	0.00
241	CH 3570	2.39	16.50	2.39	0.00
242	CH 3585	2.66	16.50	2.66	0.00
243	CH 3600	2.52	16.50	2.52	0.00
244	CH 3615	2.33	16.50	2.33	0.00
245	CH 3630	2.06	16.50	2.06	0.00
246	CH 3645	2.22	16.50	2.22	0.00
247	CH 3660	1.99	16.50	1.99	0.00
248	CH 3675	2.03	16.50	2.03	0.00
249	CH 3690	2.77	16.50	2.77	0.00
250	CH 3705	3.22	16.50	3.22	0.00
251	CH 3720	3.09	16.50	3.09	0.00
252	CH 3735	2.12	16.50	2.12	0.00
253	CH 3750	2.07	16.50	2.07	0.00
254	CH 3765	2.16	16.50	2.16	0.00
255	CH 3780	3.48	16.50	3.48	0.00
256	CH 3795	3.46	16.50	3.46	0.00
257	CH 3810	3.63	16.50	3.63	0.00
258	CH 3825	3.29	16.50	3.29	0.00
259	CH 3840	2.91	16.50	2.91	0.00
260	CH 3855	2.66	16.50	2.66	0.00

Sl. No	Chainage	Existing Canal width (m)	Proposed width (m)	Width greater than (16.50m)	Length (m)
261	CH 3870	2.87	16.50	2.87	0.00
262	CH 3885	3.91	16.50	3.91	0.00
263	CH 3900	2.62	16.50	2.62	0.00
264	CH 3915	2.65	16.50	2.65	0.00
265	CH 3930	2.62	16.50	2.62	0.00
266	CH 3945	2.58	16.50	2.58	0.00
267	CH 3960	2.72	16.50	2.72	0.00
268	CH 3975	2.68	16.50	2.68	0.00
269	CH 3990	2.60	16.50	2.60	0.00
270	CH 4005	2.66	16.50	2.66	0.00
271	CH 4020	2.59	16.50	2.59	0.00
272	CH 4035	2.61	16.50	2.61	0.00
273	CH 4050	2.73	16.50	2.73	0.00
274	CH 4065	2.73	16.50	2.73	0.00
275	CH 4080	2.63	16.50	2.63	0.00
276	CH 4095	2.74	16.50	2.74	0.00
277	CH 4110	2.74	16.50	2.74	0.00
278	CH 4125	2.54	16.50	2.54	0.00
279	CH 4140	0.00	16.50	0.00	0.00
280	CH 4155	0.00	16.50	0.00	0.00
281	CH 4170	0.00	16.50	0.00	0.00
282	CH 4185	0.00	16.50	0.00	0.00
283	CH 4200	0.00	16.50	0.00	0.00
284	CH 4215	0.00	16.50	0.00	0.00

Sl. No	Chainage	Existing Canal width (m)	Proposed width (m)	Width greater than (16.50m)	Length (m)
285	CH 4230	0.00	16.50	0.00	0.00
286	CH 4245	0.00	16.50	0.00	0.00
287	CH 4260	0.00	16.50	0.00	0.00
288	CH 4275	0.00	16.50	0.00	0.00
289	CH 4290	4.03	16.50	4.03	0.00
290	CH 4305	3.90	16.50	3.90	0.00
291	CH 4320	4.14	16.50	4.14	0.00
292	CH 4335	4.21	16.50	4.21	0.00
293	CH 4350	4.07	16.50	4.07	0.00
294	CH 4365	4.60	16.50	4.60	0.00
295	CH 4380	4.38	16.50	4.38	0.00
296	CH 4395	4.54	16.50	4.54	0.00
297	CH 4410	4.56	16.50	4.56	0.00
298	CH 4425	4.11	16.50	4.11	0.00
299	CH 4440	4.19	16.50	4.19	0.00
300	CH 4455	4.29	16.50	4.29	0.00
301	CH 4470	4.10	16.50	4.10	0.00
302	CH 4485	4.37	16.50	4.37	0.00
303	CH 4500	4.11	16.50	4.11	0.00
304	CH 4515	4.68	16.50	4.68	0.00
305	CH 4530	4.33	16.50	4.33	0.00
306	CH 4545	4.09	16.50	4.09	0.00
307	CH 4560	4.25	16.50	4.25	0.00
308	CH 4575	4.26	16.50	4.26	0.00

Sl. No	Chainage	Existing Canal width (m)	Proposed width (m)	Width greater than (16.50m)	Length (m)
309	CH 4590	4.27	16.50	4.27	0.00
310	CH 4605	4.59	16.50	4.59	0.00
311	CH 4620	3.54	16.50	3.54	0.00
312	CH 4635	4.62	16.50	4.62	0.00
313	CH 4650	4.41	16.50	4.41	0.00
314	CH 4665	3.75	16.50	3.75	0.00
315	CH 4680	4.08	16.50	4.08	0.00
316	CH 4695	4.39	16.50	4.39	0.00
317	CH 4710	3.61	16.50	3.61	0.00
318	CH 4725	3.11	16.50	3.11	0.00
319	CH 4740	3.88	16.50	3.88	0.00
320	CH 4755	3.46	16.50	3.46	0.00
321	CH 4770	3.30	16.50	3.30	0.00
322	CH 4785	3.27	16.50	3.27	0.00
323	CH 4800	3.34	16.50	3.34	0.00
324	CH 4815	4.24	16.50	4.24	0.00
325	CH 4830	4.28	16.50	4.28	0.00
326	CH 4845	4.25	16.50	4.25	0.00
327	CH 4860	3.97	16.50	3.97	0.00
328	CH 4875	3.48	16.50	3.48	0.00
329	CH 4890	4.37	16.50	4.37	0.00
330	CH 4905	5.17	16.50	5.17	0.00
331	CH 4920	4.66	16.50	4.66	0.00
332	CH 4935	4.36	16.50	4.36	0.00

Sl. No	Chainage	Existing Canal width (m)	Proposed width (m)	Width greater than (16.50m)	Length (m)
333	CH 4950	4.50	16.50	4.50	0.00
334	CH 4965	4.41	16.50	4.41	0.00
335	CH 4980	4.32	16.50	4.32	0.00
336	CH 4995	4.23	16.50	4.23	0.00
337	CH 5010	4.14	16.50	4.14	0.00
338	CH 5025	4.05	16.50	4.05	0.00
339	CH 5040	5.19	16.50	5.19	0.00
340	CH 5055	5.16	16.50	5.16	0.00
341	CH 5070	4.91	16.50	4.91	0.00
342	CH 5085	5.18	16.50	5.18	0.00
343	CH 5100	5.04	16.50	5.04	0.00
344	CH 5115	4.49	16.50	4.49	0.00
345	CH 5130	4.57	16.50	4.57	0.00
346	CH 5145	5.09	16.50	5.09	0.00
347	CH 5160	4.59	16.50	4.59	0.00
348	CH 5175	5.03	16.50	5.03	0.00
349	CH 5190	5.28	16.50	5.28	0.00
350	CH 5205	5.34	16.50	5.34	0.00
351	CH 5220	5.33	16.50	5.33	0.00
352	CH 5235	5.84	16.50	5.84	0.00
353	CH 5250	5.97	16.50	5.97	0.00
354	CH 5265	6.83	16.50	6.83	0.00
355	CH 5280	4.81	16.50	4.81	0.00
356	CH 5295	4.61	16.50	4.61	0.00

Sl. No	Chainage	Existing Canal width (m)	Proposed width (m)	Width greater than (16.50m)	Length (m)
357	CH 5310	5.12	16.50	5.12	0.00
358	CH 5325	4.91	16.50	4.91	0.00
359	CH 5340	5.83	16.50	5.83	0.00
360	CH 5355	6.49	16.50	6.49	0.00
361	CH 5370	7.30	16.50	7.30	0.00
362	CH 5385	5.99	16.50	5.99	0.00
363	CH 5400	5.43	16.50	5.43	0.00
364	CH 5415	6.55	16.50	6.55	0.00
365	CH 5430	5.91	16.50	5.91	0.00
366	CH 5445	4.21	16.50	4.21	0.00
367	CH 5460	3.51	16.50	3.51	0.00
368	CH 5475	6.09	16.50	6.09	0.00
369	CH 5490	6.04	16.50	6.04	0.00
370	CH 5505	6.01	16.50	6.01	0.00
371	CH 5520	5.48	16.50	5.48	0.00
372	CH 5535	5.19	16.50	5.19	0.00
373	CH 5550	5.40	16.50	5.40	0.00
374	CH 5565	5.74	16.50	5.74	0.00
375	CH 5580	6.13	16.50	6.13	0.00
376	CH 5595	5.74	16.50	5.74	0.00
377	CH 5610	6.30	16.50	6.30	0.00
378	CH 5625	6.72	16.50	6.72	0.00
379	CH 5640	6.73	16.50	6.73	0.00
380	CH 5655	6.91	16.50	6.91	0.00

Sl. No	Chainage	Existing Canal width (m)	Proposed width (m)	Width greater than (16.50m)	Length (m)
381	CH 5670	6.29	16.50	6.29	0.00
382	CH 5685	6.45	16.50	6.45	0.00
383	CH 5700	4.99	16.50	4.99	0.00
384	CH 5715	5.46	16.50	5.46	0.00
385	CH 5730	6.45	16.50	6.45	0.00
386	CH 5745	7.00	16.50	7.00	0.00
387	CH 5760	5.67	16.50	5.67	0.00
388	CH 5775	5.70	16.50	5.70	0.00
389	CH 5790	5.58	16.50	5.58	0.00
390	CH 5805	5.57	16.50	5.57	0.00
391	CH 5820	5.08	16.50	5.08	0.00
392	CH 5835	5.62	16.50	5.62	0.00
393	CH 5850	5.90	16.50	5.90	0.00
394	CH 5865	6.31	16.50	6.31	0.00
395	CH 5880	8.28	16.50	8.28	0.00
396	CH 5895	7.69	16.50	7.69	0.00
397	CH 5910	7.02	16.50	7.02	0.00
398	CH 5925	7.44	16.50	7.44	0.00
399	CH 5940	7.71	16.50	7.71	0.00
400	CH 5955	8.37	16.50	8.37	0.00
401	CH 5970	8.36	16.50	8.36	0.00
402	CH 5985	8.49	16.50	8.49	0.00
403	CH 6000	6.55	16.50	6.55	0.00
404	CH 6015	5.75	16.50	5.75	0.00

Sl. No	Chainage	Existing Canal width (m)	Proposed width (m)	Width greater than (16.50m)	Length (m)
405	CH 6030	6.96	16.50	6.96	0.00
406	CH 6045	7.52	16.50	7.52	0.00
407	CH 6060	8.46	16.50	8.46	0.00
408	CH 6075	8.51	16.50	8.51	0.00
409	CH 6090	8.98	16.50	8.98	0.00
410	CH 6105	9.35	16.50	9.35	0.00
411	CH 6120	9.71	16.50	9.71	0.00
412	CH 6135	10.16	16.50	10.16	0.00
413	CH 6150	14.25	16.50	14.25	0.00
414	CH 6165	13.33	16.50	13.33	0.00
415	CH 6180	10.57	16.50	10.57	0.00
416	CH 6195	10.30	16.50	10.30	0.00
417	CH 6210	10.24	16.50	10.24	0.00
418	CH 6225	10.45	16.50	10.45	0.00
419	CH 6240	10.66	16.50	10.66	0.00
420	CH 6255	10.86	16.50	10.86	0.00
421	CH 6270	11.07	16.50	11.07	0.00
422	CH 6285	10.62	16.50	10.62	0.00
423	CH 6300	12.03	16.50	12.03	0.00
424	CH 6315	12.16	16.50	12.16	0.00
425	CH 6330	11.93	16.50	11.93	0.00
426	CH 6345	9.92	16.50	9.92	0.00
427	CH 6360	8.37	16.50	8.37	0.00
428	CH 6375	8.14	16.50	8.14	0.00

Sl. No	Chainage	Existing Canal width (m)	Proposed width (m)	Width greater than (16.50m)	Length (m)
429	CH 6390	8.00	16.50	8.00	0.00
430	CH 6405	7.69	16.50	7.69	0.00
431	CH 6420	7.16	16.50	7.16	0.00
432	CH 6435	6.84	16.50	6.84	0.00
433	CH 6450	7.60	16.50	7.60	0.00
434	CH 6465	7.78	16.50	7.78	0.00
435	CH 6480	8.73	16.50	8.73	0.00
436	CH 6495	7.36	16.50	7.36	0.00
437	CH 6510	7.26	16.50	7.26	0.00
438	CH 6525	7.85	16.50	7.85	0.00
439	CH 6540	8.53	16.50	8.53	0.00
440	CH 6555	9.07	16.50	9.07	0.00
441	CH 6570	12.19	16.50	12.19	0.00
442	CH 6585	15.90	16.50	15.90	0.00
443	CH 6600	14.73	16.50	14.73	0.00
444	CH 6615	14.47	16.50	14.47	0.00
445	CH 6630	14.27	16.50	14.27	0.00
446	CH 6645	13.77	16.50	13.77	0.00
447	CH 6660	13.08	16.50	13.08	0.00
448	CH 6675	13.04	16.50	13.04	0.00
449	CH 6690	11.47	16.50	11.47	0.00
450	CH 6705	11.30	16.50	11.30	0.00
451	CH 6720	12.80	16.50	12.80	0.00
452	CH 6735	13.22	16.50	13.22	0.00

Sl. No	Chainage	Existing Canal width (m)	Proposed width (m)	Width greater than (16.50m)	Length (m)
453	CH 6750	13.33	16.50	13.33	0.00
454	CH 6765	14.08	16.50	14.08	0.00
455	CH 6780	15.04	16.50	15.04	0.00
456	CH 6795	15.67	16.50	15.67	0.00
457	CH 6810	14.92	16.50	14.92	0.00
458	CH 6825	13.78	16.50	13.78	0.00
459	CH 6840	13.65	16.50	13.65	0.00
460	CH 6855	12.85	16.50	12.85	0.00
461	CH 6870	13.06	16.50	13.06	0.00
462	CH 6885	13.81	16.50	13.81	0.00
463	CH 6900	14.84	16.50	14.84	0.00
464	CH 6915	14.24	16.50	14.24	0.00
465	CH 6930	14.57	16.50	14.57	0.00
466	CH 6945	14.93	16.50	14.93	0.00
467	CH 6960	14.56	16.50	14.56	0.00
468	CH 6975	13.74	16.50	13.74	0.00
469	CH 6990	15.69	16.50	15.69	0.00
470	CH 7005	19.64	16.50	19.64	11.22
471	CH 7020	15.25	16.50	15.25	3.50
472	CH 7035	16.48	16.50	16.48	0.00
473	CH 7042	16.82	16.50	16.82	7.00
474	CH 7050	15.80	16.50	15.80	2.23
475	CH 7065	15.41	16.50	15.41	0.00
476	CH 7080	14.46	16.50	14.46	0.00

Sl. No	Chainage	Existing Canal width (m)	Proposed width (m)	Width greater than (16.50m)	Length (m)
476	CH 7095	15.12	16.50	15.12	0.00
477	CH 7110	15.47	16.50	15.47	0.00
478	CH 7125	15.47	16.50	15.47	0.00
479	CH 7140	15.44	16.50	15.44	0.00
480	CH 7155	14.35	16.50	14.35	0.00
481	CH 7170	13.12	16.50	13.12	0.00
482	CH 7185	12.59	16.50	12.59	0.00
483	CH 7200	12.99	16.50	12.99	0.00
484	CH 7215	17.03	16.50	17.03	6.15
485	CH 7230	16.47	16.50	16.47	15.00
486	CH 7245	29.23	16.50	29.23	15.00
487	CH 7249	35.06	16.50	35.06	4.00
488	CH 7260	20.04	16.50	20.04	11.00
489	CH 7275	14.92	16.50	14.92	10.62
490	CH 7290	10.76	16.50	10.76	0.00
491	CH 7305	8.04	16.50	8.04	0.00
492	CH 7320	10.13	16.50	10.13	0.00
493	CH 7335	11.05	16.50	11.05	0.00
494	CH 7350	12.82	16.50	12.82	0.00
495	CH 7365	16.42	16.50	16.42	0.00
496	CH 7380	21.03	16.50	21.03	14.84
497	CH 7395	15.38	16.50	15.38	13.37
498	CH 7410	12.83	16.50	12.83	0.00
499	CH 7425	15.13	16.50	15.13	0.00

Sl. No	Chainage	Existing Canal width (m)	Proposed width (m)	Width greater than (16.50m)	Length (m)
500	CH 7440	15.96	16.50	15.96	0.00
501	CH 7455	14.42	16.50	14.42	0.00
502	CH 7470	16.38	16.50	16.38	0.00
503	CH 7485	12.81	16.50	12.81	0.00
504	CH 7500	13.29	16.50	13.29	0.00
505	CH 7515	15.39	16.50	15.39	0.00
506	CH 7530	15.22	16.50	15.22	0.00
507	CH 7545	15.93	16.50	15.93	0.00
508	CH 7560	16.36	16.50	16.36	0.00
509	CH 7575	15.78	16.50	15.78	0.00
510	CH 7590	16.27	16.50	16.27	0.00
511	CH 7605	16.71	16.50	16.71	8.33
512	CH 7620	15.95	16.50	15.95	6.69
513	CH 7635	16.88	16.50	16.88	8.50
514	CH 7650	16.32	16.50	16.32	4.10
515	CH 7665	12.88	16.50	12.88	0.00
516	CH 7680	9.14	16.50	9.14	0.00
517	CH 7695	11.37	16.50	11.37	0.00
518	CH 7710	12.83	16.50	12.83	0.00
519	CH 7725	13.31	16.50	13.31	0.00
520	CH 7740	13.12	16.50	13.12	0.00
521	CH 7755	12.86	16.50	12.86	0.00
522	CH 7770	12.41	16.50	12.41	0.00
523	CH 7785	12.14	16.50	12.14	0.00

Sl. No	Chainage	Existing Canal width (m)	Proposed width (m)	Width greater than (16.50m)	Length (m)
524	CH 7800	12.49	16.50	12.49	0.00
525	CH 7815	12.40	16.50	12.40	0.00
526	CH 7830	12.21	16.50	12.21	0.00
527	CH 7845	12.58	16.50	12.58	0.00
528	CH 7860	12.74	16.50	12.74	0.00
529	CH 7875	12.84	16.50	12.84	0.00
530	CH 7890	12.67	16.50	12.67	0.00
531	CH 7905	12.53	16.50	12.53	0.00
532	CH 7920	12.52	16.50	12.52	0.00
533	CH 7935	12.49	16.50	12.49	0.00
534	CH 7950	12.46	16.50	12.46	0.00
535	CH 7965	12.51	16.50	12.51	0.00
536	CH 7980	12.51	16.50	12.51	0.00
537	CH 7995	12.58	16.50	12.58	0.00
538	CH 8010	12.16	16.50	12.16	0.00
539	CH 8025	10.20	16.50	10.20	0.00
540	CH 8040	10.46	16.50	10.46	0.00
541	CH 8055	10.09	16.50	10.09	0.00
542	CH 8070	9.74	16.50	9.74	0.00
543	CH 8085	9.54	16.50	9.54	0.00
544	CH 8100	9.42	16.50	9.42	0.00
545	CH 8115	10.95	16.50	10.95	0.00
546	CH 8130	25.80	16.50	25.80	9.70
547	CH 8145	11.25	16.50	11.25	5.40

Sl. No	Chainage	Existing Canal width (m)	Proposed width (m)	Width greater than (16.50m)	Length (m)
548	CH 8160	7.93	16.50	7.93	0.00
549	CH 8175	7.94	16.50	7.94	0.00
550	CH 8190	7.96	16.50	7.96	0.00
551	CH 8205	8.20	16.50	8.20	0.00
552	CH 8220	8.53	16.50	8.53	0.00
553	CH 8235	8.50	16.50	8.50	0.00
554	CH 8250	8.00	16.50	8.00	0.00
555	CH 8265	8.54	16.50	8.54	0.00
556	CH 8280	7.73	16.50	7.73	0.00
557	CH 8295	8.01	16.50	8.01	0.00
558	CH 8310	10.69	16.50	10.69	0.00
559	CH 8325	11.44	16.50	11.44	0.00
560	CH 8340	11.48	16.50	11.48	0.00
561	CH 8355	11.33	16.50	11.33	0.00
562	CH 8370	11.26	16.50	11.26	0.00
563	CH 8385	11.05	16.50	11.05	0.00
564	CH 8400	9.66	16.50	9.66	0.00
565	CH 8415	9.29	16.50	9.29	0.00
566	CH 8430	8.84	16.50	8.84	0.00
567	CH 8445	7.99	16.50	7.99	0.00
568	CH 8460	9.17	16.50	9.17	0.00
569	CH 8475	9.58	16.50	9.58	0.00
570	CH 8490	9.13	16.50	9.13	0.00
571	CH 8505	9.53	16.50	9.53	0.00

Sl. No	Chainage	Existing Canal width (m)	Proposed width (m)	Width greater than (16.50m)	Length (m)
572	CH 8520	10.06	16.50	10.06	0.00
573	CH 8535	10.54	16.50	10.54	0.00
574	CH 8550	7.18	16.50	7.18	0.00
575	CH 8565	8.47	16.50	8.47	0.00
576	CH 8580	8.97	16.50	8.97	0.00
577	CH 8595	9.16	16.50	9.16	0.00
578	CH 8610	9.51	16.50	9.51	0.00
579	CH 8625	10.17	16.50	10.17	0.00
580	CH 8640	10.13	16.50	10.13	0.00
581	CH 8655	9.92	16.50	9.92	0.00
582	CH 8670	10.04	16.50	10.04	0.00
583	CH 8685	10.26	16.50	10.26	0.00
584	CH 8700	10.75	16.50	10.75	0.00
585	CH 8715	11.35	16.50	11.35	0.00
586	CH 8730	12.18	16.50	12.18	0.00
587	CH 8745	12.71	16.50	12.71	0.00
588	CH 8760	12.76	16.50	12.76	0.00
589	CH 8775	12.72	16.50	12.72	0.00
590	CH 8790	4.50	16.50	4.50	0.00
591	CH 8805	8.56	16.50	8.56	0.00
592	CH 8820	8.69	16.50	8.69	0.00
593	CH 8835	9.17	16.50	9.17	0.00
594	CH 8850	10.17	16.50	10.17	0.00
595	CH 8865	5.13	16.50	5.13	0.00

Sl. No	Chainage	Existing Canal width (m)	Proposed width (m)	Width greater than (16.50m)	Length (m)
596	CH 8880	12.37	16.50	12.37	0.00
597	CH 8895	45.10	16.50	45.10	10.50
598	CH 8910	45.17	16.50	45.17	15.00
599	CH 8925	45.53	16.50	45.53	15.00
600	CH 8940	60.71	16.50	60.71	15.00
601	CH 8955	77.31	16.50	77.31	15.00
602	CH 8970	72.30	16.50	72.30	15.00
603	CH 8985	71.34	16.50	71.34	15.00
604	CH 9000	71.53	16.50	71.53	15.00
605	CH 9015	71.72	16.50	71.72	15.00
606	CH 9030	72.09	16.50	72.09	15.00
607	CH 9045	74.21	16.50	74.21	15.00
608	CH 9060	71.14	16.50	71.14	15.00
609	CH 9075	67.64	16.50	67.64	15.00
610	CH 9090	65.64	16.50	65.64	15.00
611	CH 9105	64.77	16.50	64.77	15.00
612	CH 9120	66.26	16.50	66.26	15.00
613	CH 9135	66.40	16.50	66.40	15.00
614	CH 9150	68.36	16.50	68.36	15.00
615	CH 9165	69.43	16.50	69.43	15.00
616	CH 9180	74.76	16.50	74.76	15.00
617	CH 9195	78.80	16.50	78.80	15.00
618	CH 9210	82.32	16.50	82.32	15.00
619	CH 9225	86.12	16.50	86.12	15.00

Sl. No	Chainage	Existing Canal width (m)	Proposed width (m)	Width greater than (16.50m)	Length (m)
620	CH 9240	88.54	16.50	88.54	15.00
621	CH 9255	89.00	16.50	89.00	15.00
622	CH 9270	91.50	16.50	91.50	15.00
623	CH 9285	94.87	16.50	94.87	15.00
624	CH 9300	96.26	16.50	96.26	15.00
625	CH 9315	95.57	16.50	95.57	15.00
626	CH 9330	95.72	16.50	95.72	15.00
627	CH 9345	96.18	16.50	96.18	15.00
628	CH 9360	91.15	16.50	91.15	15.00
629	CH 9375	82.70	16.50	82.70	15.00
630	CH 9390	100.21	16.50	100.21	15.00
631	CH 9405	98.56	16.50	98.56	15.00
632	CH 9420	94.02	16.50	94.02	15.00
633	CH 9435	87.86	16.50	87.86	15.00
634	CH 9450	88.44	16.50	88.44	15.00
635	CH 9465	88.84	16.50	88.84	15.00
636	CH 9480	86.28	16.50	86.28	15.00
637	CH 9495	81.15	16.50	81.15	15.00
638	CH 9510	74.64	16.50	74.64	15.00
639	CH 9525	69.36	16.50	69.36	15.00
640	CH 9540	63.03	16.50	63.03	15.00
641	CH 9555	58.22	16.50	58.22	15.00
642	CH 9570	50.59	16.50	50.59	15.00
643	CH 9585	43.73	16.50	43.73	15.00

Sl. No	Chainage	Existing Canal width (m)	Proposed width (m)	Width greater than (16.50m)	Length (m)
644	CH 9600	38.35	16.50	38.35	15.00
645	CH 9615	50.46	16.50	50.46	15.00
646	CH 9630	70.80	16.50	70.80	15.00
647	CH 9645	89.15	16.50	89.15	15.00
648	CH 9660	91.23	16.50	91.23	15.00
649	CH 9675	95.05	16.50	95.05	15.00
650	CH 9690	100.57	16.50	100.57	15.00
651	CH 9705	107.36	16.50	107.36	15.00
652	CH 9720	114.77	16.50	114.77	15.00
653	CH 9735	122.13	16.50	122.13	15.00
654	CH 9750	124.12	16.50	124.12	15.00
655	CH 9765	122.71	16.50	122.71	15.00
656	CH 9780	121.30	16.50	121.30	15.00
657	CH 9795	121.42	16.50	121.42	15.00
658	CH 9810	120.73	16.50	120.73	15.00
659	CH 9825	127.16	16.50	127.16	15.00
660	CH 9840	131.31	16.50	131.31	15.00
661	CH 9855	134.78	16.50	134.78	15.00
662	CH 9870	137.13	16.50	137.13	15.00
663	CH 9885	140.27	16.50	140.27	15.00
664	CH 9900	144.69	16.50	144.69	15.00
665	CH 9915	149.52	16.50	149.52	15.00
666	CH 9930	158.55	16.50	158.55	15.00
667	CH 9945	169.01	16.50	169.01	15.00

Sl. No	Chainage	Existing Canal width (m)	Proposed width (m)	Width greater than (16.50m)	Length (m)
668	CH 9960	228.72	16.50	228.72	15.00
669	CH 9975	232.21	16.50	232.21	15.00
670	CH 9990	237.24	16.50	237.24	15.00
671	CH 10005	239.77	16.50	239.77	15.00
672	CH 10020	243.85	16.50	243.85	15.00
673	CH 10035	249.66	16.50	249.66	15.00
674	CH 10050	236.75	16.50	236.75	15.00
675	CH 10065	240.84	16.50	240.84	15.00
676	CH 10080	248.30	16.50	248.30	15.00
677	CH 10095	257.15	16.50	257.15	15.00
678	CH 10110	260.84	16.50	260.84	15.00
679	CH 10125	244.05	16.50	244.05	15.00
680	CH 10140	212.15	16.50	212.15	15.00
681	CH 10155	177.98	16.50	177.98	15.00
682	CH 10170	167.15	16.50	167.15	15.00
683	CH 10185	172.31	16.50	172.31	15.00
684	CH 10200	182.29	16.50	182.29	15.00
685	CH 10215	185.44	16.50	185.44	15.00
686	CH 10230	188.82	16.50	188.82	15.00
687	CH 10245	192.97	16.50	192.97	15.00
688	CH 10260	195.02	16.50	195.02	15.00
689	CH 10275	200.20	16.50	200.20	15.00
690	CH 10290	206.10	16.50	206.10	15.00
691	CH 10305	211.77	16.50	211.77	15.00

Sl. No	Chainage	Existing Canal width (m)	Proposed width (m)	Width greater than (16.50m)	Length (m)
692	CH 10320	216.45	16.50	216.45	15.00
693	CH 10335	221.62	16.50	221.62	15.00
694	CH 10350	225.13	16.50	225.13	15.00
695	CH 10365	228.14	16.50	228.14	15.00
696	CH 10380	231.07	16.50	231.07	15.00
697	CH 10395	234.81	16.50	234.81	15.00
698	CH 10410	237.68	16.50	237.68	15.00
699	CH 10425	235.84	16.50	235.84	15.00
700	CH 10440	235.68	16.50	235.68	15.00
701	CH 10455	236.43	16.50	236.43	15.00
702	CH 10470	237.65	16.50	237.65	15.00
703	CH 10485	237.71	16.50	237.71	15.00
704	CH 10500	236.10	16.50	236.10	15.00
705	CH 10515	235.40	16.50	235.40	15.00
706	CH 10530	230.58	16.50	230.58	15.00
707	CH 10545	227.72	16.50	227.72	15.00
708	CH 10560	222.68	16.50	222.68	15.00
709	CH 10575	217.27	16.50	217.27	15.00
710	CH 10590	221.94	16.50	221.94	15.00
711	CH 10605	222.15	16.50	222.15	15.00
712	CH 10620	225.19	16.50	225.19	15.00
713	CH 10635	230.51	16.50	230.51	15.00
714	CH 10650	234.98	16.50	234.98	15.00
715	CH 10665	241.02	16.50	241.02	15.00

Sl. No	Chainage	Existing Canal width (m)	Proposed width (m)	Width greater than (16.50m)	Length (m)
716	CH 10680	241.67	16.50	241.67	15.00
717	CH 10695	240.28	16.50	240.28	15.00
718	CH 10710	239.10	16.50	239.10	15.00
719	CH 10725	239.98	16.50	239.98	15.00
720	CH 10740	241.58	16.50	241.58	15.00
721	CH 10755	243.42	16.50	243.42	15.00
722	CH 10770	245.68	16.50	245.68	15.00
723	CH 10785	248.00	16.50	248.00	15.00
724	CH 10800	245.99	16.50	245.99	15.00
725	CH 10815	250.42	16.50	250.42	15.00
726	CH 10830	258.65	16.50	258.65	15.00
727	CH 10845	262.76	16.50	262.76	15.00
728	CH 10860	267.41	16.50	267.41	15.00
729	CH 10875	272.04	16.50	272.04	15.00
730	CH 10890	276.87	16.50	276.87	15.00
731	CH 10905	281.67	16.50	281.67	15.00
732	CH 10920	286.50	16.50	286.50	15.00
733	CH 10935	290.41	16.50	290.41	15.00
734	CH 10950	294.08	16.50	294.08	15.00
735	CH 10965	296.10	16.50	296.10	15.00
736	CH 10980	294.59	16.50	294.59	15.00
737	CH 10995	299.83	16.50	299.83	15.00
738	CH 11010	305.13	16.50	305.13	15.00
739	CH 11025	307.28	16.50	307.28	15.00

Sl. No	Chainage	Existing Canal width (m)	Proposed width (m)	Width greater than (16.50m)	Length (m)
740	CH 11040	306.18	16.50	306.18	15.00
741	CH 11055	305.10	16.50	305.10	15.00
742	CH 11070	298.90	16.50	298.90	15.00
743	CH 11085	290.45	16.50	290.45	15.00
744	CH 11100	285.88	16.50	285.88	15.00
745	CH 11115	284.96	16.50	284.96	15.00
746	CH 11130	283.73	16.50	283.73	15.00
747	CH 11145	35.75	16.50	35.00	15.00
748	CH 11150	32.00	16.50	32.00	5.00
					3195.92

1.3 Thevara_Perandoor Canal

Table 4: Details width of Thevara_Perandoor Canal

Sl. No	Chainage	Existing Canal width (m)	Proposed width (m)	Width greater than (16.50m)	Length (m)
1	CH 000	19.00	16.50	19.00	0.00
2	CH 15	31.59	16.50	31.59	15.00
3	CH 30	67.02	16.50	67.02	15.00
4	CH 45	67.12	16.50	67.12	15.00
5	CH 60	61.50	16.50	61.50	15.00
6	CH 75	55.19	16.50	55.19	15.00
7	CH 90	51.07	16.50	51.07	15.00
8	CH 105	49.10	16.50	49.10	15.00
9	CH 120	47.78	16.50	47.78	15.00
10	CH 135	46.86	16.50	46.86	15.00
11	CH 150	39.36	16.50	39.36	15.00
12	CH 165	37.86	16.50	37.86	15.00
13	CH 180	36.40	16.50	36.40	15.00
14	CH 195	34.35	16.50	34.35	15.00
15	CH 210	32.75	16.50	32.75	15.00
16	CH 225	38.41	16.50	38.41	15.00
17	CH 240	51.63	16.50	51.63	15.00
18	CH 255	57.78	16.50	57.78	15.00
19	CH 270	66.11	16.50	66.11	15.00
20	CH 285	78.37	16.50	78.37	15.00
21	CH 300	91.12	16.50	91.12	15.00

Sl. No	Chainage	Existing Canal width (m)	Proposed width (m)	Width greater than (16.50m)	Length (m)
22	CH 315	103.84	16.50	103.84	15.00
23	CH 330	114.48	16.50	114.48	15.00
24	CH 345	113.205	16.50	113.21	15.00
25	CH 360	107.18	16.50	107.18	15.00
26	CH 375	106.804	16.50	106.804	15.00
27	CH 390	107.914	16.50	107.914	15.00
28	CH 405	102.991	16.50	102.991	15.00
29	CH 420	95.632	16.50	95.632	15.00
30	CH 435	87.754	16.50	87.754	15.00
31	CH 450	77.742	16.50	77.742	15.00
32	CH 465	68.361	16.50	68.361	15.00
33	CH 480	64.449	16.50	64.449	15.00
34	CH 495	64.135	16.50	64.135	15.00
35	CH 510	63.759	16.50	63.759	15.00
36	CH 525	69.596	16.50	69.596	15.00
37	CH 540	75.451	16.50	75.451	15.00
38	CH 555	79.514	16.50	79.514	15.00
39	CH 570	79.675	16.50	79.675	15.00
40	CH 585	78.47	16.50	78.47	15.00
41	CH 600	78.37	16.50	78.37	15.00
42	CH 615	78.783	16.50	78.783	15.00
43	CH 630	75.836	16.50	75.836	15.00
44	CH 645	72.225	16.50	72.225	15.00
45	CH 660	68.602	16.50	68.602	15.00

Sl. No	Chainage	Existing Canal width (m)	Proposed width (m)	Width greater than (16.50m)	Length (m)
46	CH 675	65.027	16.50	65.027	15.00
47	CH 690	61.485	16.50	61.485	15.00
48	CH 705	58.793	16.50	58.793	15.00
49	CH 720	56.657	16.50	56.657	15.00
50	CH 735	54.759	16.50	54.759	15.00
51	CH 750	53.699	16.50	53.699	15.00
52	CH 765	52.698	16.50	52.698	15.00
53	CH 780	52.221	16.50	52.221	15.00
54	CH 795	51.055	16.50	51.055	15.00
55	CH 810	50.167	16.50	50.167	15.00
56	CH 825	51.564	16.50	51.564	15.00
57	CH 840	52.351	16.50	52.351	15.00
58	CH 855	53.459	16.50	53.459	15.00
59	CH 870	56.447	16.50	56.447	15.00
60	CH 885	57.091	16.50	57.091	15.00
61	CH 900	51.889	16.50	51.889	15.00
62	CH 915	47.126	16.50	47.126	15.00
63	CH 930	46.229	16.50	46.229	15.00
64	CH 945	45.923	16.50	45.923	15.00
65	CH 960	46.98	16.50	46.978	15.00
66	CH 975	49.749	16.50	49.75	15.00
67	CH 990	51.863	16.50	51.863	15.00
68	CH 1005	53.163	16.50	53.163	15.00
69	CH 1020	48.238	16.50	48.238	15.00

Sl. No	Chainage	Existing Canal width (m)	Proposed width (m)	Width greater than (16.50m)	Length (m)
70	CH 1035	41.98	16.50	41.98	15.00
71	CH 1050	36.12	16.50	36.12	15.00
72	CH 1065	30.69	16.50	30.69	15.00
73	CH 1080	30.34	16.50	30.34	15.00
74	CH 1095	31.26	16.50	31.26	15.00
75	CH 1110	33.86	16.50	33.86	15.00
76	CH 1125	31.71	16.50	31.71	15.00
77	CH 1140	30.43	16.50	30.43	15.00
78	CH 1155	33.38	16.50	33.38	15.00
80	CH 1170	45.08	16.50	45.08	10.00
79	CH 1180	57.20	16.50	57.20	5.00
81	CH 1185	54.12	16.50	54.12	15.00
82	CH 1200	50.51	16.50	50.51	15.00
83	CH 1215	47.75	16.50	47.75	15.00
84	CH 1230	46.43	16.50	46.43	15.00
85	CH 1245	51.48	16.50	51.48	15.00
86	CH 1260	57.36	16.50	57.36	15.00
87	CH 1275	52.55	16.50	52.55	15.00
88	CH 1290	48.09	16.50	48.09	15.00
89	CH 1305	48.34	16.50	48.34	15.00
90	CH 1320	46.064	16.50	46.06	15.00
91	CH 1335	41.91	16.50	41.91	15.00
92	CH 1350	36.72	16.50	36.72	15.00
93	CH 1365	34.40	16.50	34.40	15.00

Sl. No	Chainage	Existing Canal width (m)	Proposed width (m)	Width greater than (16.50m)	Length (m)
94	CH 1380	34.41	16.50	34.41	15.00
95	CH 1395	36.17	16.50	36.17	15.00
96	CH 1410	38.53	16.50	38.53	15.00
97	CH 1425	41.56	16.50	41.56	15.00
98	CH 1440	45.98	16.50	45.98	15.00
99	CH 1455	48.02	16.50	48.02	15.00
100	CH 1470	47.00	16.50	47.00	15.00
101	CH 1485	45.51	16.50	45.51	15.00
102	CH 1500	47.73	16.50	47.73	15.00
103	CH 1515	43.38	16.50	43.38	15.00
104	CH 1530	40.84	16.50	40.84	15.00
105	CH 1545	36.63	16.50	36.63	15.00
106	CH 1560	37.17	16.50	37.17	15.00
107	CH 1575	35.90	16.50	35.90	15.00
108	CH 1590	39.04	16.50	39.04	15.00
109	CH 1605	45.71	16.50	45.71	15.00
110	CH 1620	52.19	16.50	52.19	15.00
111	CH 1635	56.90	16.50	56.90	15.00
112	CH 1650	59.14	16.50	59.14	15.00
113	CH 1665	62.42	16.50	62.42	15.00
114	CH 1680	64.84	16.50	64.84	15.00
115	CH 1695	71.07	16.50	71.07	15.00
116	CH 1710	50.60	16.50	50.60	15.00
117	CH 1725	40.32	16.50	40.32	15.00

Sl. No	Chainage	Existing Canal width (m)	Proposed width (m)	Width greater than (16.50m)	Length (m)
118	CH 1740	33.58	16.50	33.58	15.00
119	CH 1755	38.98	16.50	38.98	15.00
120	CH 1770	42.86	16.50	42.86	15.00
121	CH 1785	38.70	16.50	38.70	15.00
122	CH 1800	36.88	16.50	36.88	15.00
123	CH 1815	35.14	16.50	35.14	15.00
125	CH 1830	34.34	16.50	34.34	15.00
126	CH 1845	32.18	16.50	32.18	15.00
127	CH 1860	31.14	16.50	31.14	15.00
128	CH 1875	32.35	16.50	32.35	15.00
129	CH 1890	35.08	16.50	35.08	15.00
130	CH 1905	36.70	16.50	36.70	15.00
131	CH 1920	29.94	16.50	29.94	15.00
132	CH 1935	30.83	16.50	30.83	15.00
133	CH 1950	31.88	16.50	31.88	15.00
134	CH 1965	29.55	16.50	29.55	15.00
135	CH 1980	27.17	16.50	27.17	15.00
136	CH 1995	26.65	16.50	26.65	15.00
137	CH 2010	27.60	16.50	27.60	15.00
138	CH 2025	28.64	16.50	28.64	15.00
139	CH 2040	32.65	16.50	32.65	15.00
140	CH 2055	33.04	16.50	33.04	15.00
141	CH 2070	36.34	16.50	36.34	15.00
142	CH 2085	18.23	16.50	18.23	15.00

Sl. No	Chainage	Existing Canal width (m)	Proposed width (m)	Width greater than (16.50m)	Length (m)
143	CH 2100	17.19	16.50	17.19	7.50
144	CH 2115	15.22	16.50	15.22	0.00
145	CH 2130	12.95	16.50	12.95	0.00
146	CH 2145	15.72	16.50	15.72	0.00
147	CH 2160	17.71	16.50	17.71	7.50
148	CH 2175	18.37	16.50	18.37	15.00
149	CH 2190	17.10	16.50	17.10	15.00
150	CH 2205	19.26	16.50	19.26	15.00
151	CH 2220	21.48	16.50	21.48	15.00
152	CH 2235	22.85	16.50	22.85	15.00
153	CH 2250	19.96	16.50	19.96	15.00
154	CH 2265	19.56	16.50	19.56	15.00
155	CH 2280	19.47	16.50	19.47	15.00
156	CH 2295	19.68	16.50	19.68	15.00
157	CH 2310	20.45	16.50	20.45	15.00
158	CH 2325	21.23	16.50	21.23	15.00
160	CH 2340	20.23	16.50	20.23	15.00
161	CH 2355	19.53	16.50	19.53	15.00
164	CH 2370	19.63	16.50	19.63	15.00
165	CH 2385	19.01	16.50	19.01	15.00
166	CH 2400	19.54	16.50	19.54	15.00
167	CH 2415	21.74	16.50	21.74	15.00
168	CH 2430	20.59	16.50	20.59	15.00
169	CH 2445	22.64	16.50	22.64	15.00

Sl. No	Chainage	Existing Canal width (m)	Proposed width (m)	Width greater than (16.50m)	Length (m)
170	CH 2452.5	25.43	16.50	25.43	7.50
171	CH 2460	24.07	16.50	24.07	7.50
172	CH 2475	24.82	16.50	24.82	15.00
173	CH 2490	24.52	16.50	24.52	15.00
174	CH 2505	25.62	16.50	25.62	15.00
175	CH 2520	29.18	16.50	29.18	15.00
176	CH 2535	18.00	16.50	18.00	15.00
177	CH 2550	22.52	16.50	22.52	15.00
178	CH 2565	44.12	16.50	44.12	15.00
179	CH 2580	29.95	16.50	29.95	15.00
180	CH 2595	20.81	16.50	20.81	15.00
181	CH 2610	20.20	16.50	20.20	7.50
182	CH 2625	15.20	16.50	15.20	0.00
183	CH 2640	13.35	16.50	13.35	0.00
184	CH 2655	15.55	16.50	15.55	0.00
185	CH 2670	12.67	16.50	12.67	0.00
186	CH 2685	12.47	16.50	12.47	0.00
187	CH 2700	14.49	16.50	14.49	7.50
188	CH 2715	18.80	16.50	18.80	15.00
189	CH 2730	18.15	16.50	18.15	15.00
190	CH 2737.5	22.62	16.50	22.62	7.50
191	CH 2745	16.02	16.50	16.02	0.00
192	CH 2760	11.84	16.50	11.84	0.00
193	CH 2775	10.86	16.50	10.86	0.00

Sl. No	Chainage	Existing Canal width (m)	Proposed width (m)	Width greater than (16.50m)	Length (m)
194	CH 2790	10.69	16.50	10.69	0.00
195	CH 2805	10.36	16.50	10.36	0.00
196	CH 2820	10.94	16.50	10.94	0.00
197	CH 2827.5	19.30	16.50	19.30	7.50
198	CH 2835	14.05	16.50	14.05	7.50
199	CH 2850	14.03	16.50	14.03	0.00
200	CH 2865	20.98	16.50	20.98	7.50
201	CH 2880	16.32	16.50	16.32	7.50
202	CH 2895	12.18	16.50	12.18	0.00
203	CH 2910	13.30	16.50	13.30	0.00
204	CH 2925	11.50	16.50	11.50	0.00
205	CH 2940	10.94	16.50	10.94	0.00
206	CH 2955	10.57	16.50	10.57	0.00
207	CH 2970	7.47	16.50	7.47	0.00
208	CH 2985	8.56	16.50	8.56	0.00
209	CH 3000	12.14	16.50	12.14	0.00
210	CH 3015	11.55	16.50	11.55	0.00
211	CH 3030	11.79	16.50	11.79	0.00
212	CH 3045	12.39	16.50	12.39	0.00
213	CH 3060	13.43	16.50	13.43	0.00
214	CH 3075	16.14	16.50	16.14	0.00
215	CH 3090	14.95	16.50	14.95	7.50
216	CH 3105	18.06	16.50	18.06	7.50
217	CH 3120	15.19	16.50	15.19	0.00

Sl. No	Chainage	Existing Canal width (m)	Proposed width (m)	Width greater than (16.50m)	Length (m)
218	CH 3135	9.00	16.50	9.00	0.00
219	CH 3150	9.18	16.50	9.18	0.00
220	CH 3165	7.64	16.50	7.64	0.00
221	CH 3180	11.15	16.50	11.15	0.00
222	CH 3195	8.97	16.50	8.97	0.00
223	CH 3210	8.83	16.50	8.83	0.00
224	CH 3225	9.14	16.50	9.14	0.00
225	CH 3240	8.14	16.50	8.14	0.00
226	CH 3255	7.61	16.50	7.61	0.00
227	CH 3270	8.00	16.50	8.00	0.00
228	CH 3285	8.02	16.50	8.02	0.00
229	CH 3300	7.65	16.50	7.65	0.00
230	CH 3315	6.40	16.50	6.40	0.00
231	CH 3330	9.79	16.50	9.79	0.00
232	CH 3345	6.88	16.50	6.88	0.00
233	CH 3360	6.78	16.50	6.78	0.00
234	CH 3375	6.72	16.50	6.72	0.00
235	CH 3390	6.56	16.50	6.56	0.00
236	CH 3405	6.11	16.50	6.11	0.00
237	CH 3420	5.10	16.50	5.10	0.00
238	CH 3435	5.13	16.50	5.13	0.00
239	CH 3450	5.60	16.50	5.60	0.00
240	CH 3465	7.24	16.50	7.24	0.00
241	CH 3480	8.95	16.50	8.95	0.00

Sl. No	Chainage	Existing Canal width (m)	Proposed width (m)	Width greater than (16.50m)	Length (m)
242	CH 3495	6.21	16.50	6.21	0.00
243	CH 3510	6.48	16.50	6.48	0.00
244	CH 3525	7.14	16.50	7.14	0.00
245	CH 3540	7.92	16.50	7.92	0.00
246	CH 3555	9.57	16.50	9.57	0.00
247	CH 3570	10.12	16.50	10.12	0.00
248	CH 3585	9.75	16.50	9.75	0.00
249	CH 3600	9.33	16.50	9.33	0.00
250	CH 3615	9.18	16.50	9.18	0.00
251	CH 3630	8.45	16.50	8.45	0.00
252	CH 3645	7.65	16.50	7.65	0.00
253	CH 3660	6.66	16.50	6.66	0.00
254	CH 3675	7.02	16.50	7.02	0.00
255	CH 3690	7.82	16.50	7.82	0.00
256	CH 3705	8.35	16.50	8.35	0.00
257	CH 3720	6.16	16.50	6.16	0.00
258	CH 3735	6.30	16.50	6.30	0.00
259	CH 3750	6.81	16.50	6.81	0.00
260	CH 3765	7.19	16.50	7.19	0.00
261	CH 3780	8.19	16.50	8.19	0.00
262	CH 3795	8.30	16.50	8.30	0.00
263	CH 3810	8.23	16.50	8.23	0.00
264	CH 3825	6.40	16.50	6.40	0.00
265	CH 3840	5.96	16.50	5.96	0.00

Sl. No	Chainage	Existing Canal width (m)	Proposed width (m)	Width greater than (16.50m)	Length (m)
266	CH 3855	6.27	16.50	6.27	0.00
267	CH 3870	6.25	16.50	6.25	0.00
268	CH 3885	6.64	16.50	6.64	0.00
269	CH 3900	7.00	16.50	7.00	0.00
270	CH 3915	6.13	16.50	6.13	0.00
271	CH 3930	5.71	16.50	5.71	0.00
272	CH 3945	4.93	16.50	4.93	0.00
273	CH 3960	5.03	16.50	5.03	0.00
274	CH 3975	4.63	16.50	4.63	0.00
275	CH 3990	4.79	16.50	4.79	0.00
276	CH 4005	5.07	16.50	5.07	0.00
277	CH 4020	5.82	16.50	5.82	0.00
278	CH 4035	6.83	16.50	6.83	0.00
279	CH 4050	6.07	16.50	6.07	0.00
280	CH 4065	5.71	16.50	5.71	0.00
281	CH 4080	5.58	16.50	5.58	0.00
282	CH 4095	5.35	16.50	5.35	0.00
283	CH 4110	6.50	16.50	6.50	0.00
284	CH 4125	6.76	16.50	6.76	0.00
285	CH 4140	6.73	16.50	6.73	0.00
286	CH 4155	5.72	16.50	5.72	0.00
287	CH 4170	5.82	16.50	5.82	0.00
288	CH 4185	6.97	16.50	6.97	0.00
289	CH 4200	7.04	16.50	7.04	0.00

Sl. No	Chainage	Existing Canal width (m)	Proposed width (m)	Width greater than (16.50m)	Length (m)
290	CH 4215	6.71	16.50	6.71	0.00
291	CH 4230	6.95	16.50	6.95	0.00
292	CH 4245	6.41	16.50	6.41	0.00
293	CH 4260	6.45	16.50	6.45	0.00
294	CH 4275	7.08	16.50	7.08	0.00
295	CH 4290	5.77	16.50	5.77	0.00
296	CH 4305	6.13	16.50	6.13	0.00
297	CH 4320	7.84	16.50	7.84	0.00
298	CH 4335	7.54	16.50	7.54	0.00
299	CH 4350	6.43	16.50	6.43	0.00
300	CH 4365	5.86	16.50	5.86	0.00
301	CH 4380	6.28	16.50	6.28	0.00
302	CH 4395	7.61	16.50	7.61	0.00
303	CH 4410	8.44	16.50	8.44	0.00
304	CH 4425	9.11	16.50	9.11	0.00
305	CH 4440	9.52	16.50	9.52	0.00
306	CH 4455	9.01	16.50	9.01	0.00
307	CH 4470	8.67	16.50	8.67	0.00
308	CH 4485	8.56	16.50	8.56	0.00
309	CH 4500	9.01	16.50	9.01	0.00
310	CH 4515	8.84	16.50	8.84	0.00
311	CH 4530	8.66	16.50	8.66	0.00
312	CH 4545	9.01	16.50	9.01	0.00
313	CH 4560	8.79	16.50	8.79	0.00

Sl. No	Chainage	Existing Canal width (m)	Proposed width (m)	Width greater than (16.50m)	Length (m)
314	CH 4575	8.57	16.50	8.57	0.00
315	CH 4590	8.15	16.50	8.15	0.00
316	CH 4605	7.93	16.50	7.93	0.00
317	CH 4620	7.90	16.50	7.90	0.00
318	CH 4635	8.24	16.50	8.24	0.00
319	CH 4650	7.19	16.50	7.19	0.00
320	CH 4665	6.42	16.50	6.42	0.00
321	CH 4680	7.67	16.50	7.67	0.00
322	CH 4695	7.55	16.50	7.55	0.00
323	CH 4710	7.26	16.50	7.26	0.00
324	CH 4725	7.00	16.50	7.00	0.00
325	CH 4740	7.28	16.50	7.28	0.00
326	CH 4755	7.87	16.50	7.87	0.00
327	CH 4770	7.43	16.50	7.43	0.00
328	CH 4785	7.16	16.50	7.16	0.00
329	CH 4800	6.88	16.50	6.88	0.00
330	CH 4815	6.20	16.50	6.20	0.00
331	CH 4830	6.42	16.50	6.42	0.00
332	CH 4845	7.14	16.50	7.14	0.00
333	CH 4860	6.23	16.50	6.23	0.00
334	CH 4875	6.50	16.50	6.50	0.00
335	CH 4890	7.02	16.50	7.02	0.00
336	CH 4905	7.24	16.50	7.24	0.00
337	CH 4920	7.40	16.50	7.40	0.00

Sl. No	Chainage	Existing Canal width (m)	Proposed width (m)	Width greater than (16.50m)	Length (m)
338	CH 4935	6.95	16.50	6.95	0.00
339	CH 4950	6.43	16.50	6.43	0.00
340	CH 4965	6.65	16.50	6.65	0.00
341	CH 4980	8.12	16.50	8.12	0.00
342	CH 4995	7.93	16.50	7.93	0.00
343	CH 5010	8.24	16.50	8.24	0.00
344	CH 5025	8.48	16.50	8.48	0.00
345	CH 5040	8.77	16.50	8.77	0.00
346	CH 5055	8.81	16.50	8.81	0.00
347	CH 5070	9.03	16.50	9.03	0.00
348	CH 5085	9.15	16.50	9.15	0.00
349	CH 5100	9.30	16.50	9.30	0.00
350	CH 5115	9.44	16.50	9.44	0.00
351	CH 5130	9.38	16.50	9.38	0.00
352	CH 5145	9.27	16.50	9.27	0.00
353	CH 5160	9.16	16.50	9.16	0.00
354	CH 5175	9.21	16.50	9.21	0.00
355	CH 5190	9.42	16.50	9.42	0.00
356	CH 5205	9.57	16.50	9.57	0.00
357	CH 5220	9.64	16.50	9.64	0.00
358	CH 5235	6.56	16.50	6.56	0.00
359	CH 5250	6.86	16.50	6.86	0.00
360	CH 5265	7.42	16.50	7.42	0.00
361	CH 5280	6.94	16.50	6.94	0.00

Sl. No	Chainage	Existing Canal width (m)	Proposed width (m)	Width greater than (16.50m)	Length (m)
362	CH 5295	7.00	16.50	7.00	0.00
363	CH 5310	7.60	16.50	7.60	0.00
364	CH 5313	11.39	16.50	11.39	0.00
365	CH 5325	4.64	16.50	4.64	0.00
366	CH 5340	0.00	16.50	0.00	0.00
367	CH 5355	0.00	16.50	0.00	0.00
368	CH 5370	0.00	16.50	0.00	0.00
369	CH 5385	1.90	16.50	1.90	0.00
370	CH 5400	7.18	16.50	7.18	0.00
371	CH 5415	8.23	16.50	8.23	0.00
372	CH 5430	8.26	16.50	8.26	0.00
373	CH 5445	8.43	16.50	8.43	0.00
374	CH 5460	7.93	16.50	7.93	0.00
375	CH 5475	6.74	16.50	6.74	0.00
376	CH 5490	4.89	16.50	4.89	0.00
377	CH 5505	6.06	16.50	6.06	0.00
378	CH 5520	7.18	16.50	7.18	0.00
379	CH 5535	7.38	16.50	7.38	0.00
380	CH 5550	7.39	16.50	7.39	0.00
381	CH 5565	7.23	16.50	7.23	0.00
382	CH 5580	9.18	16.50	9.18	0.00
383	CH 5586	11.65	16.50	11.65	0.00
384	CH 5595	9.35	16.50	9.35	0.00
385	CH 5610	5.89	16.50	5.89	0.00

Sl. No	Chainage	Existing Canal width (m)	Proposed width (m)	Width greater than (16.50m)	Length (m)
386	CH 5625	6.04	16.50	6.04	0.00
387	CH 5640	6.24	16.50	6.24	0.00
388	CH 5655	6.37	16.50	6.37	0.00
389	CH 5670	6.20	16.50	6.20	0.00
390	CH 5685	6.03	16.50	6.03	0.00
391	CH 5700	6.21	16.50	6.21	0.00
392	CH 5715	6.47	16.50	6.47	0.00
393	CH 5730	6.79	16.50	6.79	0.00
394	CH 5745	6.08	16.50	6.08	0.00
395	CH 5752	5.72	16.50	5.72	0.00
396	CH 5760	3.91	16.50	3.91	0.00
397	CH 5775	11.71	16.50	11.71	0.00
398	CH 5790	11.29	16.50	11.29	0.00
399	CH 5805	15.84	16.50	15.84	0.00
400	CH 5820	8.74	16.50	8.74	0.00
401	CH 5835	8.33	16.50	8.33	0.00
402	CH 5850	8.11	16.50	8.11	0.00
403	CH 5865	8.28	16.50	8.28	0.00
404	CH 5880	9.80	16.50	9.80	0.00
405	CH 5895	9.62	16.50	9.62	0.00
406	CH 5910	9.53	16.50	9.53	0.00
407	CH 5925	9.92	16.50	9.92	0.00
408	CH 5940	10.79	16.50	10.79	0.00
409	CH 5955	12.15	16.50	12.15	0.00

Sl. No	Chainage	Existing Canal width (m)	Proposed width (m)	Width greater than (16.50m)	Length (m)
410	CH 5970	14.80	16.50	14.80	0.00
411	CH 5985	16.40	16.50	16.40	0.00
412	CH 6000	14.01	16.50	14.01	0.00
413	CH 6015	14.26	16.50	14.26	0.00
414	CH 6030	14.08	16.50	14.08	0.00
415	CH 6045	13.95	16.50	13.95	0.00
416	CH 6060	13.38	16.50	13.38	0.00
417	CH 6075	13.12	16.50	13.12	0.00
418	CH 6090	14.02	16.50	14.02	0.00
419	CH 6105	13.74	16.50	13.74	0.00
420	CH 6120	12.19	16.50	12.19	0.00
421	CH 6135	12.15	16.50	12.15	0.00
422	CH 6150	15.11	16.50	15.11	0.00
423	CH 6165	14.79	16.50	14.79	0.00
424	CH 6180	13.58	16.50	13.58	0.00
425	CH 6195	11.43	16.50	11.43	0.00
426	CH 6210	11.62	16.50	11.62	0.00
427	CH 6225	12.70	16.50	12.70	0.00
428	CH 6240	13.54	16.50	13.54	0.00
429	CH 6255	11.30	16.50	11.30	0.00
430	CH 6270	11.25	16.50	11.25	0.00
431	CH 6285	12.10	16.50	12.10	0.00
432	CH 6300	13.27	16.50	13.27	0.00
433	CH 6315	15.28	16.50	15.28	0.00

Sl. No	Chainage	Existing Canal width (m)	Proposed width (m)	Width greater than (16.50m)	Length (m)
434	CH 6330	16.27	16.50	16.27	0.00
435	CH 6345	17.26	16.50	17.26	15.00
436	CH 6360	17.68	16.50	17.68	15.00
437	CH 6375	17.27	16.50	17.27	15.00
438	CH 6390	16.77	16.50	16.77	15.00
439	CH 6405	16.27	16.50	16.27	7.50
440	CH 6420	15.77	16.50	15.77	0.00
441	CH 6435	15.27	16.50	15.27	0.00
442	CH 6450	14.77	16.50	14.77	0.00
443	CH 6465	14.27	16.50	14.27	0.00
444	CH 6480	13.78	16.50	13.78	0.00
445	CH 6495	13.06	16.50	13.06	0.00
446	CH 6510	12.25	16.50	12.25	0.00
447	CH 6525	8.95	16.50	8.95	0.00
448	CH 6540	7.28	16.50	7.28	0.00
449	CH 6555	11.02	16.50	11.02	0.00
450	CH 6570	13.45	16.50	13.45	0.00
451	CH 6585	13.84	16.50	13.84	0.00
452	CH 6600	10.29	16.50	10.29	0.00
453	CH 6615	9.03	16.50	9.03	0.00
454	CH 6630	11.88	16.50	11.88	0.00
455	CH 6645	12.17	16.50	12.17	0.00
456	CH 6660	12.94	16.50	12.94	0.00
457	CH 6675	10.93	16.50	10.93	0.00

Sl. No	Chainage	Existing Canal width (m)	Proposed width (m)	Width greater than (16.50m)	Length (m)
458	CH 6690	11.50	16.50	11.50	0.00
459	CH 6705	11.68	16.50	11.68	0.00
460	CH 6720	13.89	16.50	13.89	0.00
461	CH 6735	15.35	16.50	15.35	7.50
462	CH 6750	17.14	16.50	17.14	7.50
463	CH 6765	15.85	16.50	15.85	0.00
464	CH 6780	16.49	16.50	16.49	0.00
465	CH 6795	16.39	16.50	16.39	0.00
466	CH 6810	16.12	16.50	16.12	0.00
467	CH 6825	15.77	16.50	15.77	0.00
468	CH 6840	14.47	16.50	14.47	0.00
469	CH 6855	12.07	16.50	12.07	0.00
470	CH 6870	12.03	16.50	12.03	0.00
471	CH 6885	13.35	16.50	13.35	0.00
472	CH 6900	16.21	16.50	16.21	0.00
473	CH 6915	16.70	16.50	16.70	7.50
474	CH 6930	17.97	16.50	17.97	15.00
475	CH 6945	16.71	16.50	16.71	15.00
476	CH 6960	16.31	16.50	16.31	7.50
477	CH 6975	16.08	16.50	16.08	0.00
478	CH 6990	15.34	16.50	15.34	0.00
479	CH 7005	15.19	16.50	15.19	0.00
480	CH 7020	15.90	16.50	15.90	0.00
481	CH 7035	15.86	16.50	15.86	0.00

Sl. No	Chainage	Existing Canal width (m)	Proposed width (m)	Width greater than (16.50m)	Length (m)
482	CH 7050	15.06	16.50	15.06	0.00
483	CH 7065	14.64	16.50	14.64	0.00
484	CH 7080	14.20	16.50	14.20	0.00
485	CH 7095	13.75	16.50	13.75	0.00
486	CH 7110	13.31	16.50	13.31	0.00
487	CH 7125	13.07	16.50	13.07	0.00
488	CH 7140	14.07	16.50	14.07	0.00
489	CH 7155	14.74	16.50	14.74	0.00
490	CH 7170	12.25	16.50	12.25	0.00
491	CH 7185	12.41	16.50	12.41	0.00
492	CH 7200	14.17	16.50	14.17	0.00
493	CH 7215	13.27	16.50	13.27	0.00
494	CH 7230	12.64	16.50	12.64	0.00
495	CH 7245	11.90	16.50	11.90	0.00
496	CH 7260	14.26	16.50	14.26	0.00
497	CH 7275	14.77	16.50	14.77	0.00
498	CH 7290	14.57	16.50	14.57	0.00
499	CH 7305	13.95	16.50	13.95	0.00
500	CH 7320	14.28	16.50	14.28	0.00
501	CH 7335	15.15	16.50	15.15	0.00
502	CH 7350	14.80	16.50	14.80	0.00
503	CH 7365	13.95	16.50	13.95	0.00
504	CH 7380	12.76	16.50	12.76	0.00
505	CH 7395	12.28	16.50	12.28	0.00

Sl. No	Chainage	Existing Canal width (m)	Proposed width (m)	Width greater than (16.50m)	Length (m)
506	CH 7410	13.09	16.50	13.09	0.00
507	CH 7425	14.30	16.50	14.30	0.00
508	CH 7440	15.51	16.50	15.51	0.00
509	CH 7455	16.78	16.50	16.78	7.50
510	CH 7470	16.82	16.50	16.82	15.00
511	CH 7485	16.49	16.50	16.49	15.00
512	CH 7500	16.13	16.50	16.13	0.00
513	CH 7515	15.79	16.50	15.79	0.00
514	CH 7530	15.42	16.50	15.42	0.00
515	CH 7545	14.04	16.50	14.04	0.00
516	CH 7560	12.72	16.50	12.72	0.00
517	CH 7575	11.49	16.50	11.49	0.00
518	CH 7590	11.49	16.50	11.49	0.00
519	CH 7605	12.91	16.50	12.91	0.00
520	CH 7620	12.96	16.50	12.96	0.00
521	CH 7635	13.00	16.50	13.00	0.00
522	CH 7650	13.01	16.50	13.01	0.00
523	CH 7665	12.81	16.50	12.81	0.00
524	CH 7680	12.82	16.50	12.82	0.00
525	CH 7695	13.48	16.50	13.48	0.00
526	CH 7710	15.59	16.50	15.59	0.00
527	CH 7725	16.15	16.50	16.15	0.00
528	CH 7740	14.37	16.50	14.37	0.00
529	CH 7755	16.70	16.50	16.70	7.50

Sl. No	Chainage	Existing Canal width (m)	Proposed width (m)	Width greater than (16.50m)	Length (m)
530	CH 7770	16.79	16.50	16.79	15.00
531	CH 7785	16.83	16.50	16.83	15.00
532	CH 7800	16.90	16.50	16.90	15.00
533	CH 7815	17.08	16.50	17.08	15.00
534	CH 7830	17.02	16.50	17.02	15.00
535	CH 7845	15.11	16.50	15.11	7.50
536	CH 7860	16.40	16.50	16.40	0.00
537	CH 7875	16.57	16.50	16.57	7.50
538	CH 7890	16.33	16.50	16.33	7.50
539	CH 7905	15.73	16.50	15.73	0.00
540	CH 7920	15.27	16.50	15.27	0.00
541	CH 7935	14.87	16.50	14.87	0.00
542	CH 7950	14.80	16.50	14.80	0.00
543	CH 7965	14.53	16.50	14.53	0.00
544	CH 7980	14.53	16.50	14.53	0.00
545	CH 7995	14.34	16.50	14.34	0.00
546	CH 8010	14.34	16.50	14.34	0.00
547	CH 8025	14.34	16.50	14.34	0.00
548	CH 8040	12.93	16.50	12.93	0.00
549	CH 8055	13.65	16.50	13.65	0.00
550	CH 8070	13.60	16.50	13.60	0.00
551	CH 8085	14.48	16.50	14.48	0.00
552	CH 8100	14.24	16.50	14.24	0.00
553	CH 8115	13.68	16.50	13.68	0.00

Sl. No	Chainage	Existing Canal width (m)	Proposed width (m)	Width greater than (16.50m)	Length (m)
554	CH 8130	16.41	16.50	16.41	0.00
555	CH 8145	15.50	16.50	15.50	0.00
556	CH 8160	15.73	16.50	15.73	0.00
557	CH 8175	16.34	16.50	16.34	0.00
558	CH 8190	17.31	16.50	17.31	7.50
559	CH 8205	17.07	16.50	17.07	15.00
560	CH 8220	17.13	16.50	17.13	15.00
561	CH 8235	17.35	16.50	17.35	15.00
562	CH 8250	17.40	16.50	17.40	15.00
563	CH 8265	17.95	16.50	17.95	15.00
564	CH 8280	17.19	16.50	17.19	15.00
565	CH 8295	16.07	16.50	16.07	7.50
566	CH 8310	15.59	16.50	15.59	0.00
567	CH 8325	15.58	16.50	15.58	0.00
568	CH 8340	15.19	16.50	15.19	0.00
569	CH 8355	15.11	16.50	15.11	0.00
570	CH 8370	12.17	16.50	12.17	0.00
571	CH 8385	13.54	16.50	13.54	0.00
572	CH 8400	14.68	16.50	14.68	0.00
573	CH 8415	14.14	16.50	14.14	0.00
574	CH 8430	14.43	16.50	14.43	0.00
575	CH 8445	15.11	16.50	15.11	0.00
576	CH 8460	14.60	16.50	14.60	0.00
577	CH 8475	14.19	16.50	14.19	0.00

Sl. No	Chainage	Existing Canal width (m)	Proposed width (m)	Width greater than (16.50m)	Length (m)
578	CH 8490	13.70	16.50	13.70	0.00
579	CH 8505	13.64	16.50	13.64	0.00
580	CH 8520	13.54	16.50	13.54	0.00
581	CH 8535	13.27	16.50	13.27	0.00
582	CH 8550	13.29	16.50	13.29	0.00
583	CH 8565	13.32	16.50	13.32	0.00
584	CH 8580	13.59	16.50	13.59	0.00
585	CH 8595	13.79	16.50	13.79	0.00
586	CH 8610	13.77	16.50	13.77	0.00
587	CH 8625	13.07	16.50	13.07	0.00
588	CH 8640	13.13	16.50	13.13	0.00
589	CH 8655	13.25	16.50	13.25	0.00
590	CH 8670	13.30	16.50	13.30	0.00
591	CH 8685	13.31	16.50	13.31	0.00
592	CH 8700	13.73	16.50	13.73	0.00
593	CH 8715	16.24	16.50	16.24	0.00
594	CH 8730	16.51	16.50	16.51	7.50
595	CH 8745	15.59	16.50	15.59	7.50
596	CH 8760	15.52	16.50	15.52	0.00
597	CH 8775	15.95	16.50	15.95	0.00
598	CH 8790	16.36	16.50	16.36	0.00
599	CH 8805	15.51	16.50	15.51	0.00
600	CH 8820	15.51	16.50	15.51	0.00
601	CH 8835	15.70	16.50	15.70	0.00

Sl. No	Chainage	Existing Canal width (m)	Proposed width (m)	Width greater than (16.50m)	Length (m)
602	CH 8850	15.40	16.50	15.40	0.00
603	CH 8865	17.53	16.50	17.53	7.50
604	CH 8880	16.38	16.50	16.38	7.50
605	CH 8895	15.05	16.50	15.05	0.00
606	CH 8910	14.84	16.50	14.84	0.00
607	CH 8925	15.65	16.50	15.65	0.00
608	CH 8940	16.46	16.50	16.46	7.50
609	CH 8955	17.36	16.50	17.36	15.00
610	CH 8970	17.96	16.50	17.96	15.00
611	CH 8985	18.23	16.50	18.23	15.00
612	CH 9000	18.12	16.50	18.12	15.00
613	CH 9015	17.83	16.50	17.83	15.00
614	CH 9030	17.24	16.50	17.24	15.00
615	CH 9045	22.49	16.50	22.49	15.00
616	CH 9060	21.63	16.50	21.63	15.00
617	CH 9075	22.90	16.50	22.90	15.00
618	CH 9090	21.49	16.50	21.49	15.00
619	CH 9105	17.19	16.50	17.19	15.00
620	CH 9120	17.28	16.50	17.28	15.00
621	CH 9135	17.35	16.50	17.35	15.00
622	CH 9150	17.51	16.50	17.51	15.00
623	CH 9165	18.11	16.50	18.11	15.00
624	CH 9180	18.75	16.50	18.75	15.00
625	CH 9195	18.98	16.50	18.98	15.00

Sl. No	Chainage	Existing Canal width (m)	Proposed width (m)	Width greater than (16.50m)	Length (m)
626	CH 9210	19.15	16.50	19.15	15.00
627	CH 9225	19.06	16.50	19.06	15.00
628	CH 9240	19.00	16.50	19.00	15.00
629	CH 9255	17.80	16.50	17.80	15.00
630	CH 9270	16.16	16.50	16.16	7.50
631	CH 9285	14.85	16.50	14.85	0.00
632	CH 9300	14.49	16.50	14.49	0.00
633	CH 9315	14.57	16.50	14.57	0.00
634	CH 9330	14.79	16.50	14.79	0.00
635	CH 9345	15.11	16.50	15.11	0.00
636	CH 9360	14.72	16.50	14.72	0.00
637	CH 9375	14.45	16.50	14.45	0.00
638	CH 9390	14.20	16.50	14.20	0.00
639	CH 9405	14.05	16.50	14.05	0.00
640	CH 9420	14.28	16.50	14.28	0.00
641	CH 9435	14.54	16.50	14.54	0.00
642	CH 9450	14.72	16.50	14.72	0.00
643	CH 9465	15.13	16.50	15.13	0.00
644	CH 9480	15.73	16.50	15.73	0.00
645	CH 9495	15.84	16.50	15.84	0.00
646	CH 9510	15.36	16.50	15.36	0.00
647	CH 9525	14.78	16.50	14.78	0.00
648	CH 9540	14.79	16.50	14.79	0.00
649	CH 9555	14.79	16.50	14.79	0.00

Sl. No	Chainage	Existing Canal width (m)	Proposed width (m)	Width greater than (16.50m)	Length (m)
650	CH 9570	16.49	16.50	16.49	15.00
651	CH 9585	18.41	16.50	18.41	15.00
652	CH 9600	19.32	16.50	19.32	15.00
653	CH 9615	18.06	16.50	18.06	15.00
654	CH 9630	18.00	16.50	18.00	15.00
655	CH 9645	18.05	16.50	18.05	15.00
656	CH 9660	18.31	16.50	18.31	15.00
657	CH 9675	18.05	16.50	18.05	15.00
658	CH 9690	17.89	16.50	17.89	15.00
659	CH 9705	17.59	16.50	17.59	15.00
660	CH 9720	17.13	16.50	17.13	15.00
661	CH 9735	16.89	16.50	16.89	15.00
662	CH 9750	16.98	16.50	16.98	15.00
663	CH 9765	17.28	16.50	17.28	15.00
664	CH 9780	17.52	16.50	17.52	15.00
665	CH 9795	18.17	16.50	18.17	15.00
666	CH 9810	18.52	16.50	18.52	15.00
667	CH 9825	18.53	16.50	18.53	15.00
668	CH 9840	16.86	16.50	16.86	15.00
669	CH 9855	17.29	16.50	17.29	15.00
670	CH 9870	16.52	16.50	16.52	15.00
671	CH 9884.64	45.24	16.50	45.24	14.64
	9885			**Total length**	**3697.14**

1.4 Thevara Canal

Table 5: Details of width of Thevara Canal

Sl. No	Chainage	Existing Canal width (m)	Proposed width (m)	Width greater than (16.50m)	Length (m)
1	CH 00	22.81	16.50	22.81	0.00
2	CH 15	20.94	16.50	20.94	15.00
3	CH 30	19.95	16.50	19.95	15.00
4	CH 45	19.11	16.50	19.11	15.00
5	CH 60	18.77	16.50	18.77	15.00
6	CH 75	18.86	16.50	18.86	15.00
7	CH 90	16.41	16.50	16.41	7.50
8	CH 105	16.10	16.50	16.10	0.00
9	CH 120	14.73	16.50	14.73	0.00
10	CH 135	14.47	16.50	14.47	0.00
11	CH150	17.36	16.50	17.36	7.50
12	CH 165	19.42	16.50	19.42	15.00
13	CH 180	19.22	16.50	19.22	15.00
14	CH 195	19.25	16.50	19.25	15.00
15	CH 210	19.31	16.50	19.31	15.00
16	CH 225	19.05	16.50	19.05	15.00
17	CH 240	19.27	16.50	19.27	15.00
18	CH 255	19.51	16.50	19.51	15.00
19	CH 270	19.52	16.50	19.52	15.00
20	CH 285	19.48	16.50	19.48	15.00
21	CH 300	19.13	16.50	19.13	15.00

Sl. No	Chainage	Existing Canal width (m)	Proposed width (m)	Width greater than (16.50m)	Length (m)
22	CH 315	18.73	16.50	18.73	15.00
23	CH 330	19.12	16.50	19.12	15.00
24	CH 345	20.06	16.50	20.06	15.00
25	CH 360	19.97	16.50	19.97	15.00
26	CH 375	19.24	16.50	19.24	15.00
27	CH 390	18.48	16.50	18.48	15.00
28	CH 405	18.31	16.50	18.31	15.00
29	CH 420	18.94	16.50	18.94	15.00
30	CH 435	19.02	16.50	19.02	15.00
31	CH 450	19.42	16.50	19.42	15.00
32	CH 465	19.20	16.50	19.20	15.00
33	CH 480	19.36	16.50	19.36	15.00
34	CH 495	18.35	16.50	18.35	15.00
35	CH 510	15.90	16.50	15.90	7.50
36	CH 525	15.95	16.50	15.95	0.00
37	CH 540	15.69	16.50	15.69	0.00
38	CH 555	15.67	16.50	15.67	0.00
39	CH 570	15.74	16.50	15.74	0.00
40	CH 585	17.12	16.50	17.12	7.50
41	CH 600	17.04	16.50	17.04	15.00
42	CH 615	16.86	16.50	16.86	15.00
43	CH 630	15.61	16.50	15.61	7.50
44	CH 645	16.47	16.50	16.47	0.00
45	CH 660	16.51	16.50	16.51	7.50

Sl. No	Chainage	Existing Canal width (m)	Proposed width (m)	Width greater than (16.50m)	Length (m)
46	CH 675	17.00	16.50	17.00	15.00
47	CH 690	17.11	16.50	17.11	15.00
48	CH 705	17.10	16.50	17.10	15.00
49	CH 720	14.82	16.50	14.82	7.50
50	CH 735	13.88	16.50	13.88	0.00
51	CH 750	13.46	16.50	13.46	0.00
52	CH 765	13.04	16.50	13.04	0.00
53	CH 780	16.42	16.50	16.42	0.00
54	CH 795	19.12	16.50	19.12	7.50
55	CH 810	17.84	16.50	17.84	15.00
56	CH 825	18.77	16.50	18.77	15.00
57	CH 840	21.92	16.50	21.92	15.00
58	CH 855	17.35	16.50	17.35	15.00
59	CH 870	18.57	16.50	18.57	15.00
60	CH 885	19.44	16.50	19.44	15.00
61	CH 900	20.41	16.50	20.41	15.00
62	CH 915	18.81	16.50	18.81	15.00
63	CH 930	18.33	16.50	18.33	15.00
64	CH 945	17.79	16.50	17.79	15.00
65	CH 960	17.45	16.50	17.45	15.00
66	CH 975	17.19	16.50	17.19	15.00
67	CH 990	16.18	16.50	16.18	7.50
68	CH 1005	17.16	16.50	17.16	7.50
69	CH 1020	16.45	16.50	16.45	7.50

Sl. No	Chainage	Existing Canal width (m)	Proposed width (m)	Width greater than (16.50m)	Length (m)
70	CH 1035	15.86	16.50	15.86	0.00
71	CH 1050	15.04	16.50	15.04	0.00
72	CH 1065	16.22	16.50	16.22	0.00
73	CH 1080	17.13	16.50	17.13	7.50
74	CH 1095	16.62	16.50	16.62	15.00
75	CH 1110	17.32	16.50	17.32	15.00
76	CH 1125	16.91	16.50	16.91	15.00
77	CH 1140	17.71	16.50	17.71	15.00
78	CH 1155	18.57	16.50	18.57	15.00
79	CH 1170	20.95	16.50	20.95	15.00
80	CH 1185	23.15	16.50	23.15	15.00
81	CH 1200	24.94	16.50	24.94	15.00
82	CH 1215	24.93	16.50	24.93	15.00
83	CH 1230	24.46	16.50	24.46	15.00
84	CH 1245	23.37	16.50	23.37	15.00
85	CH 1260	21.96	16.50	21.96	15.00
86	CH 1275	21.39	16.50	21.39	15.00
87	CH 1290	20.78	16.50	20.78	15.00
88	CH 1305	19.96	16.50	19.96	15.00
89	CH 1320	19.11	16.50	19.11	15.00
90	CH 1335	18.49	16.50	18.49	15.00
91	CH 1350	17.79	16.50	17.79	15.00
92	CH 1365	17.40	16.50	17.40	15.00
93	CH 1380	17.66	16.50	17.66	15.00

Sl. No	Chainage	Existing Canal width (m)	Proposed width (m)	Width greater than (16.50m)	Length (m)
94	CH 1395	17.65	16.50	17.65	15.00
95	CH 1405	17.83	16.50	17.83	10.00
					1090.00

1.5 Market Canal

Table 6: Details of width of Market Canal

Sl. No	Chainage	Existing Canal width (m)	Proposed width (m)	Width greater than (16.50m)	Length (m)
1	CH 00	16.87	16.50	16.87	0.00
2	CH 15	14.05	16.50	14.05	7.50
3	CH 30	13.95	16.50	13.95	0.00
4	CH 45	13.98	16.50	13.98	0.00
5	CH 60	14.16	16.50	14.16	0.00
6	CH 75	13.86	16.50	13.86	0.00
7	CH 90	16.20	16.50	16.20	0.00
8	CH 105	15.48	16.50	15.48	0.00
9	CH 120	12.02	16.50	12.02	0.00
10	CH 135	12.33	16.50	12.33	0.00
11	CH150	12.31	16.50	12.31	0.00
12	CH 165	12.33	16.50	12.33	0.00
13	CH 180	12.41	16.50	12.41	0.00
14	CH 195	12.20	16.50	12.20	0.00
15	CH 210	12.54	16.50	12.54	0.00
16	CH 225	13.02	16.50	13.02	0.00
17	CH 240	13.14	16.50	13.14	0.00
18	CH 255	13.14	16.50	13.14	0.00
19	CH 270	13.00	16.50	13.00	0.00
20	CH 285	13.22	16.50	13.22	0.00

Sl. No	Chainage	Existing Canal width (m)	Proposed width (m)	Width greater than (16.50m)	Length (m)
21	CH 300	13.37	16.50	13.37	0.00
22	CH 303	15.00	16.50	15.00	0.00
23	CH 315	31.44	16.50	31.44	15.00
24	CH 330	31.67	16.50	31.67	15.00
25	CH 345	32.09	16.50	32.09	15.00
26	CH 360	22.82	16.50	22.82	15.00
27	CH 375	7.71	16.50	7.71	7.50
28	CH 390	7.58	16.50	7.58	0.00
29	CH 405	7.45	16.50	7.45	0.00
30	CH 420	7.32	16.50	7.32	0.00
31	CH 435	7.20	16.50	7.20	0.00
32	CH 450	7.18	16.50	7.18	0.00
33	CH 465	7.12	16.50	7.12	0.00
34	CH 480	7.11	16.50	7.11	0.00
35	CH 495	7.11	16.50	7.11	0.00
36	CH 510	7.04	16.50	7.04	0.00
37	CH 525	6.92	16.50	6.92	0.00
38	CH 540	6.83	16.50	6.83	0.00
39	CH 555	6.94	16.50	6.94	0.00
40	CH 570	7.01	16.50	7.01	0.00
41	CH 585	7.14	16.50	7.14	0.00
42	CH 600	7.30	16.50	7.30	0.00

Sl. No	Chainage	Existing Canal width (m)	Proposed width (m)	Width greater than (16.50m)	Length (m)
43	CH 615	7.52	16.50	7.52	0.00
44	CH 630	7.72	16.50	7.72	0.00
45	CH 645	7.74	16.50	7.74	0.00
46	CH 660	5.90	16.50	5.90	0.00
47	CH 664	1.83	16.50	1.83	0.00
					75.00

Table 1: Summary of Canal Deepening

Sl. No	Name of the canal	Unit	Deepening Quantity (cum)	Quantity to be filled (cum)	Quantity to be conveyed (cum)
1	Edappally	cum	1,66,607.77	29,948.97	1,36,658.80
2	Chilavanoor	cum	1,41,591.12	26,109.05	1,15,482.07
3	Thevara_Perandoor	cum	1,14,539.16	20,859.05	93,680.11
4	Thevara	cum	24,641.47	3,595.21	21,046.26
5	Market	cum	6,633.53	1,120.91	5,512.62
	Total Quantity		**4,54,013.05**	**81633.18123**	**3,72,379.86**

1.1 Edappally Canal

Table 2: Details of Edappally Canal Deepening

Sl. No	Chainage	W (m)	Wd (m)	L (m)	Assumed canal depth (m)	De-Silting Quantity (m3)	Remarks
1	CH 000 : CH 15	13.23	13.23	15.00	0.70	138.88	
2	CH 15 : CH 30	11.77	11.77	15.00	0.70	123.57	
3	CH 30 : CH 45	9.03	9.03	15.00	0.70	94.83	
4	CH 45 : CH 60	7.05	7.05	15.00	0.70	74.03	
5	CH 60 : CH 75	7.48	7.48	15.00	0.70	78.51	
6	CH 75 : CH 90	6.53	6.53	15.00	0.70	68.51	
7	CH 90 : CH 105	7.00	7.00	15.00	0.70	73.50	
8	CH 105 : CH 120	7.45	7.45	15.00	0.70	78.23	
9	CH 120 : CH 135	7.10	7.10	15.00	0.70	74.59	
10	CH 135 : CH 150	7.70	7.70	15.00	0.70	80.80	
11	CH 150 : CH 165	9.37	9.37	15.00	0.70	98.39	
12	CH 165 : CH 180	10.35	10.35	15.00	0.70	108.68	
13	CH 180 : CH 195	7.66	7.66	15.00	0.70	80.43	
14	CH 195 : CH 210	7.09	7.09	15.00	0.70	74.39	
15	CH 210 : CH 225	7.60	7.60	15.00	0.70	79.77	
16	CH 225 : CH 240	7.16	7.16	15.00	0.70	75.13	
17	CH 240 : CH 255	10.36	10.36	15.00	0.70	108.73	
18	CH 255 : CH 270	15.50	15.50	15.00	0.70	162.75	
19	CH 270 : CH 285	11.10	11.10	15.00	0.70	116.55	
20	CH 285 : CH 300	6.23	6.23	15.00	0.70	65.36	
21	CH 300 : CH 315	5.99	5.99	15.00	0.70	62.90	

Sl. No	Chainage	W (m)	Wd (m)	L (m)	Assumed canal depth (m)	De-Silting Quantity (m3)	Remarks
22	CH 315 : CH 330	6.34	6.34	15.00	0.70	66.52	
23	CH 330 : CH 345	6.13	6.13	15.00	0.70	64.31	
24	CH 345 : CH 360	6.33	6.33	15.00	0.70	66.47	
25	CH 360 : CH 375	6.18	6.18	15.00	0.70	64.84	
26	CH 375 : CH 390	6.15	6.15	15.00	0.70	64.58	
27	CH 390 : CH 405	7.20	7.20	15.00	0.70	75.60	
28	CH 405 : CH 420	8.22	8.22	15.00	0.70	86.28	
29	CH 420 : CH 435	8.50	8.50	15.00	0.70	89.25	
30	CH 435 : CH 450	10.90	10.90	15.00	0.70	114.40	
31	CH 450 : CH 465	12.14	12.14	15.00	0.70	127.42	
32	CH 465 : CH 480	11.42	11.42	15.00	0.70	119.91	
33	CH 480 : CH 495	11.09	11.09	15.00	0.70	116.39	
34	CH 495 : CH 510	11.19	11.19	15.00	0.70	117.53	
35	CH 510 : CH 525	10.05	10.05	15.00	0.70	105.53	
36	CH 525 : CH 540	9.34	9.34	15.00	0.70	98.07	
37	CH 540 : CH 555	9.59	9.59	15.00	0.70	100.64	
38	CH 555 : CH 570	10.22	10.22	15.00	0.70	107.31	
39	CH 570 : CH 585	10.95	10.95	15.00	0.70	114.94	
40	CH 585 : CH 600	11.08	11.08	15.00	0.70	116.34	
41	CH 600 : CH 615	11.85	11.85	15.00	0.70	124.43	
42	CH 615 : CH 630	12.96	12.96	15.00	0.70	136.03	
43	CH 630 : CH 645	13.09	13.09	15.00	0.70	137.39	
44	CH 645 : CH 660	12.91	12.91	15.00	0.70	135.56	
45	CH 660 : CH 675	13.17	13.17	15.00	0.70	138.23	
46	CH 675 : CH 690	12.87	12.87	15.00	0.70	135.14	

Sl. No	Chainage	W (m)	Wd (m)	L (m)	Assumed canal depth (m)	De-Silting Quantity (m3)	Remarks
47	CH 690 : CH 705	11.70	11.70	15.00	0.70	122.85	
48	CH 705 : CH 720	9.48	9.48	15.00	0.70	99.49	
49	CH 720 : CH 735	8.01	8.01	15.00	0.70	84.05	
50	CH 735 : CH 750	7.84	7.84	15.00	0.70	82.27	
51	CH 750 : CH 765	7.40	7.40	15.00	0.70	77.65	
52	CH 765 : CH 780	7.52	7.52	15.00	0.70	78.96	
53	CH 780 : CH 795	8.07	8.07	15.00	0.70	84.68	
54	CH 795 : CH 810	7.85	7.85	15.00	0.70	82.37	
55	CH 810 : CH 825	8.02	8.02	15.00	0.70	84.21	
56	CH 825 : CH 840	8.67	8.67	15.00	0.70	90.98	
57	CH 840 : CH 855	10.20	10.20	15.00	0.70	107.07	
58	CH 855 : CH 870	10.98	10.98	15.00	0.70	115.24	
59	CH 870 : CH 885	10.03	10.03	15.00	0.70	105.32	
60	CH 885 : CH 900	9.30	9.30	15.00	0.70	97.60	
61	CH 900 : CH 915	9.51	9.51	15.00	0.70	99.89	
62	CH 915 : CH 930	8.28	8.28	15.00	0.70	86.89	
63	CH 930 : CH 945	8.61	8.61	15.00	0.70	90.41	
64	CH 945 : CH 960	8.59	8.59	15.00	0.70	90.20	
65	CH 960 : CH 975	8.02	8.02	15.00	0.70	84.16	
66	CH 975 : CH 990	8.52	8.52	15.00	0.70	89.46	
67	CH 990 : CH 1005	7.90	7.90	15.00	0.70	82.95	
68	CH 1005 : CH 1020	7.89	7.89	15.00	0.70	82.85	
69	CH 1020 : CH 1035	8.88	8.88	15.00	0.70	93.24	
70	CH 1035 : CH 1050	9.49	9.49	15.00	0.70	99.59	
71	CH 1050 : CH 1065	9.94	9.94	15.00	0.70	104.37	

Sl. No	Chainage	W (m)	Wd (m)	L (m)	Assumed canal depth (m)	De-Silting Quantity (m3)	Remarks
72	CH 1065 : CH 1080	10.33	10.33	15.00	0.70	108.47	
73	CH 1080 : CH 1095	11.34	11.34	15.00	0.70	119.02	
74	CH 1095 : CH 1110	15.86	15.86	15.00	0.70	166.57	
75	CH 1110 : CH 1125	17.77	17.77	15.00	0.70	186.59	
76	CH 1125 : CH 1140	17.54	17.54	15.00	0.70	184.12	
77	CH 1140 : CH 1155	15.42	15.42	15.00	0.70	161.91	
78	CH 1155 : CH 1170	13.81	13.81	15.00	0.70	144.95	
79	CH 1170 : CH 1185	13.28	13.28	15.00	0.70	139.39	
80	CH 1185 : CH 1200	13.41	13.41	15.00	0.70	140.75	
81	CH 1200 : CH 1215	12.93	12.93	15.00	0.70	135.77	
82	CH 1215 : CH 1230	11.16	11.16	15.00	0.70	117.13	
83	CH 1230 : CH 1245	10.45	10.45	15.00	0.70	109.67	
84	CH 1245 : CH 1260	11.16	11.16	15.00	0.70	117.18	
85	CH 1260 : CH 1275	11.61	11.61	15.00	0.70	121.85	
86	CH 1275 : CH 1290	10.93	10.93	15.00	0.70	114.71	
87	CH 1290 : CH 1305	10.02	10.02	15.00	0.70	105.21	
88	CH 1305 : CH 1320	10.29	10.29	15.00	0.70	108.05	
89	CH 1320 : CH 1335	10.70	10.70	15.00	0.70	112.39	
90	CH 1335 : CH 1350	10.21	10.21	15.00	0.70	107.15	
91	CH 1350 : CH 1365	10.37	10.37	15.00	0.70	108.83	
92	CH 1365 : CH 1380	10.53	10.53	15.00	0.70	110.51	
93	CH 1380 : CH 1395	10.78	10.78	15.00	0.70	113.14	
94	CH 1395 : CH 1410	11.38	11.38	15.00	0.70	119.49	
95	CH 1410 : CH 1425	11.66	11.66	15.00	0.70	122.43	
96	CH 1425 : CH 1440	10.70	10.70	15.00	0.70	112.30	

Sl. No	Chainage	W (m)	Wd (m)	L (m)	Assumed canal depth (m)	De-Silting Quantity (m3)	Remarks
97	CH 1440 : CH 1455	10.47	10.47	15.00	0.70	109.94	
98	CH 1455 : CH 1470	10.51	10.51	15.00	0.70	110.39	
99	CH 1470 : CH 1485	9.81	9.81	15.00	0.70	102.95	
100	CH 1485 : CH 1500	11.20	11.20	15.00	0.70	117.55	
101	CH 1500 : CH 1515	12.11	12.11	15.00	0.70	127.10	
102	CH 1515 : CH 1530	9.78	9.78	15.00	0.70	102.69	
103	CH 1530 : CH 1545	8.09	8.09	15.00	0.70	84.89	
104	CH 1545 : CH 1560	8.93	8.93	15.00	0.70	93.77	
105	CH 1560 : CH 1575	9.06	9.06	15.00	0.70	95.13	
106	CH 1575 : CH 1590	8.52	8.52	15.00	0.70	89.46	
107	CH 1590 : CH 1605	8.64	8.64	15.00	0.70	90.67	
108	CH 1605 : CH 1620	8.82	8.82	15.00	0.70	92.61	
109	CH 1620 : CH 1635	8.80	8.80	15.00	0.70	92.40	
110	CH 1635 : CH 1650	9.73	9.73	15.00	0.70	102.11	
111	CH 1650 : CH 1665	10.85	10.85	15.00	0.70	113.87	
112	CH 1665 : CH 1680	11.92	11.92	15.00	0.70	125.16	
113	CH 1680 : CH 1695	12.03	12.03	15.00	0.70	126.32	
114	CH 1695 : CH 1710	10.11	10.11	15.00	0.70	106.10	
115	CH 1710 : CH 1725	9.90	9.90	15.00	0.70	103.95	
116	CH 1725 : CH 1740	10.28	10.28	15.00	0.70	107.94	
117	CH 1740 : CH 1755	11.46	11.46	15.00	0.70	120.28	
118	CH 1755 : CH 1770	12.49	12.49	15.00	0.70	131.15	
119	CH 1770 : CH 1785	12.31	12.31	15.00	0.70	129.29	
120	CH 1785 : CH 1800	10.82	10.82	15.00	0.70	113.61	
121	CH 1800 : CH 1815	9.97	9.97	15.00	0.70	104.69	

Sl. No	Chainage	W (m)	Wd (m)	L (m)	Assumed canal depth (m)	De-Silting Quantity (m3)	Remarks
122	CH 1815 : CH 1830	10.55	10.55	15.00	0.70	110.72	
123	CH 1830 : CH 1845	11.51	11.51	15.00	0.70	120.86	
124	CH 1845 : CH 1860	12.45	12.45	15.00	0.70	130.67	
125	CH 1860 : CH 1875	13.00	13.00	15.00	0.70	136.47	
126	CH 1875 : CH 1890	12.24	12.24	15.00	0.70	128.49	
127	CH 1890 : CH 1905	12.64	12.64	15.00	0.70	132.67	
128	CH 1905 : CH 1920	13.14	13.14	15.00	0.70	138.01	
129	CH 1920 : CH 1935	11.43	11.43	15.00	0.70	119.96	
130	CH 1935 : CH 1950	10.81	10.81	15.00	0.70	113.51	
131	CH 1950 : CH 1965	10.95	10.95	15.00	0.70	114.98	
132	CH 1965 : CH 1980	11.11	11.11	15.00	0.70	116.60	
133	CH 1980 : CH 1995	10.90	10.90	15.00	0.70	114.40	
134	CH 1995 : CH 2010	10.81	10.81	15.00	0.70	113.51	
135	CH 2010 : CH 2025	11.08	11.08	15.00	0.70	116.34	
136	CH 2025 : CH 2040	12.10	12.10	15.00	0.70	127.09	
137	CH 2040 : CH 2055	12.90	12.90	15.00	0.70	135.40	
138	CH 2055 : CH 2070	14.67	14.67	15.00	0.70	153.98	
139	CH 2070 : CH 2085	15.97	15.97	15.00	0.70	167.69	
140	CH 2085 : CH 2100	17.78	17.78	15.00	0.70	186.64	w>16.50
141	CH 2100 : CH 2115	20.81	20.81	15.00	0.70	218.45	"
142	CH 2115 : CH 2130	22.87	22.87	15.00	0.70	240.17	"
143	CH 2130 : CH 2145	19.57	19.57	15.00	0.70	205.43	"
144	CH 2145 : CH 2160	18.09	18.09	15.00	0.70	189.89	"
145	CH 2160 : CH 2175	19.51	19.51	15.00	0.70	204.86	"
146	CH 2175 : CH 2190	18.27	18.27	15.00	0.70	191.78	"

Sl. No	Chainage	W (m)	Wd (m)	L (m)	Assumed canal depth (m)	De-Silting Quantity (m3)	Remarks
147	CH 2190 : CH 2205	15.24	15.24	15.00	0.70	160.02	
148	CH 2205 : CH 2220	14.93	14.93	15.00	0.70	156.71	
149	CH 2220 : CH 2235	17.56	17.56	15.00	0.70	184.33	w>16.50
150	CH 2235 : CH 2250	19.12	19.12	15.00	0.70	200.71	"
151	CH 2250 : CH 2265	19.14	19.14	15.00	0.70	200.97	"
152	CH 2265 : CH 2280	18.58	18.58	15.00	0.70	195.04	"
153	CH 2280 : CH 2295	17.33	17.33	15.00	0.70	181.91	"
154	CH 2295 : CH 2310	16.48	16.48	15.00	0.70	172.99	
155	CH 2310 : CH 2325	16.09	16.09	15.00	0.70	168.89	
156	CH 2325 : CH 2340	15.56	15.56	15.00	0.70	163.38	
157	CH 2340 : CH 2355	14.61	14.61	15.00	0.70	153.35	
158	CH 2355 : CH 2370	14.45	14.45	15.00	0.70	151.67	
159	CH 2370 : CH 2385	17.04	17.04	15.00	0.70	178.87	w>16.50
160	CH 2385 : CH 2400	18.02	18.02	15.00	0.70	189.21	"
161	CH 2400 : CH 2415	16.43	16.43	15.00	0.70	172.46	
162	CH 2415 : CH 2430	17.03	17.03	15.00	0.70	178.82	w>16.50
163	CH 2430 : CH 2445	18.88	18.88	15.00	0.70	198.19	"
164	CH 2445 : CH 2460	20.09	20.09	15.00	0.70	210.89	"
165	CH 2460 : CH 2475	22.07	22.07	15.00	0.70	231.68	"
166	CH 2475 : CH 2490	23.83	23.83	15.00	0.70	250.22	"
167	CH 2490 : CH 2505	21.91	21.91	15.00	0.70	230.06	"
168	CH 2505 : CH 2520	17.51	17.51	15.00	0.70	183.86	
169	CH 2520 : CH 2535	14.88	14.88	15.00	0.70	156.24	
170	CH 2535 : CH 2550	15.12	15.12	15.00	0.70	158.76	
171	CH 2550 : CH 2565	16.16	16.16	15.00	0.70	169.68	

Sl. No	Chainage	W (m)	Wd (m)	L (m)	Assumed canal depth (m)	De-Silting Quantity (m3)	Remarks
172	CH 2565 : CH 2580	16.15	16.15	15.00	0.70	169.52	
173	CH 2580 : CH 2595	16.19	16.19	15.00	0.70	170.00	
174	CH 2595 : CH 2610	16.63	16.63	15.00	0.70	174.62	w>16.50
175	CH 2610 : CH 2625	16.39	16.39	15.00	0.70	172.10	
176	CH 2625 : CH 2640	15.49	15.49	15.00	0.70	162.59	
177	CH 2640 : CH 2655	14.30	14.30	15.00	0.70	150.10	
178	CH 2655 : CH 2670	13.43	13.43	15.00	0.70	141.02	
179	CH 2670 : CH 2685	13.02	13.02	15.00	0.70	136.66	
180	CH 2685 : CH 2700	13.88	13.88	15.00	0.70	145.69	
181	CH 2700 : CH 2715	15.69	15.69	15.00	0.70	164.75	
182	CH 2715 : CH 2730	14.14	14.14	15.00	0.70	148.44	
183	CH 2730 : CH 2745	15.03	15.03	15.00	0.70	157.76	
184	CH 2745 : CH 2760	15.31	15.31	15.00	0.70	160.76	
185	CH 2760 : CH 2775	15.21	15.21	15.00	0.70	159.71	
186	CH 2775 : CH 2790	14.04	14.04	15.00	0.70	147.42	
187	CH 2790 : CH 2805	12.42	12.42	15.00	0.70	130.41	
188	CH 2805 : CH 2820	10.88	10.88	15.00	0.70	114.24	
189	CH 2820 : CH 2835	10.10	10.10	15.00	0.70	106.00	
190	CH 2835 : CH 2850	10.33	10.33	15.00	0.70	108.47	
191	CH 2850 : CH 2865	12.26	12.26	15.00	0.70	128.68	
192	CH 2865 : CH 2880	14.00	14.00	15.00	0.70	147.00	
193	CH 2880 : CH 2895	14.48	14.48	15.00	0.70	151.99	
194	CH 2895 : CH 2910	13.57	13.57	15.00	0.70	142.43	
195	CH 2910 : CH 2925	11.74	11.74	15.00	0.70	123.27	
196	CH 2925 : CH 2940	11.56	11.56	15.00	0.70	121.38	

Sl. No	Chainage	W (m)	Wd (m)	L (m)	Assumed canal depth (m)	De-Silting Quantity (m3)	Remarks
197	CH 2940 : CH 2955	11.94	11.94	15.00	0.70	125.32	
198	CH 2955 : CH 2970	11.76	11.76	15.00	0.70	123.43	
199	CH 2970 : CH 2985	12.58	12.58	15.00	0.70	132.09	
200	CH 2985 : CH 3000	14.59	14.59	15.00	0.70	153.20	
201	CH 3000 : CH 3015	16.45	16.45	15.00	0.70	172.67	
202	CH 3015 : CH 3030	16.85	16.85	15.00	0.70	176.93	
203	CH 3030 : CH 3045	14.84	14.84	15.00	0.70	155.77	
204	CH 3045 : CH 3060	12.84	12.84	15.00	0.70	134.77	
205	CH 3060 : CH 3075	12.22	12.22	15.00	0.70	128.26	
206	CH 3075 : CH 3090	11.99	11.99	15.00	0.70	125.84	
207	CH 3090 : CH 3105	12.13	12.13	15.00	0.70	127.37	
208	CH 3105 : CH 3120	12.55	12.55	15.00	0.70	131.78	
209	CH 3120 : CH 3135	12.58	12.58	15.00	0.70	132.04	
210	CH 3135 : CH 3150	12.59	12.59	15.00	0.70	132.14	
211	CH 3150 : CH 3165	13.15	13.15	15.00	0.70	138.08	
212	CH 3165 : CH 3180	13.51	13.51	15.00	0.70	141.86	
213	CH 3180 : CH 3195	12.72	12.72	15.00	0.70	133.51	
214	CH 3195 : CH 3210	11.55	11.55	15.00	0.70	121.28	
215	CH 3210 : CH 3225	10.43	10.43	15.00	0.70	109.46	
216	CH 3225 : CH 3240	9.67	9.67	15.00	0.70	101.48	
217	CH 3240 : CH 3255	10.30	10.30	15.00	0.70	108.15	
218	CH 3255 : CH 3270	11.37	11.37	15.00	0.70	119.39	
219	CH 3270 : CH 3285	11.84	11.84	15.00	0.70	124.27	
220	CH 3285 : CH 3300	13.00	13.00	15.00	0.70	136.45	
221	CH 3300 : CH 3315	15.11	15.11	15.00	0.70	158.60	

Sl. No	Chainage	W (m)	Wd (m)	L (m)	Assumed canal depth (m)	De-Silting Quantity (m3)	Remarks
222	CH 3315 : CH 3330	16.70	16.70	15.00	0.70	175.30	w>16.50
223	CH 3330 : CH 3345	17.48	17.48	15.00	0.70	183.49	w>16.50
224	CH 3345 : CH 3360	17.48	17.48	15.00	0.70	183.49	"
225	CH 3360 : CH 3375	17.61	17.61	15.00	0.70	184.85	"
226	CH 3375 : CH 3390	17.83	17.83	15.00	0.70	187.22	"
227	CH 3390 : CH 3405	17.41	17.41	15.00	0.70	182.81	"
228	CH 3405 : CH 3420	16.78	16.78	15.00	0.70	176.14	"
229	CH 3420 : CH 3435	16.43	16.43	15.00	0.70	172.46	
230	CH 3435 : CH 3450	16.14	16.14	15.00	0.70	169.47	
231	CH 3450 : CH 3465	15.82	15.82	15.00	0.70	166.11	
232	CH 3465 : CH 3480	15.48	15.48	15.00	0.70	162.54	
233	CH 3480 : CH 3495	16.36	16.36	15.00	0.70	171.78	
234	CH 3495 : CH 3510	17.95	17.95	15.00	0.70	188.42	w>16.50
235	CH 3510 : CH 3525	16.15	16.15	15.00	0.70	169.52	
236	CH 3525 : CH 3540	12.70	12.70	15.00	0.70	133.39	
237	CH 3540 : CH 3555	12.96	12.96	15.00	0.70	136.03	
238	CH 3555 : CH 3570	13.25	13.25	15.00	0.70	139.07	
239	CH 3570 : CH 3585	13.11	13.11	15.00	0.70	137.66	
240	CH 3585 : CH 3600	12.96	12.96	15.00	0.70	136.03	
241	CH 3600 : CH 3615	12.06	12.06	15.00	0.70	126.63	
242	CH 3615 : CH 3630	10.60	10.60	15.00	0.70	111.25	
243	CH 3630 : CH 3645	10.15	10.15	15.00	0.70	106.58	
244	CH 3645 : CH 3660	10.47	10.47	15.00	0.70	109.88	
245	CH 3660 : CH 3675	10.49	10.49	15.00	0.70	110.15	
246	CH 3675 : CH 3690	10.51	10.51	15.00	0.70	110.36	

Sl. No	Chainage	W (m)	Wd (m)	L (m)	Assumed canal depth (m)	De-Silting Quantity (m3)	Remarks
247	CH 3690 : CH 3705	10.79	10.79	15.00	0.70	113.30	
248	CH 3705 : CH 3720	10.80	10.80	15.00	0.70	113.35	
249	CH 3720 : CH 3735	10.66	10.66	15.00	0.70	111.88	
250	CH 3735 : CH 3750	11.16	11.16	15.00	0.70	117.13	
251	CH 3750 : CH 3765	12.29	12.29	15.00	0.70	128.99	
252	CH 3765 : CH 3780	13.55	13.55	15.00	0.70	142.28	
253	CH 3780 : CH 3795	14.78	14.78	15.00	0.70	155.14	
254	CH 3795 : CH 3810	15.25	15.25	15.00	0.70	160.07	
255	CH 3810 : CH 3825	15.28	15.28	15.00	0.70	160.39	
256	CH 3825 : CH 3840	16.19	16.19	15.00	0.70	170.00	
257	CH 3840 : CH 3855	16.21	16.21	15.00	0.70	170.15	
258	CH 3855 : CH 3870	15.55	15.55	15.00	0.70	163.22	
259	CH 3870 : CH 3885	16.23	16.23	15.00	0.70	170.42	
260	CH 3885 : CH 3900	18.01	18.01	15.00	0.70	189.05	w>16.50
261	CH 3900 : CH 3915	18.96	18.96	15.00	0.70	199.08	"
262	CH 3915 : CH 3930	17.60	17.60	15.00	0.70	184.80	"
263	CH 3930 : CH 3945	15.32	15.32	15.00	0.70	160.86	
264	CH 3945 : CH 3960	12.50	12.50	15.00	0.70	131.20	
265	CH 3960 : CH 3975	11.19	11.19	15.00	0.70	117.50	
266	CH 3975 : CH 3990	12.06	12.06	15.00	0.70	126.63	
267	CH 3990 : CH 4005	12.14	12.14	15.00	0.70	127.47	
268	CH 4005 : CH 4020	11.43	11.43	15.00	0.70	120.02	
269	CH 4020 : CH 4035	12.75	12.75	15.00	0.70	133.82	
270	CH 4035 : CH 4050	14.87	14.87	15.00	0.70	156.08	
271	CH 4050 : CH 4065	13.54	13.54	15.00	0.70	142.12	

Sl. No	Chainage	W (m)	Wd (m)	L (m)	Assumed canal depth (m)	De-Silting Quantity (m3)	Remarks
272	CH 4065 : CH 4080	11.47	11.47	15.00	0.70	120.44	
273	CH 4080 : CH 4095	11.10	11.10	15.00	0.70	116.55	
274	CH 4095 : CH 4110	11.08	11.08	15.00	0.70	116.29	
275	CH 4110 : CH 4125	11.90	11.90	15.00	0.70	124.95	
276	CH 4125 : CH 4140	13.29	13.29	15.00	0.70	139.58	
277	CH 4140 : CH 4155	13.21	13.21	15.00	0.70	138.65	
278	CH 4155 : CH 4170	13.47	13.47	15.00	0.70	141.44	
279	CH 4170 : CH 4185	15.62	15.62	15.00	0.70	163.96	
280	CH 4185 : CH 4200	16.55	16.55	15.00	0.70	173.72	w>16.50
281	CH 4200 : CH 4215	15.38	15.38	15.00	0.70	161.49	
282	CH 4215 : CH 4230	14.59	14.59	15.00	0.70	153.16	
283	CH 4230 : CH 4245	15.63	15.63	15.00	0.70	164.12	
284	CH 4245 : CH 4260	15.79	15.79	15.00	0.70	165.74	
285	CH 4260 : CH 4275	14.36	14.36	15.00	0.70	150.78	
286	CH 4275 : CH 4290	14.04	14.04	15.00	0.70	147.42	
287	CH 4290 : CH 4305	15.22	15.22	15.00	0.70	159.81	
288	CH 4305 : CH 4320	15.99	15.99	15.00	0.70	167.84	
289	CH 4320 : CH 4335	16.46	16.46	15.00	0.70	172.78	
290	CH 4335 : CH 4350	16.61	16.61	15.00	0.70	174.41	w>16.50
291	CH 4350 : CH 4365	16.24	16.24	15.00	0.70	170.52	
292	CH 4365 : CH 4380	15.61	15.61	15.00	0.70	163.85	
293	CH 4380 : CH 4395	15.51	15.51	15.00	0.70	162.80	
294	CH 4395 : CH 4410	15.94	15.94	15.00	0.70	167.32	
295	CH 4410 : CH 4425	16.59	16.59	15.00	0.70	174.20	
296	CH 4425 : CH 4440	17.44	17.44	15.00	0.70	183.07	w>16.50

Sl. No	Chainage	W (m)	Wd (m)	L (m)	Assumed canal depth (m)	De-Silting Quantity (m3)	Remarks
297	CH 4440 : CH 4455	17.54	17.54	15.00	0.70	184.12	w>16.50
298	CH 4455 : CH 4470	17.14	17.14	15.00	0.70	179.97	w>16.50
299	CH 4470 : CH 4485	16.41	16.41	15.00	0.70	172.25	
300	CH 4485 : CH 4500	14.86	14.86	15.00	0.70	155.98	
301	CH 4500 : CH 4515	13.95	13.95	15.00	0.70	146.42	
302	CH 4515 : CH 4530	14.84	14.84	15.00	0.70	155.77	
303	CH 4530 : CH 4545	16.83	16.83	15.00	0.70	176.66	w>16.50
304	CH 4545 : CH 4560	17.80	17.80	15.00	0.70	186.90	"
305	CH 4560 : CH 4575	18.79	18.79	15.00	0.70	197.30	"
306	CH 4575 : CH 4590	20.27	20.27	15.00	0.70	212.78	"
307	CH 4590 : CH 4605	20.30	20.30	15.00	0.70	213.15	"
308	CH 4605 : CH 4620	18.32	18.32	15.00	0.70	192.31	"
309	CH 4620 : CH 4635	16.56	16.56	15.00	0.70	173.88	"
310	CH 4635 : CH 4650	16.27	16.27	15.00	0.70	170.84	
311	CH 4650 : CH 4665	16.08	16.08	15.00	0.70	168.84	
312	CH 4665 : CH 4680	15.60	15.60	15.00	0.70	163.80	
313	CH 4680 : CH 4695	15.84	15.84	15.00	0.70	166.32	
314	CH 4695 : CH 4710	16.23	16.23	15.00	0.70	170.36	
315	CH 4710 : CH 4725	14.75	14.75	15.00	0.70	154.82	
316	CH 4725 : CH 4740	13.93	13.93	15.00	0.70	146.21	
317	CH 4740 : CH 4755	14.79	14.79	15.00	0.70	155.24	
318	CH 4755 : CH 4770	16.01	16.01	15.00	0.70	168.11	
319	CH 4770 : CH 4785	17.51	17.51	15.00	0.70	183.86	w>16.50
320	CH 4785 : CH 4800	18.52	18.52	15.00	0.70	194.46	"
321	CH 4800 : CH 4815	18.23	18.23	15.00	0.70	191.42	"

Sl. No	Chainage	W (m)	Wd (m)	L (m)	Assumed canal depth (m)	De-Silting Quantity (m3)	Remarks
322	CH 4815 : CH 4830	17.31	17.31	15.00	0.70	181.76	"
323	CH 4830 : CH 4845	16.87	16.87	15.00	0.70	177.14	"
324	CH 4845 : CH 4860	17.34	17.34	15.00	0.70	182.02	"
325	CH 4860 : CH 4875	18.09	18.09	15.00	0.70	189.95	"
326	CH 4875 : CH 4890	18.39	18.39	15.00	0.70	193.10	"
327	CH 4890 : CH 4905	18.77	18.77	15.00	0.70	197.03	"
328	CH 4905 : CH 4920	20.20	20.20	15.00	0.70	212.05	"
329	CH 4920 : CH 4935	21.75	21.75	15.00	0.70	228.38	"
330	CH 4935 : CH 4950	22.27	22.27	15.00	0.70	233.78	"
331	CH 4950 : CH 4965	22.30	22.30	15.00	0.70	234.10	"
332	CH 4965 : CH 4980	20.87	20.87	15.00	0.70	219.14	"
333	CH 4980 : CH 4995	18.84	18.84	15.00	0.70	197.82	"
334	CH 4995 : CH 5010	17.98	17.98	15.00	0.70	188.74	"
335	CH 5010 : CH 5025	17.67	17.67	15.00	0.70	185.54	"
336	CH 5025 : CH 5040	17.17	17.17	15.00	0.70	180.23	"
337	CH 5040 : CH 5055	16.63	16.63	15.00	0.70	174.62	"
338	CH 5055 : CH 5070	16.90	16.90	15.00	0.70	177.45	"
339	CH 5070 : CH 5085	17.59	17.59	15.00	0.70	184.64	"
340	CH 5085 : CH 5100	16.83	16.83	15.00	0.70	176.72	
341	CH 5100 : CH 5115	15.15	15.15	15.00	0.70	159.02	
342	CH 5115 : CH 5130	14.79	14.79	15.00	0.70	155.24	
343	CH 5130 : CH 5145	16.74	16.74	15.00	0.70	175.72	
344	CH 5145 : CH 5160	18.01	18.01	15.00	0.70	189.11	w>16.50
345	CH 5160 : CH 5175	16.69	16.69	15.00	0.70	175.25	"
346	CH 5175 : CH 5190	15.60	15.60	15.00	0.70	163.75	

Sl. No	Chainage	W (m)	Wd (m)	L (m)	Assumed canal depth (m)	De-Silting Quantity (m3)	Remarks
347	CH 5190 : CH 5205	16.85	16.85	15.00	0.70	176.93	
348	CH 5205 : CH 5220	19.46	19.46	15.00	0.70	204.28	w>16.50
349	CH 5220 : CH 5235	21.14	21.14	15.00	0.70	221.97	"
350	CH 5235 : CH 5250	21.47	21.47	15.00	0.70	225.38	"
351	CH 5250 : CH 5265	21.01	21.01	15.00	0.70	220.55	"
352	CH 5265 : CH 5280	21.10	21.10	15.00	0.70	221.55	"
353	CH 5280 : CH 5295	21.56	21.56	15.00	0.70	226.38	"
354	CH 5295 : CH 5310	21.95	21.95	15.00	0.70	230.42	"
355	CH 5310 : CH 5325	22.46	22.46	15.00	0.70	235.83	"
356	CH 5325 : CH 5340	22.89	22.89	15.00	0.70	240.29	"
357	CH 5340 : CH 5355	23.02	23.02	15.00	0.70	241.66	"
358	CH 5355 : CH 5370	22.53	22.53	15.00	0.70	236.57	"
359	CH 5370 : CH 5385	21.61	21.61	15.00	0.70	226.91	"
360	CH 5385 : CH 5400	20.63	20.63	15.00	0.70	216.56	"
361	CH 5400 : CH 5415	19.51	19.51	15.00	0.70	204.80	"
362	CH 5415 : CH 5430	19.63	19.63	15.00	0.70	206.06	"
363	CH 5430 : CH 5445	20.56	20.56	15.00	0.70	215.88	"
364	CH 5445 : CH 5460	22.15	22.15	15.00	0.70	232.58	"
365	CH 5460 : CH 5475	23.23	23.23	15.00	0.70	243.86	"
366	CH 5475 : CH 5490	24.26	24.26	15.00	0.70	254.68	"
367	CH 5490 : CH 5505	25.36	24.50	15.00	0.70	257.25	"
368	CH 5505 : CH 5520	24.80	24.50	15.00	0.70	257.25	"
369	CH 5520 : CH 5535	24.03	24.03	15.00	0.70	252.26	"
370	CH 5535 : CH 5550	22.43	22.43	15.00	0.70	235.52	"
371	CH 5550 : CH 5565	21.20	21.20	15.00	0.70	222.55	"

Sl. No	Chainage	W (m)	Wd (m)	L (m)	Assumed canal depth (m)	De-Silting Quantity (m3)	Remarks
372	CH 5565 : CH 5580	19.71	19.71	15.00	0.70	206.96	"
373	CH 5580 : CH 5595	17.97	17.97	15.00	0.70	188.69	"
374	CH 5595 : CH 5610	18.82	18.82	15.00	0.70	197.61	"
375	CH 5610 : CH 5625	19.44	19.44	15.00	0.70	204.12	"
376	CH 5625 : CH 5640	19.72	19.72	15.00	0.70	207.01	"
377	CH 5640 : CH 5655	20.09	20.09	15.00	0.70	210.89	"
378	CH 5655 : CH 5670	19.79	19.79	15.00	0.70	207.80	"
379	CH 5670 : CH 5685	20.42	20.42	15.00	0.70	214.41	"
380	CH 5685 : CH 5700	22.00	22.00	15.00	0.70	230.95	"
381	CH 5700 : CH 5715	22.98	22.98	15.00	0.70	241.29	"
382	CH 5715 : CH 5730	22.80	22.80	15.00	0.70	239.40	"
383	CH 5730 : CH 5745	22.42	22.42	15.00	0.70	235.41	"
384	CH 5745 : CH 5760	21.82	21.82	15.00	0.70	229.06	"
385	CH 5760 : CH 5775	21.64	21.64	15.00	0.70	227.22	"
386	CH 5775 : CH 5790	22.17	22.17	15.00	0.70	232.79	"
387	CH 5790 : CH 5805	23.21	23.21	15.00	0.70	243.71	"
388	CH 5805 : CH 5820	24.07	24.07	15.00	0.70	252.68	"
389	CH 5820 : CH 5835	23.64	23.64	15.00	0.70	248.22	"
390	CH 5835 : CH 5850	22.26	22.26	15.00	0.70	233.68	"
391	CH 5850 : CH 5865	21.71	21.71	15.00	0.70	227.90	"
392	CH 5865 : CH 5880	21.52	21.52	15.00	0.70	225.91	"
393	CH 5880 : CH 5895	19.64	19.64	15.00	0.70	206.17	"
394	CH 5895 : CH 5910	16.91	16.91	15.00	0.70	177.50	
395	CH 5910 : CH 5925	15.24	15.24	15.00	0.70	160.02	
396	CH 5925 : CH 5940	16.85	16.85	15.00	0.70	176.87	

Sl. No	Chainage	W (m)	Wd (m)	L (m)	Assumed canal depth (m)	De-Silting Quantity (m3)	Remarks
397	CH 5940 : CH 5955	21.03	21.03	15.00	0.70	220.76	w>16.50
398	CH 5955 : CH 5970	22.96	22.96	15.00	0.70	241.08	"
399	CH 5970 : CH 5985	24.13	24.13	15.00	0.70	253.37	"
400	CH 5985 : CH 6000	25.55	24.50	15.00	0.70	257.25	"
401	CH 6000 : CH 6015	25.51	24.50	15.00	0.70	257.25	"
402	CH 6015 : CH 6030	26.13	24.50	15.00	0.70	257.25	"
403	CH 6030 : CH 6045	27.31	24.50	15.00	0.70	257.25	"
404	CH 6045 : CH 6060	27.38	24.50	15.00	0.70	257.25	"
405	CH 6060 : CH 6075	26.16	24.50	15.00	0.70	257.25	"
406	CH 6075 : CH 6090	25.36	24.50	15.00	0.70	257.25	"
407	CH 6090 : CH 6105	26.30	24.50	15.00	0.70	257.25	"
408	CH 6105 : CH 6120	28.11	24.50	15.00	0.70	257.25	"
409	CH 6120 : CH 6135	31.04	24.50	15.00	0.70	257.25	"
410	CH 6135 : CH 6150	33.51	24.50	15.00	0.70	257.25	"
411	CH 6150 : CH 6165	32.16	24.50	15.00	0.70	257.25	"
412	CH 6165 : CH 6180	28.96	24.50	15.00	0.70	257.25	"
413	CH 6180 : CH 6195	27.98	24.50	15.00	0.70	257.25	"
414	CH 6195 : CH 6210	27.60	24.50	15.00	0.70	257.25	"
415	CH 6210 : CH 6225	25.18	24.50	15.00	0.70	257.25	"
416	CH 6225 : CH 6240	22.73	22.73	15.00	0.70	238.67	"
417	CH 6240 : CH 6255	21.03	21.03	15.00	0.70	220.76	"
418	CH 6255 : CH 6270	20.45	20.45	15.00	0.70	214.73	"
419	CH 6270 : CH 6285	21.39	21.39	15.00	0.70	224.60	"
420	CH 6285 : CH 6300	22.92	22.92	15.00	0.70	240.66	"
421	CH 6300 : CH 6315	25.16	24.50	15.00	0.70	257.25	"

Sl. No	Chainage	W (m)	Wd (m)	L (m)	Assumed canal depth (m)	De-Silting Quantity (m3)	Remarks
422	CH 6315 : CH 6330	26.96	24.50	15.00	0.70	257.25	"
423	CH 6330 : CH 6345	26.18	24.50	15.00	0.70	257.25	"
424	CH 6345 : CH 6360	25.20	24.50	15.00	0.70	257.25	"
425	CH 6360 : CH 6375	25.44	24.50	15.00	0.70	257.25	"
426	CH 6375 : CH 6390	25.64	24.50	15.00	0.70	257.25	"
427	CH 6390 : CH 6405	26.70	24.50	15.00	0.70	257.25	"
428	CH 6405 : CH 6420	28.20	24.50	15.00	0.70	257.25	"
429	CH 6420 : CH 6435	29.18	24.50	15.00	0.70	257.25	"
430	CH 6435 : CH 6450	27.85	24.50	15.00	0.70	257.25	"
431	CH 6450 : CH 6465	25.68	24.50	15.00	0.70	257.25	"
432	CH 6465 : CH 6480	27.81	24.50	15.00	0.70	257.25	"
433	CH 6480 : CH 6495	30.65	24.50	15.00	0.70	257.25	"
434	CH 6495 : CH 6510	31.33	24.50	15.00	0.70	257.25	"
435	CH 6510 : CH 6525	30.77	24.50	15.00	0.70	257.25	"
436	CH 6525 : CH 6540	25.96	24.50	15.00	0.70	257.25	"
437	CH 6540 : CH 6555	20.33	20.33	15.00	0.70	213.41	"
438	CH 6555 : CH 6570	17.77	17.77	15.00	0.70	186.53	"
439	CH 6570 : CH 6585	17.22	17.22	15.00	0.70	180.81	"
440	CH 6585 : CH 6600	18.54	18.54	15.00	0.70	194.67	"
441	CH 6600 : CH 6615	21.38	21.38	15.00	0.70	224.44	"
442	CH 6615 : CH 6630	23.41	23.41	15.00	0.70	245.75	"
443	CH 6630 : CH 6645	24.06	24.06	15.00	0.70	252.63	"
444	CH 6645 : CH 6660	24.69	24.50	15.00	0.70	257.25	"
445	CH 6660 : CH 6675	24.29	24.29	15.00	0.70	255.05	"
446	CH 6675 : CH 6690	22.91	22.91	15.00	0.70	240.50	"

Sl. No	Chainage	W (m)	Wd (m)	L (m)	Assumed canal depth (m)	De-Silting Quantity (m3)	Remarks
447	CH 6690 : CH 6705	22.32	22.32	15.00	0.70	234.31	"
448	CH 6705 : CH 6720	22.58	22.58	15.00	0.70	237.09	"
449	CH 6720 : CH 6735	22.88	22.88	15.00	0.70	240.24	"
450	CH 6735 : CH 6750	24.92	24.50	15.00	0.70	257.25	"
451	CH 6750 : CH 6765	27.08	24.50	15.00	0.70	257.25	"
452	CH 6765 : CH 6780	27.70	24.50	15.00	0.70	257.25	"
453	CH 6780 : CH 6795	25.98	24.50	15.00	0.70	257.25	"
454	CH 6795 : CH 6810	25.43	24.50	15.00	0.70	257.25	"
455	CH 6810 : CH 6825	28.13	24.50	15.00	0.70	257.25	"
456	CH 6825 : CH 6840	30.28	24.50	15.00	0.70	257.25	"
457	CH 6840 : CH 6855	31.35	24.50	15.00	0.70	257.25	"
458	CH 6855 : CH 6870	30.16	24.50	15.00	0.70	257.25	"
459	CH 6870 : CH 6885	29.32	24.50	15.00	0.70	257.25	"
460	CH 6885 : CH 6900	30.99	24.50	15.00	0.70	257.25	"
461	CH 6900 : CH 6915	33.40	24.50	15.00	0.70	257.25	"
462	CH 6915 : CH 6930	34.06	24.50	15.00	0.70	257.25	"
463	CH 6930 : CH 6945	32.19	24.50	15.00	0.70	257.25	"
464	CH 6945 : CH 6960	29.79	24.50	15.00	0.70	257.25	"
465	CH 6960 : CH 6975	28.41	24.50	15.00	0.70	257.25	"
466	CH 6975 : CH 6990	27.25	24.50	15.00	0.70	257.25	"
467	CH 6990 : CH 7005	26.02	24.50	15.00	0.70	257.25	"
468	CH 7005 : CH 7020	26.37	24.50	15.00	0.70	257.25	"
469	CH 7020 : CH 7035	26.18	24.50	15.00	0.70	257.25	"
470	CH 7035 : CH 7050	25.02	24.50	15.00	0.70	257.25	"
471	CH 7050 : CH 7065	24.90	24.50	15.00	0.70	257.25	"

Sl. No	Chainage	W (m)	Wd (m)	L (m)	Assumed canal depth (m)	De-Silting Quantity (m3)	Remarks
472	CH 7065 : CH 7080	24.07	24.07	15.00	0.70	252.74	"
473	CH 7080 : CH 7095	22.65	22.65	15.00	0.70	237.83	"
474	CH 7095 : CH 7110	21.07	21.07	15.00	0.70	221.24	"
475	CH 7110 : CH 7125	24.43	24.43	15.00	0.70	256.46	"
476	CH 7125 : CH 7140	31.75	24.50	15.00	0.70	257.25	"
477	CH 7140 : CH 7155	36.44	24.50	15.00	0.70	257.25	"
478	CH 7155 : CH 7170	40.43	24.50	15.00	0.70	257.25	"
479	CH 7170 : CH 7185	38.78	24.50	15.00	0.70	257.25	"
480	CH 7185 : CH 7200	35.19	24.50	15.00	0.70	257.25	"
481	CH 7200 : CH 7215	33.31	24.50	15.00	0.70	257.25	"
482	CH 7215 : CH 7230	30.07	24.50	15.00	0.70	257.25	"
483	CH 7230 : CH 7245	28.86	24.50	15.00	0.70	257.25	"
484	CH 7245 : CH 7260	25.38	24.50	15.00	0.70	257.25	"
485	CH 7260 : CH 7275	23.07	23.07	15.00	0.70	242.24	"
486	CH 7275 : CH 7290	25.23	24.50	15.00	0.70	257.25	"
487	CH 7290 : CH 7305	27.32	24.50	15.00	0.70	257.25	"
488	CH 7305 : CH 7320	29.60	24.50	15.00	0.70	257.25	"
489	CH 7320 : CH 7335	31.18	24.50	15.00	0.70	257.25	"
490	CH 7335 : CH 7350	31.90	24.50	15.00	0.70	257.25	"
491	CH 7350 : CH 7365	32.63	24.50	15.00	0.70	257.25	"
492	CH 7365 : CH 7380	33.60	24.50	15.00	0.70	257.25	"
493	CH 7380 : CH 7395	33.81	24.50	15.00	0.70	257.25	"
494	CH 7395 : CH 7410	32.98	24.50	15.00	0.70	257.25	"
495	CH 7410 : CH 7425	32.10	24.50	15.00	0.70	257.25	"
496	CH 7425 : CH 7440	31.62	24.50	15.00	0.70	257.25	"

Sl. No	Chainage	W (m)	Wd (m)	L (m)	Assumed canal depth (m)	De-Silting Quantity (m3)	Remarks
497	CH 7440 : CH 7455	31.66	24.50	15.00	0.70	257.25	"
498	CH 7455 : CH 7470	31.95	24.50	15.00	0.70	257.25	"
499	CH 7470 : CH 7485	32.38	24.50	15.00	0.70	257.25	"
500	CH 7485 : CH 7500	32.82	24.50	15.00	0.70	257.25	"
501	CH 7500 : CH 7515	33.93	24.50	15.00	0.70	257.25	"
502	CH 7515 : CH 7530	36.05	24.50	15.00	0.70	257.25	"
503	CH 7530 : CH 7545	37.49	24.50	15.00	0.70	257.25	"
504	CH 7545 : CH 7560	37.40	24.50	15.00	0.70	257.25	"
505	CH 7560 : CH 7575	37.17	24.50	15.00	0.70	257.25	"
506	CH 7575 : CH 7590	36.05	24.50	15.00	0.70	257.25	"
507	CH 7590 : CH 7605	34.35	24.50	15.00	0.70	257.25	"
508	CH 7605 : CH 7620	33.28	24.50	15.00	0.70	257.25	"
509	CH 7620 : CH 7635	32.58	24.50	15.00	0.70	257.25	"
510	CH 7635 : CH 7650	30.59	24.50	15.00	0.70	257.25	"
511	CH 7650 : CH 7665	28.09	24.50	15.00	0.70	257.25	"
512	CH 7665 : CH 7680	27.23	24.50	15.00	0.70	257.25	"
513	CH 7680 : CH 7695	29.32	24.50	15.00	0.70	257.25	"
514	CH 7695 : CH 7710	34.59	24.50	15.00	0.70	257.25	"
515	CH 7710 : CH 7725	39.65	24.50	15.00	0.70	257.25	"
516	CH 7725 : CH 7740	40.30	24.50	15.00	0.70	257.25	"
517	CH 7740 : CH 7755	35.88	24.50	15.00	0.70	257.25	"
518	CH 7755 : CH 7770	31.74	24.50	15.00	0.70	257.25	"
519	CH 7770 : CH 7785	30.17	24.50	15.00	0.70	257.25	"
520	CH 7785 : CH 7800	28.29	24.50	15.00	0.70	257.25	"
521	CH 7800 : CH 7815	26.49	24.50	15.00	0.70	257.25	"

Sl. No	Chainage	W (m)	Wd (m)	L (m)	Assumed canal depth (m)	De-Silting Quantity (m3)	Remarks
522	CH 7815 : CH 7830	27.25	24.50	15.00	0.70	257.25	"
523	CH 7830 : CH 7845	30.46	24.50	15.00	0.70	257.25	"
524	CH 7845 : CH 7860	33.49	24.50	15.00	0.70	257.25	"
525	CH 7860 : CH 7875	34.32	24.50	15.00	0.70	257.25	"
526	CH 7875 : CH 7890	35.31	24.50	15.00	0.70	257.25	"
527	CH 7890 : CH 7905	37.48	24.50	15.00	0.70	257.25	"
528	CH 7905 : CH 7920	37.60	24.50	15.00	0.70	257.25	"
529	CH 7920 : CH 7935	35.09	24.50	15.00	0.70	257.25	"
530	CH 7935 : CH 7950	31.74	24.50	15.00	0.70	257.25	"
531	CH 7950 : CH 7965	29.69	24.50	15.00	0.70	257.25	"
532	CH 7965 : CH 7980	28.84	24.50	15.00	0.70	257.25	"
533	CH 7980 : CH 7995	27.60	24.50	15.00	0.70	257.25	"
534	CH 7995 : CH 8010	26.35	24.50	15.00	0.70	257.25	"
535	CH 8010 : CH 8025	26.52	24.50	15.00	0.70	257.25	"
536	CH 8025 : CH 8040	28.13	24.50	15.00	0.70	257.25	"
537	CH 8040 : CH 8055	28.86	24.50	15.00	0.70	257.25	"
538	CH 8055 : CH 8070	28.56	24.50	15.00	0.70	257.25	"
539	CH 8070 : CH 8085	27.95	24.50	15.00	0.70	257.25	"
540	CH 8085 : CH 8100	27.15	24.50	15.00	0.70	257.25	"
541	CH 8100 : CH 8115	26.84	24.50	15.00	0.70	257.25	"
542	CH 8115 : CH 8130	27.19	24.50	15.00	0.70	257.25	"
543	CH 8130 : CH 8145	28.29	24.50	15.00	0.70	257.25	"
544	CH 8145 : CH 8160	30.64	24.50	15.00	0.70	257.25	"
545	CH 8160 : CH 8175	32.75	24.50	15.00	0.70	257.25	"
546	CH 8175 : CH 8190	32.74	24.50	15.00	0.70	257.25	"

Sl. No	Chainage	W (m)	Wd (m)	L (m)	Assumed canal depth (m)	De-Silting Quantity (m3)	Remarks
547	CH 8190 : CH 8205	31.49	24.50	15.00	0.70	257.25	"
548	CH 8205 : CH 8220	30.26	24.50	15.00	0.70	257.25	"
549	CH 8220 : CH 8235	29.95	24.50	15.00	0.70	257.25	"
550	CH 8235 : CH 8250	32.06	24.50	15.00	0.70	257.25	"
551	CH 8250 : CH 8265	33.65	24.50	15.00	0.70	257.25	"
552	CH 8265 : CH 8280	33.13	24.50	15.00	0.70	257.25	"
553	CH 8280 : CH 8295	33.43	24.50	15.00	0.70	257.25	"
554	CH 8295 : CH 8310	33.12	24.50	15.00	0.70	257.25	"
555	CH 8310 : CH 8325	31.11	24.50	15.00	0.70	257.25	"
556	CH 8325 : CH 8340	30.83	24.50	15.00	0.70	257.25	"
557	CH 8340 : CH 8355	35.54	24.50	15.00	0.70	257.25	"
558	CH 8355 : CH 8370	43.52	24.50	15.00	0.70	257.25	"
559	CH 8370 : CH 8385	54.40	24.50	15.00	0.70	257.25	"
560	CH 8385 : CH 8400	59.05	24.50	15.00	0.70	257.25	"
561	CH 8400 : CH 8415	54.58	24.50	15.00	0.70	257.25	"
562	CH 8415 : CH 8430	53.32	24.50	15.00	0.70	257.25	"
563	CH 8430 : CH 8445	55.61	24.50	15.00	0.70	257.25	"
564	CH 8445 : CH 8460	55.62	24.50	15.00	0.70	257.25	"
565	CH 8460 : CH 8475	55.62	24.50	15.00	0.70	257.25	"
566	CH 8475 : CH 8490	58.77	24.50	15.00	0.70	257.25	"
567	CH 8490 : CH 8505	62.18	24.50	15.00	0.70	257.25	"
568	CH 8505 : CH 8520	62.69	24.50	15.00	0.70	257.25	"
569	CH 8520 : CH 8535	59.54	24.50	15.00	0.70	257.25	"
570	CH 8535 : CH 8550	56.89	24.50	15.00	0.70	257.25	"
571	CH 8550 : CH 8565	55.98	24.50	15.00	0.70	257.25	"

Sl. No	Chainage	W (m)	Wd (m)	L (m)	Assumed canal depth (m)	De-Silting Quantity (m3)	Remarks
572	CH 8565 : CH 8580	54.77	24.50	15.00	0.70	257.25	"
573	CH 8580 : CH 8595	54.40	24.50	15.00	0.70	257.25	"
574	CH 8595 : CH 8610	55.37	24.50	15.00	0.70	257.25	"
575	CH 8610 : CH 8625	56.34	24.50	15.00	0.70	257.25	"
576	CH 8625 : CH 8640	57.13	24.50	15.00	0.70	257.25	"
577	CH 8640 : CH 8655	55.99	24.50	15.00	0.70	257.25	"
578	CH 8655 : CH 8670	52.77	24.50	15.00	0.70	257.25	"
579	CH 8670 : CH 8685	52.29	24.50	15.00	0.70	257.25	"
580	CH 8685 : CH 8700	54.38	24.50	15.00	0.70	257.25	"
581	CH 8700 : CH 8715	56.59	24.50	15.00	0.70	257.25	"
582	CH 8715 : CH 8730	57.65	24.50	15.00	0.70	257.25	"
583	CH 8730 : CH 8745	60.41	24.50	15.00	0.70	257.25	"
584	CH 8745 : CH 8760	72.49	24.50	15.00	0.70	257.25	"
585	CH 8760 : CH 8775	104.23	24.50	15.00	0.70	257.25	"
586	CH 8775 : CH 8790	151.67	24.50	15.00	0.70	257.25	"
587	CH 8790 : CH 8805	170.85	24.50	15.00	0.70	257.25	"
588	CH 8805 : CH 8820	123.65	24.50	15.00	0.70	257.25	"
589	CH 8820 : CH 8835	85.75	24.50	15.00	0.70	257.25	"
590	CH 8835 : CH 8850	77.10	24.50	15.00	0.70	257.25	"
591	CH 8850 : CH 8865	75.48	24.50	15.00	0.70	257.25	"
592	CH 8865 : CH 8880	76.00	24.50	15.00	0.70	257.25	"
593	CH 8880 : CH 8895	76.90	24.50	15.00	0.70	257.25	"
594	CH 8895 : CH 8910	75.81	24.50	15.00	0.70	257.25	"
595	CH 8910 : CH 8925	73.30	24.50	15.00	0.70	257.25	"
596	CH 8925 : CH 8940	71.93	24.50	15.00	0.70	257.25	"

Sl. No	Chainage	W (m)	Wd (m)	L (m)	Assumed canal depth (m)	De-Silting Quantity (m3)	Remarks
597	CH 8940 : CH 8955	69.95	24.50	15.00	0.70	257.25	"
598	CH 8955 : CH 8970	66.09	24.50	15.00	0.70	257.25	"
599	CH 8970 : CH 8985	59.97	24.50	15.00	0.70	257.25	"
600	CH 8985 : CH 9000	54.43	24.50	15.00	0.70	257.25	"
601	CH 9000 : CH 9015	57.70	24.50	15.00	0.70	257.25	"
602	CH 9015 : CH 9030	67.51	24.50	15.00	0.70	257.25	"
603	CH 9030 : CH 9045	81.22	24.50	15.00	0.70	257.25	"
604	CH 9045 : CH 9060	109.44	24.50	15.00	0.70	257.25	"
605	CH 9060 : CH 9075	130.75	24.50	15.00	0.70	257.25	"
606	CH 9075 : CH 9090	134.15	24.50	15.00	0.70	257.25	"
607	CH 9090 : CH 9105	135.61	24.50	15.00	0.70	257.25	"
608	CH 9105 : CH 9120	137.19	24.50	15.00	0.70	257.25	"
609	CH 9120 : CH 9135	119.75	24.50	15.00	0.70	257.25	"
610	CH 9135 : CH 9150	90.99	24.50	15.00	0.70	257.25	"
611	CH 9150 : CH 9165	76.87	24.50	15.00	0.70	257.25	"
612	CH 9165 : CH 9180	69.45	24.50	15.00	0.70	257.25	"
613	CH 9180 : CH 9195	65.55	24.50	15.00	0.70	257.25	"
614	CH 9195 : CH 9210	63.63	24.50	15.00	0.70	257.25	"
615	CH 9210 : CH 9225	61.47	24.50	15.00	0.70	257.25	"
616	CH 9225 : CH 9240	58.99	24.50	15.00	0.70	257.25	"
617	CH 9240 : CH 9255	57.22	24.50	15.00	0.70	257.25	"
618	CH 9255 : CH 9270	57.36	24.50	15.00	0.70	257.25	"
619	CH 9270 : CH 9285	54.06	24.50	15.00	0.70	257.25	"
620	CH 9285 : CH 9300	50.88	24.50	15.00	0.70	257.25	"
621	CH 9300 : CH 9315	52.38	24.50	15.00	0.70	257.25	"

Sl. No	Chainage	W (m)	Wd (m)	L (m)	Assumed canal depth (m)	De-Silting Quantity (m3)	Remarks
622	CH 9315 : CH 9330	53.14	24.50	15.00	0.70	257.25	"
623	CH 9330 : CH 9345	53.63	24.50	15.00	0.70	257.25	"
624	CH 9345 : CH 9360	53.80	24.50	15.00	0.70	257.25	"
625	CH 9360 : CH 9375	53.55	24.50	15.00	0.70	257.25	"
626	CH 9375 : CH 9390	52.78	24.50	15.00	0.70	257.25	"
627	CH 9390 : CH 9405	51.34	24.50	15.00	0.70	257.25	"
628	CH 9405 : CH 9420	51.09	24.50	15.00	0.70	257.25	"
629	CH 9420 : CH 9435	53.12	24.50	15.00	0.70	257.25	"
630	CH 9435 : CH 9450	56.15	24.50	15.00	0.70	257.25	"
631	CH 9450 : CH 9465	57.10	24.50	15.00	0.70	257.25	"
632	CH 9465 : CH 9480	55.42	24.50	15.00	0.70	257.25	"
633	CH 9480 : CH 9495	51.78	24.50	15.00	0.70	257.25	"
634	CH 9495 : CH 9510	48.21	24.50	15.00	0.70	257.25	"
635	CH 9510 : CH 9525	46.71	24.50	15.00	0.70	257.25	"
636	CH 9525 : CH 9540	47.83	24.50	15.00	0.70	257.25	"
637	CH 9540 : CH 9555	49.60	24.50	15.00	0.70	257.25	"
638	CH 9555 : CH 9570	49.72	24.50	15.00	0.70	257.25	"
639	CH 9570 : CH 9585	49.51	24.50	15.00	0.70	257.25	"
640	CH 9585 : CH 9600	50.16	24.50	15.00	0.70	257.25	"
641	CH 9600 : CH 9615	51.15	24.50	15.00	0.70	257.25	"
642	CH 9615 : CH 9630	51.80	24.50	15.00	0.70	257.25	"
643	CH 9630 : CH 9645	52.38	24.50	15.00	0.70	257.25	"
644	CH 9645 : CH 9660	52.92	24.50	15.00	0.70	257.25	"
645	CH 9660 : CH 9675	53.42	24.50	15.00	0.70	257.25	"
646	CH 9675 : CH 9690	53.90	24.50	15.00	0.70	257.25	"

Sl. No	Chainage	W (m)	Wd (m)	L (m)	Assumed canal depth (m)	De-Silting Quantity (m3)	Remarks
647	CH 9690 : CH 9705	54.16	24.50	15.00	0.70	257.25	"
648	CH 9705 : CH 9720	53.65	24.50	15.00	0.70	257.25	"
649	CH 9720 : CH 9735	52.49	24.50	15.00	0.70	257.25	"
650	CH 9735 : CH 9750	51.68	24.50	15.00	0.70	257.25	"
651	CH 9750 : CH 9765	51.52	24.50	15.00	0.70	257.25	"
652	CH 9765 : CH 9780	52.07	24.50	15.00	0.70	257.25	"
653	CH 9780 : CH 9795	52.24	24.50	15.00	0.70	257.25	"
654	CH 9795 : CH 9810	50.76	24.50	15.00	0.70	257.25	"
655	CH 9810 : CH 9825	48.37	24.50	15.00	0.70	257.25	"
656	CH 9825 : CH 9840	47.51	24.50	15.00	0.70	257.25	"
657	CH 9840 : CH 9855	49.73	24.50	15.00	0.70	257.25	"
658	CH 9855 : CH 9870	53.46	24.50	15.00	0.70	257.25	"
659	CH 9870 : CH 9885	56.92	24.50	15.00	0.70	257.25	"
660	CH 9885 : CH 9900	58.96	24.50	15.00	0.70	257.25	"
661	CH 9900 : CH 9915	57.04	24.50	15.00	0.70	257.25	"
662	CH 9915 : CH 9930	56.69	24.50	15.00	0.70	257.25	"
663	CH 9930 : CH 9945	56.62	24.50	15.00	0.70	257.25	"
664	CH 9945 : CH 9960	53.61	24.50	15.00	0.70	257.25	"
665	CH 9960 : CH 9975	53.16	24.50	15.00	0.70	257.25	"
666	CH 9975 : CH 9990	57.48	24.50	15.00	0.70	257.25	"
667	CH 9990 : CH 10005	60.38	24.50	15.00	0.70	257.25	"
668	CH 10005 : CH 10020	61.92	24.50	15.00	0.70	257.25	"
669	CH 10020 : CH 10035	64.26	24.50	15.00	0.70	257.25	"
670	CH 10035 : CH 10050	65.02	24.50	15.00	0.70	257.25	"
671	CH 10050 : CH 10065	62.78	24.50	15.00	0.70	257.25	"

Sl. No	Chainage	W (m)	Wd (m)	L (m)	Assumed canal depth (m)	De-Silting Quantity (m3)	Remarks
672	CH 10065 : CH 10080	60.81	24.50	15.00	0.70	257.25	"
673	CH 10080 : CH 10095	57.15	24.50	15.00	0.70	257.25	"
674	CH 10095 : CH 10110	51.61	24.50	15.00	0.70	257.25	"
675	CH 10110 : CH 10125	47.21	24.50	15.00	0.70	257.25	"
676	CH 10125 : CH 10140	45.93	24.50	15.00	0.70	257.25	"
677	CH 10140 : CH 10155	46.08	24.50	15.00	0.70	257.25	"
678	CH 10155 : CH 10170	46.44	24.50	15.00	0.70	257.25	"
679	CH 10170 : CH 10185	48.74	24.50	15.00	0.70	257.25	"
680	CH 10185 : CH 10200	51.79	24.50	15.00	0.70	257.25	"
681	CH 10200 : CH 10215	54.59	24.50	15.00	0.70	257.25	"
682	CH 10215 : CH 10230	56.04	24.50	15.00	0.70	257.25	"
683	CH 10230 : CH 10245	56.17	24.50	15.00	0.70	257.25	"
684	CH 10245 : CH 10260	57.95	24.50	15.00	0.70	257.25	"
685	CH 10260 : CH 10275	55.06	24.50	15.00	0.70	257.25	"
686	CH 10275 : CH 10290	52.91	24.50	15.00	0.70	257.25	"
687	CH 10290 : CH 10305	54.13	24.50	15.00	0.70	257.25	"
688	CH 10305 : CH 10320	52.86	24.50	15.00	0.70	257.25	"
689	CH 10320 : CH 10335	52.69	24.50	15.00	0.70	257.25	"
690	CH 10335 : CH 10350	51.89	24.50	15.00	0.70	257.25	"
691	CH 10350 : CH 10365	52.13	24.50	15.00	0.70	257.25	"
692	CH 10365 : CH 10380	53.94	24.50	15.00	0.70	257.25	"
693	CH 10380 : CH 10395	54.60	24.50	15.00	0.70	257.25	"
694	CH 10395 : CH 10410	54.10	24.50	15.00	0.70	257.25	"
695	CH 10410 : CH 10425	51.91	24.50	15.00	0.70	257.25	"
696	CH 10425 : CH 10440	51.34	24.50	15.00	0.70	257.25	"

Sl. No	Chainage	W (m)	Wd (m)	L (m)	Assumed canal depth (m)	De-Silting Quantity (m3)	Remarks
697	CH 10440 : CH 10455	52.68	24.50	15.00	0.70	257.25	"
698	CH 10455 : CH 10470	53.79	24.50	15.00	0.70	257.25	"
699	CH 10470 : CH 10485	55.46	24.50	15.00	0.70	257.25	"
700	CH 10485 : CH 10500	55.82	24.50	15.00	0.70	257.25	"
701	CH 10500 : CH 10515	55.04	24.50	15.00	0.70	257.25	"
702	CH 10515 : CH 10530	55.55	24.50	15.00	0.70	257.25	"
703	CH 10530 : CH 10545	55.62	24.50	15.00	0.70	257.25	"
704	CH 10545 : CH 10560	55.13	24.50	15.00	0.70	257.25	"
705	CH 10560 : CH 10575	59.01	24.50	15.00	0.70	257.25	"
706	CH 10575 : CH 10590	59.79	24.50	15.00	0.70	257.25	"
707	CH 10590 : CH 10605	55.46	24.50	15.00	0.70	257.25	"
708	CH 10605 : CH 10620	55.63	24.50	15.00	0.70	257.25	"
709	CH 10620 : CH 10635	57.68	24.50	15.00	0.70	257.25	"
710	CH 10635 : CH 10650	57.25	24.50	15.00	0.70	257.25	"
711	CH 10650 : CH 10665	56.52	24.50	15.00	0.70	257.25	"
712	CH 10665 : CH 10680	56.77	24.50	15.00	0.70	257.25	"
713	CH 10680 : CH 10695	58.15	24.50	15.00	0.70	257.25	"
714	CH 10695 : CH 10710	60.01	24.50	15.00	0.70	257.25	"
715	CH 10710 : CH 10725	60.64	24.50	15.00	0.70	257.25	"
716	CH 10725 : CH 10740	61.17	24.50	15.00	0.70	257.25	"
717	CH 10740 : CH 10755	62.15	24.50	15.00	0.70	257.25	"
718	CH 10755 : CH 10770	59.80	24.50	15.00	0.70	257.25	"
719	CH 10770 : CH 10785	58.50	24.50	15.00	0.70	257.25	"
720	CH 10785 : CH 10800	60.70	24.50	15.00	0.70	257.25	"
721	CH 10800 : CH 10815	62.81	24.50	15.00	0.70	257.25	"

Sl. No	Chainage	W (m)	Wd (m)	L (m)	Assumed canal depth (m)	De-Silting Quantity (m3)	Remarks
722	CH 10815 : CH 10830	66.72	24.50	15.00	0.70	257.25	"
723	CH 10830 : CH 10845	68.60	24.50	15.00	0.70	257.25	"
724	CH 10845 : CH 10860	66.62	24.50	15.00	0.70	257.25	"
725	CH 10860 : CH 10875	65.68	24.50	15.00	0.70	257.25	"
726	CH 10875 : CH 10890	64.89	24.50	15.00	0.70	257.25	"
727	CH 10890 : CH 10905	63.02	24.50	15.00	0.70	257.25	"
728	CH 10905 : CH 10920	62.80	24.50	15.00	0.70	257.25	"
729	CH 10920 : CH 10935	63.22	24.50	15.00	0.70	257.25	"
730	CH 10935 : CH 10950	64.11	24.50	15.00	0.70	257.25	"
731	CH 10950 : CH 10965	68.17	24.50	15.00	0.70	257.25	"
732	CH 10965 : CH 10980	76.45	24.50	15.00	0.70	257.25	"
733	CH 10980 : CH 10995	88.04	24.50	15.00	0.70	257.25	"
734	CH 10995 : CH 11010	94.56	24.50	15.00	0.70	257.25	"
735	CH 11010 : CH 11025	95.31	24.50	15.00	0.70	257.25	"
736	CH 11025 : CH 11040	99.38	24.50	15.00	0.70	257.25	"
737	CH 11040 : CH 11055	106.00	24.50	15.00	0.70	257.25	"
738	CH 11055 : CH 11070	112.14	24.50	15.00	0.70	257.25	"
739	CH 11070 : CH 11085	99.65	24.50	15.00	0.70	257.25	"
740	CH 11085 : CH 11100	77.99	24.50	15.00	0.70	257.25	"
741	CH 11100 : CH 11115	65.67	24.50	15.00	0.70	257.25	"
742	CH 11115 : CH 11130	51.92	24.50	15.00	0.70	257.25	"
743	CH 11130 : CH 11145	43.00	24.50	15.00	0.70	257.25	"
744	CH 11145 : CH 11160	40.66	24.50	15.00	0.70	257.25	"
745	CH 11160 : CH 11175	41.17	24.50	15.00	0.70	257.25	"
746	CH 11175 : CH 11190	47.27	24.50	15.00	0.70	257.25	"

Sl. No	Chainage	W (m)	Wd (m)	L (m)	Assumed canal depth (m)	De-Silting Quantity (m3)	Remarks
747	CH 11190 : CH 11205	55.83	24.50	15.00	0.70	257.25	"
748	CH 11205 : CH 11220	64.05	24.50	15.00	0.70	257.25	"
749	CH 11220 : CH 11231	80.60	24.50	11.00	0.70	188.65	"
	Total Quantity					**1,49,744.84**	
	Deepening quantity of subcanals (14 nos)	3.78		14890.00	0.30	16862.93	
	Grand Total					**1,66,607.77**	

1.2 Chilavanoor Canal

Table 3: Deepening details of Chilavanoor Canal

Sl.No	Chainage	W (m)	Wd	L (m)	Assumed canal depth (m)	De-Silting Quantity (m3)	Remarks
1	CH 0 : CH 15	51.29	24.50	15.00	0.70	257.25	w>16.50
2	CH 15 : CH 30	42.05	24.50	15.00	0.70	257.25	"
3	CH 30 : CH 45	29.99	24.50	15.00	1.00	367.50	"
4	CH 45 : CH 60	22.39	22.39	15.00	1.00	335.87	"
5	CH 60 : CH 75	20.58	20.58	15.00	1.00	308.64	"
6	CH 75 : CH 90	21.77	21.77	15.00	1.00	326.61	"
7	CH 90 : CH 105	23.82	23.82	15.00	1.00	357.37	"
8	CH 105 : CH 120	25.31	24.50	15.00	1.00	367.50	"
9	CH 120 : CH 135	27.15	24.50	15.00	1.00	367.50	"
10	CH 135 : CH 150	29.08	24.50	15.00	1.00	367.50	"
11	CH 150 : CH 165	30.42	24.50	15.00	1.00	367.50	"
12	CH 165 : CH 180	29.31	24.50	15.00	1.00	367.50	"
13	CH 180 : CH 195	24.12	24.12	15.00	1.20	434.21	"
14	CH 195 : CH 210	18.15	18.15	15.00	1.20	326.75	"
15	CH 210 : CH 225	16.50	16.50	15.00	1.20	296.96	
16	CH 225 : CH 240	16.93	16.93	15.00	1.20	304.78	"
17	CH 240 : CH 255	17.00	17.00	15.00	1.20	305.92	"
18	CH 255 : CH 270	17.07	17.07	15.00	1.20	307.32	"
19	CH 270 : CH 285	18.97	18.97	15.00	1.20	341.51	"
20	CH 285 : CH 300	20.54	20.54	15.00	1.20	369.68	"
21	CH 300 : CH 315	19.79	19.79	15.00	1.20	356.20	"

Sl.No	Chainage	W (m)	Wd	L (m)	Assumed canal depth (m)	De-Silting Quantity (m3)	Remarks
22	CH 315 : CH 330	19.15	19.15	15.00	1.20	344.77	"
23	CH 330 : CH 345	20.83	20.83	15.00	1.20	374.90	"
24	CH 345 : CH 360	22.09	22.09	15.00	1.20	397.55	"
25	CH 360 : CH 375	17.48	17.48	15.00	1.20	314.59	
26	CH 375 : CH 390	13.66	13.66	15.00	1.20	245.80	
27	CH 390 : CH 405	11.85	11.85	15.00	1.20	213.38	
28	CH 405 : CH 420	17.18	17.18	15.00	1.20	309.17	
29	CH 420 : CH 435	18.56	18.56	15.00	1.20	334.08	"
30	CH 435 : CH 450	18.85	18.85	15.00	1.20	339.37	"
31	CH 450 : CH 465	19.43	19.43	15.00	1.20	349.65	"
32	CH 465 : CH 480	20.37	20.37	15.00	1.20	366.71	"
33	CH 480 : CH 495	20.83	20.83	15.00	1.20	374.85	"
34	CH 495 : CH 510	18.48	18.48	15.00	1.20	332.65	"
35	CH 510 : CH 525	19.74	19.74	15.00	1.20	355.37	"
36	CH 525 : CH 540	26.37	24.50	15.00	1.20	441.00	"
37	CH 540 : CH 555	29.15	24.50	15.00	1.20	441.00	"
38	CH 555 : CH 570	28.47	24.50	15.00	1.20	441.00	"
39	CH 570 : CH 585	27.46	24.50	15.00	1.20	441.00	"
40	CH 585 : CH 600	26.20	24.50	15.00	1.20	441.00	"
41	CH 600 : CH 615	24.68	24.50	15.00	1.20	441.00	"
42	CH 615 : CH 630	24.59	24.50	15.00	1.20	441.00	"
43	CH 630 : CH 645	24.35	24.35	15.00	1.20	438.30	"
44	CH 645 : CH 660	22.08	22.08	15.00	1.20	397.46	"
45	CH 660 : CH 675	18.79	18.79	15.00	1.20	338.22	"

Sl.No	Chainage	W (m)	Wd	L (m)	Assumed canal depth (m)	De-Silting Quantity (m3)	Remarks
46	CH 675 : CH 690	16.30	16.30	15.00	1.20	293.43	
47	CH 690 : CH 705	15.60	15.60	15.00	1.20	280.88	
48	CH 705 : CH 720	14.02	14.02	15.00	1.20	252.34	
49	CH 720 : CH 735	13.23	13.23	15.00	1.20	238.14	
50	CH 735 : CH 750	14.39	14.39	15.00	1.20	259.00	
51	CH 750 : CH 765	15.36	15.36	15.00	1.20	276.44	
52	CH 765 : CH 780	15.37	15.37	15.00	1.20	276.64	
53	CH 780 : CH 795	15.51	15.51	15.00	1.20	279.23	
54	CH 795 : CH 810	15.68	15.68	15.00	1.20	282.20	
55	CH 810 : CH 825	15.58	15.58	15.00	1.20	280.51	
56	CH 825 : CH 840	15.47	15.47	15.00	1.20	278.49	
57	CH 840 : CH 855	15.38	15.38	15.00	1.20	276.79	
58	CH 855 : CH 870	15.73	15.73	15.00	1.20	283.10	
59	CH 870 : CH 885	16.75	16.75	15.00	1.20	301.52	"
60	CH 885 : CH 900	17.08	17.08	15.00	1.20	307.37	"
61	CH 900 : CH 915	16.25	16.25	15.00	1.20	292.52	
62	CH 915 : CH 930	15.66	15.66	15.00	1.20	281.92	
63	CH 930 : CH 945	15.54	15.54	15.00	1.20	279.75	
64	CH 945 : CH 960	17.53	17.53	15.00	1.20	315.61	"
65	CH 960 : CH 975	19.95	19.95	15.00	1.20	359.07	"
66	CH 975 : CH 990	18.49	18.49	15.00	1.20	332.83	"
67	CH 990 : CH 1005	15.62	15.62	15.00	1.20	281.21	
68	CH 1005 : CH 1020	13.86	13.86	15.00	1.20	249.50	
69	CH 1020 : CH 1035	13.52	13.52	15.00	1.20	243.31	

Sl.No	Chainage	W (m)	Wd	L (m)	Assumed canal depth (m)	De-Silting Quantity (m3)	Remarks
70	CH 1035 : CH 1050	14.22	14.22	15.00	1.20	255.96	
71	CH 1050 : CH 1065	14.35	14.35	15.00	1.20	258.24	
72	CH 1065 : CH 1080	13.77	13.77	15.00	1.20	247.91	
73	CH 1080 : CH 1095	13.04	13.04	15.00	1.20	234.71	
74	CH 1095 : CH 1110	12.50	12.50	15.00	1.20	224.96	
75	CH 1110 : CH 1125	12.02	12.02	15.00	1.20	216.43	
76	CH 1125 : CH 1140	11.41	11.41	15.00	1.20	205.43	
77	CH 1140 : CH 1155	11.46	11.46	15.00	1.20	206.19	
78	CH 1155 : CH 1170	12.60	12.60	15.00	1.20	226.74	
79	CH 1170 : CH 1185	14.03	14.03	15.00	1.20	252.56	
80	CH 1185 : CH 1200	15.37	15.37	15.00	1.20	276.68	
81	CH 1200 : CH 1215	16.89	16.89	15.00	1.20	303.96	
82	CH 1215 : CH 1230	17.82	17.82	15.00	1.20	320.84	"
83	CH 1230 : CH 1245	16.72	16.72	15.00	1.20	301.00	
84	CH 1245 : CH 1260	15.29	15.29	15.00	1.20	275.29	
85	CH 1260 : CH 1275	14.23	14.23	15.00	1.20	256.13	
86	CH 1275 : CH 1290	13.40	13.40	15.00	1.20	241.25	
87	CH 1290 : CH 1305	13.59	13.59	15.00	1.20	244.63	
88	CH 1305 : CH 1320	14.40	14.40	15.00	1.20	259.17	
89	CH 1320 : CH 1335	16.36	16.36	15.00	1.20	294.39	
90	CH 1335 : CH 1350	20.22	20.22	15.00	1.20	363.96	"
91	CH 1350 : CH 1365	18.57	18.57	15.00	1.20	334.34	"
92	CH 1365 : CH 1380	12.24	12.24	15.00	1.20	220.31	
93	CH 1380 : CH 1395	9.83	9.83	15.00	1.20	176.89	

Sl.No	Chainage	W (m)	Wd	L (m)	Assumed canal depth (m)	De-Silting Quantity (m3)	Remarks
94	CH 1395 : CH 1410	9.42	9.42	15.00	1.20	169.52	
95	CH 1410 : CH 1425	9.92	9.92	15.00	1.20	178.59	
96	CH 1425 : CH 1440	11.30	11.30	15.00	1.20	203.33	
97	CH 1440 : CH 1455	11.56	11.56	15.00	1.20	208.10	
98	CH 1455 : CH 1470	10.54	10.54	15.00	1.20	189.66	
99	CH 1470 : CH 1485	9.35	9.35	15.00	1.20	168.26	
100	CH 1485 : CH 1500	8.96	8.96	15.00	1.20	161.30	
101	CH 1500 : CH 1515	8.98	8.98	15.00	1.20	161.69	
102	CH 1515 : CH 1530	9.77	9.77	15.00	1.20	175.92	
103	CH 1530 : CH 1545	10.74	10.74	15.00	1.20	193.38	
104	CH 1545 : CH 1560	11.20	11.20	15.00	1.20	201.59	
105	CH 1560 : CH 1575	12.88	12.88	15.00	1.20	231.82	
106	CH 1575 : CH 1590	14.52	14.52	15.00	1.20	261.41	
107	CH 1590 : CH 1605	15.35	15.35	15.00	1.20	276.29	
108	CH 1605 : CH 1620	16.03	16.03	15.00	1.20	288.58	
109	CH 1620 : CH 1635	16.47	16.47	15.00	1.20	296.47	
110	CH 1635 : CH 1650	16.31	16.31	15.00	1.20	293.62	
111	CH 1650 : CH 1665	15.26	15.26	15.00	1.20	274.62	
112	CH 1665 : CH 1680	13.84	13.84	15.00	1.20	249.13	
113	CH 1680 : CH 1695	12.98	12.98	15.00	1.20	233.69	
114	CH 1695 : CH 1710	12.51	12.51	15.00	1.20	225.21	
115	CH 1710 : CH 1725	11.53	11.53	15.00	1.20	207.52	
116	CH 1725 : CH 1740	11.12	11.12	15.00	1.20	200.23	
117	CH 1740 : CH 1755	11.51	11.51	15.00	1.20	207.10	

Sl.No	Chainage	W (m)	Wd	L (m)	Assumed canal depth (m)	De-Silting Quantity (m3)	Remarks
118	CH 1755 : CH 1770	11.41	11.41	15.00	1.20	205.29	
119	CH 1770 : CH 1785	11.59	11.59	15.00	1.20	208.64	
120	CH 1785 : CH 1800	12.29	12.29	15.00	1.20	221.14	
121	CH 1800 : CH 1815	12.42	12.42	15.00	1.20	223.52	
122	CH 1815 : CH 1830	12.06	12.06	15.00	1.20	217.08	
123	CH 1830 : CH 1845	11.43	11.43	15.00	1.20	205.78	
124	CH 1845 : CH 1860	10.59	10.59	15.00	1.20	190.66	
125	CH 1860 : CH 1875	10.04	10.04	15.00	1.20	180.75	
126	CH 1875 : CH 1890	9.13	9.13	15.00	1.20	164.30	
127	CH 1890 : CH 1905	8.62	8.62	15.00	1.20	155.11	
128	CH 1905 : CH 1920	8.70	8.70	15.00	1.20	156.56	
129	CH 1920 : CH 1935	8.62	8.62	15.00	1.20	155.09	
130	CH 1935 : CH 1950	8.78	8.78	15.00	1.20	157.97	
131	CH 1950 : CH 1965	8.96	8.96	15.00	1.20	161.27	
132	CH 1965 : CH 1980	8.99	8.99	15.00	1.20	161.86	
133	CH 1980 : CH 1995	8.47	8.47	15.00	1.20	152.53	
134	CH 1995 : CH 2010	7.58	7.58	15.00	1.20	136.47	
135	CH 2010 : CH 2025	6.69	6.69	15.00	1.20	120.46	
136	CH 2025 : CH 2040	5.97	5.97	15.00	1.20	107.41	
137	CH 2040 : CH 2055	6.11	6.11	15.00	1.20	109.95	
138	CH 2055 : CH 2070	6.74	6.74	15.00	1.20	121.27	
139	CH 2070 : CH 2085	6.53	6.53	15.00	1.20	117.59	
140	CH 2085 : CH 2100	6.19	6.19	15.00	1.20	111.49	
141	CH 2100 : CH 2115	6.26	6.26	15.00	1.20	112.66	

Sl.No	Chainage	W (m)	Wd	L (m)	Assumed canal depth (m)	De-Silting Quantity (m3)	Remarks
142	CH 2115 : CH 2130	6.03	6.03	15.00	1.20	108.61	
143	CH 2130 : CH 2145	5.52	5.52	15.00	1.20	99.29	
144	CH 2145 : CH 2160	5.50	5.50	15.00	1.20	99.07	
145	CH 2160 : CH 2175	5.46	5.46	15.00	1.20	98.29	
146	CH 2175 : CH 2190	5.18	5.18	15.00	1.20	93.29	
147	CH 2190 : CH 2205	5.72	5.72	15.00	1.20	102.88	
148	CH 2205 : CH 2220	6.07	6.07	15.00	1.20	109.30	
149	CH 2220 : CH 2235	6.03	6.03	15.00	1.20	108.60	
150	CH 2235 : CH 2250	5.28	5.28	15.00	1.20	94.95	
151	CH 2250 : CH 2265	5.47	5.47	15.00	1.20	98.46	
152	CH 2265 : CH 2280	6.25	6.25	15.00	1.20	112.46	
153	CH 2280 : CH 2295	5.53	5.53	15.00	1.20	99.60	
154	CH 2295 : CH 2310	5.72	5.72	15.00	1.20	102.99	
155	CH 2310 : CH 2325	6.14	6.14	15.00	1.20	110.56	
156	CH 2325 : CH 2340	6.11	6.11	15.00	1.20	110.03	
157	CH 2340 : CH 2355	6.42	6.42	15.00	1.20	115.50	
158	CH 2355 : CH 2370	5.67	5.67	15.00	1.20	102.03	
159	CH 2370 : CH 2385	4.56	4.56	15.00	1.20	82.13	
160	CH 2385 : CH 2400	4.53	4.53	15.00	1.20	81.56	
161	CH 2400 : CH 2415	5.10	5.10	15.00	1.20	91.84	
162	CH 2415 : CH 2430	5.10	5.10	15.00	1.20	91.84	
163	CH 2430 : CH 2445	4.43	4.43	15.00	1.20	79.66	
164	CH 2445 : CH 2460	4.71	4.71	15.00	1.20	84.75	
165	CH 2460 : CH 2475	5.03	5.03	15.00	1.20	90.45	

Sl.No	Chainage	W (m)	Wd	L (m)	Assumed canal depth (m)	De-Silting Quantity (m3)	Remarks
166	CH 2475 : CH 2490	4.51	4.51	15.00	1.20	81.11	
167	CH 2490 : CH 2505	4.42	4.42	15.00	1.20	79.50	
168	CH 2505 : CH 2520	5.17	5.17	15.00	1.20	93.12	
169	CH 2520 : CH 2535	5.41	5.41	15.00	1.20	97.43	
170	CH 2535 : CH 2550	4.82	4.82	15.00	1.20	86.73	
171	CH 2550 : CH 2565	4.82	4.82	15.00	1.20	86.74	
172	CH 2565 : CH 2580	5.28	5.28	15.00	1.20	95.08	
173	CH 2580 : CH 2595	5.48	5.48	15.00	1.20	98.70	
174	CH 2595 : CH 2610	5.36	5.36	15.00	1.20	96.44	
175	CH 2610 : CH 2625	5.28	5.28	15.00	1.20	95.00	
176	CH 2625 : CH 2640	5.00	5.00	15.00	1.20	90.06	
177	CH 2640 : CH 2655	4.92	4.92	15.00	1.20	88.48	
178	CH 2655 : CH 2670	5.44	5.44	15.00	1.20	97.97	
179	CH 2670 : CH 2685	5.44	5.44	15.00	1.20	97.95	
180	CH 2685 : CH 2700	4.51	4.51	15.00	1.20	81.18	
181	CH 2700 : CH 2715	3.92	3.92	15.00	1.20	70.61	
182	CH 2715 : CH 2730	4.12	4.12	15.00	1.20	74.09	
183	CH 2730 : CH 2745	4.24	4.24	15.00	1.20	76.39	
184	CH 2745 : CH 2760	3.92	3.92	15.00	1.20	70.61	
185	CH 2760 : CH 2775	3.55	3.55	15.00	1.20	63.86	
186	CH 2775 : CH 2790	3.50	3.50	15.00	1.20	62.99	
187	CH 2790 : CH 2805	3.77	3.77	15.00	1.20	67.84	
188	CH 2805 : CH 2820	3.86	3.86	15.00	1.20	69.50	
189	CH 2820 : CH 2835	3.72	3.72	15.00	1.20	67.03	

Sl.No	Chainage	W (m)	Wd	L (m)	Assumed canal depth (m)	De-Silting Quantity (m3)	Remarks
190	CH 2835 : CH 2850	3.66	3.66	15.00	1.20	65.84	
191	CH 2850 : CH 2865	3.73	3.73	15.00	1.20	67.06	
192	CH 2865 : CH 2880	3.82	3.82	15.00	1.20	68.75	
193	CH 2880 : CH 2895	3.57	3.57	15.00	1.20	64.21	
194	CH 2895 : CH 2910	3.40	3.40	15.00	1.20	61.12	
195	CH 2910 : CH 2925	3.30	3.30	15.00	1.20	59.36	
196	CH 2925 : CH 2940	3.42	3.42	15.00	1.20	61.58	
197	CH 2940 : CH 2955	3.72	3.72	15.00	1.20	67.03	
198	CH 2955 : CH 2970	3.70	3.70	15.00	1.20	66.62	
199	CH 2970 : CH 2985	3.65	3.65	15.00	1.20	65.63	
200	CH 2985 : CH 3000	3.62	3.62	15.00	1.20	65.09	
201	CH 3000 : CH 3015	3.57	3.57	15.00	1.20	64.28	
202	CH 3015 : CH 3030	3.40	3.40	15.00	1.20	61.17	
203	CH 3030 : CH 3045	3.12	3.12	15.00	1.20	56.13	
204	CH 3045 : CH 3060	3.31	3.31	15.00	1.20	59.56	
205	CH 3060 : CH 3075	3.75	3.75	15.00	1.20	67.49	
206	CH 3075 : CH 3090	3.54	3.54	15.00	1.20	63.74	
207	CH 3090 : CH 3105	3.13	3.13	15.00	1.20	56.40	
208	CH 3105 : CH 3120	3.11	3.11	15.00	1.20	55.94	
209	CH 3120 : CH 3135	3.20	3.20	15.00	1.20	57.55	
210	CH 3135 : CH 3150	3.08	3.08	15.00	1.20	55.51	
211	CH 3150 : CH 3165	3.02	3.02	15.00	1.20	54.28	
212	CH 3165 : CH 3180	3.21	3.21	15.00	1.20	57.72	
213	CH 3180 : CH 3195	3.32	3.32	15.00	1.20	59.68	

Sl.No	Chainage	W (m)	Wd	L (m)	Assumed canal depth (m)	De-Silting Quantity (m3)	Remarks
214	CH 3195 : CH 3210	3.07	3.07	15.00	1.20	55.32	
215	CH 3210 : CH 3225	3.12	3.12	15.00	1.20	56.07	
216	CH 3225 : CH 3240	3.11	3.11	15.00	1.20	55.94	
217	CH 3240 : CH 3255	3.05	3.05	15.00	1.20	54.91	
218	CH 3255 : CH 3270	3.13	3.13	15.00	1.20	56.41	
219	CH 3270 : CH 3285	3.17	3.17	15.00	1.20	57.06	
220	CH 3285 : CH 3300	3.27	3.27	15.00	1.20	58.80	
221	CH 3300 : CH 3315	3.24	3.24	15.00	1.20	58.40	
222	CH 3315 : CH 3330	3.03	3.03	15.00	1.20	54.53	
223	CH 3330 : CH 3345	3.22	3.22	15.00	1.20	58.04	
224	CH 3345 : CH 3360	3.38	3.38	15.00	1.20	60.87	
225	CH 3360 : CH 3375	2.86	2.86	15.00	1.20	51.51	
226	CH 3375 : CH 3390	2.77	2.77	15.00	1.20	49.87	
227	CH 3390 : CH 3405	3.39	3.39	15.00	1.20	61.03	
228	CH 3405 : CH 3420	3.72	3.72	15.00	1.20	66.92	
229	CH 3420 : CH 3435	2.82	2.82	15.00	1.20	50.81	
230	CH 3435 : CH 3450	2.31	2.31	15.00	1.20	41.49	
231	CH 3450 : CH 3465	2.27	2.27	15.00	1.20	40.82	
232	CH 3465 : CH 3480	2.29	2.29	15.00	1.20	41.17	
233	CH 3480 : CH 3495	2.51	2.51	15.00	1.20	45.12	
234	CH 3495 : CH 3510	2.57	2.57	15.00	1.20	46.27	
235	CH 3510 : CH 3525	2.49	2.49	15.00	1.20	44.80	
236	CH 3525 : CH 3540	2.43	2.43	15.00	1.20	43.74	
237	CH 3540 : CH 3555	2.56	2.56	15.00	1.20	46.07	

Sl.No	Chainage	W (m)	Wd	L (m)	Assumed canal depth (m)	De-Silting Quantity (m3)	Remarks
238	CH 3555 : CH 3570	2.48	2.48	15.00	1.20	44.55	
239	CH 3570 : CH 3585	2.52	2.52	15.00	1.20	45.42	
240	CH 3585 : CH 3600	2.59	2.59	15.00	1.20	46.63	
241	CH 3600 : CH 3615	2.43	2.43	15.00	1.20	43.68	
242	CH 3615 : CH 3630	2.20	2.20	15.00	1.20	39.53	
243	CH 3630 : CH 3645	2.14	2.14	15.00	1.20	38.57	
244	CH 3645 : CH 3660	2.11	2.11	15.00	1.20	37.91	
245	CH 3660 : CH 3675	2.01	2.01	15.00	1.20	36.14	
246	CH 3675 : CH 3690	2.40	2.40	15.00	1.20	43.20	
247	CH 3690 : CH 3705	2.99	2.99	15.00	1.20	53.89	
248	CH 3705 : CH 3720	3.16	3.16	15.00	1.20	56.79	
249	CH 3720 : CH 3735	2.61	2.61	15.00	1.20	46.92	
250	CH 3735 : CH 3750	2.10	2.10	15.00	1.20	37.71	
251	CH 3750 : CH 3765	2.12	2.12	15.00	1.20	38.10	
252	CH 3765 : CH 3780	2.82	2.82	15.00	1.20	50.75	
253	CH 3780 : CH 3795	3.47	3.47	15.00	1.20	62.42	
254	CH 3795 : CH 3810	3.54	3.54	15.00	1.20	63.77	
255	CH 3810 : CH 3825	3.46	3.46	15.00	1.20	62.23	
256	CH 3825 : CH 3840	3.10	3.10	15.00	1.20	55.76	
257	CH 3840 : CH 3855	2.78	2.78	15.00	1.20	50.09	
258	CH 3855 : CH 3870	2.76	2.76	15.00	1.20	49.75	
259	CH 3870 : CH 3885	3.39	3.39	15.00	1.20	61.01	
260	CH 3885 : CH 3900	3.27	3.27	15.00	1.20	58.77	
261	CH 3900 : CH 3915	2.63	2.63	15.00	1.20	47.39	

Sl.No	Chainage	W (m)	Wd	L (m)	Assumed canal depth (m)	De-Silting Quantity (m3)	Remarks
262	CH 3915 : CH 3930	2.63	2.63	15.00	1.20	47.41	
263	CH 3930 : CH 3945	2.60	2.60	15.00	1.20	46.82	
264	CH 3945 : CH 3960	2.65	2.65	15.00	1.20	47.66	
265	CH 3960 : CH 3975	2.70	2.70	15.00	1.20	48.56	
266	CH 3975 : CH 3990	2.64	2.64	15.00	1.20	47.51	
267	CH 3990 : CH 4005	2.63	2.63	15.00	1.20	47.33	
268	CH 4005 : CH 4020	2.62	2.62	15.00	1.20	47.21	
269	CH 4020 : CH 4035	2.60	2.60	15.00	1.20	46.76	
270	CH 4035 : CH 4050	2.67	2.67	15.00	1.20	48.07	
271	CH 4050 : CH 4065	2.73	2.73	15.00	1.20	49.13	
272	CH 4065 : CH 4080	2.68	2.68	15.00	1.20	48.19	
273	CH 4080 : CH 4095	2.68	2.68	15.00	1.20	48.32	
274	CH 4095 : CH 4110	2.74	2.74	15.00	1.20	49.29	
275	CH 4110 : CH 4125	2.64	2.64	15.00	1.20	47.47	
276	CH 4125 : CH 4140	1.27	1.27	15.00	1.20	22.85	"
277	CH 4140 : CH 4155	0.00	0.00	15.00	1.20	0.00	Near JLN metro station (Crossing Banerji Road)
278	CH 4155 : CH 4170	0.00	0.00	15.00	1.20	0.00	
279	CH 4170 : CH 4185	0.00	0.00	15.00	1.20	0.00	
280	CH 4185 : CH 4200	0.00	0.00	15.00	1.20	0.00	
281	CH 4200 : CH 4215	0.00	0.00	15.00	1.20	0.00	
282	CH 4215 : CH 4230	0.00	0.00	15.00	1.20	0.00	
283	CH 4230 : CH 4245	0.00	0.00	15.00	1.20	0.00	
284	CH 4245 : CH 4260	0.00	0.00	15.00	1.20	0.00	
285	CH 4260 : CH 4275	0.00	0.00	15.00	1.20	0.00	

Sl.No	Chainage	W (m)	Wd	L (m)	Assumed canal depth (m)	De-Silting Quantity (m3)	Remarks
286	CH 4275 : CH 4290	2.01	2.01	15.00	1.20	36.23	
287	CH 4290 : CH 4305	3.96	3.96	15.00	1.20	71.31	
288	CH 4305 : CH 4320	4.02	4.02	15.00	1.20	72.32	
289	CH 4320 : CH 4335	4.17	4.17	15.00	1.20	75.11	
290	CH 4335 : CH 4350	4.14	4.14	15.00	1.20	74.48	
291	CH 4350 : CH 4365	4.34	4.34	15.00	1.20	78.05	
292	CH 4365 : CH 4380	4.49	4.49	15.00	1.20	80.89	
293	CH 4380 : CH 4395	4.46	4.46	15.00	1.20	80.29	
294	CH 4395 : CH 4410	4.55	4.55	15.00	1.20	81.86	
295	CH 4410 : CH 4425	4.33	4.33	15.00	1.20	77.98	
296	CH 4425 : CH 4440	4.15	4.15	15.00	1.20	74.68	
297	CH 4440 : CH 4455	4.24	4.24	15.00	1.20	76.29	
298	CH 4455 : CH 4470	4.19	4.19	15.00	1.20	75.49	
299	CH 4470 : CH 4485	4.24	4.24	15.00	1.20	76.24	
300	CH 4485 : CH 4500	4.24	4.24	15.00	1.20	76.27	
301	CH 4500 : CH 4515	4.39	4.39	15.00	1.20	79.09	
302	CH 4515 : CH 4530	4.51	4.51	15.00	1.20	81.09	
303	CH 4530 : CH 4545	4.21	4.21	15.00	1.20	75.73	
304	CH 4545 : CH 4560	4.17	4.17	15.00	1.20	75.03	
305	CH 4560 : CH 4575	4.26	4.26	15.00	1.20	76.64	
306	CH 4575 : CH 4590	4.27	4.27	15.00	1.20	76.77	
307	CH 4590 : CH 4605	4.43	4.43	15.00	1.20	79.70	
308	CH 4605 : CH 4620	4.07	4.07	15.00	1.20	73.18	
309	CH 4620 : CH 4635	4.08	4.08	15.00	1.20	73.41	

Sl.No	Chainage	W (m)	Wd	L (m)	Assumed canal depth (m)	De-Silting Quantity (m3)	Remarks
310	CH 4635 : CH 4650	4.51	4.51	15.00	1.20	81.26	
311	CH 4650 : CH 4665	4.08	4.08	15.00	1.20	73.51	
312	CH 4665 : CH 4680	3.92	3.92	15.00	1.20	70.52	
313	CH 4680 : CH 4695	4.24	4.24	15.00	1.20	76.28	
314	CH 4695 : CH 4710	4.00	4.00	15.00	1.20	72.01	
315	CH 4710 : CH 4725	3.36	3.36	15.00	1.20	60.42	
316	CH 4725 : CH 4740	3.49	3.49	15.00	1.20	62.87	
317	CH 4740 : CH 4755	3.67	3.67	15.00	1.20	66.07	
318	CH 4755 : CH 4770	3.38	3.38	15.00	1.20	60.83	
319	CH 4770 : CH 4785	3.28	3.28	15.00	1.20	59.10	
320	CH 4785 : CH 4800	3.30	3.30	15.00	1.20	59.45	
321	CH 4800 : CH 4815	3.79	3.79	15.00	1.20	68.20	
322	CH 4815 : CH 4830	4.26	4.26	15.00	1.20	76.68	
323	CH 4830 : CH 4845	4.27	4.27	15.00	1.20	76.80	
324	CH 4845 : CH 4860	4.11	4.11	15.00	1.20	74.04	
325	CH 4860 : CH 4875	3.73	3.73	15.00	1.20	67.05	
326	CH 4875 : CH 4890	3.92	3.92	15.00	1.20	70.60	
327	CH 4890 : CH 4905	4.77	4.77	15.00	1.20	85.85	
328	CH 4905 : CH 4920	4.91	4.91	15.00	1.20	88.44	
329	CH 4920 : CH 4935	4.51	4.51	15.00	1.20	81.15	
330	CH 4935 : CH 4950	4.43	4.43	15.00	1.20	79.76	
331	CH 4950 : CH 4965	4.46	4.46	15.00	1.20	80.19	
332	CH 4965 : CH 4980	4.37	4.37	15.00	1.20	78.57	
333	CH 4980 : CH 4995	4.28	4.28	15.00	1.20	76.96	

Sl.No	Chainage	W (m)	Wd	L (m)	Assumed canal depth (m)	De-Silting Quantity (m3)	Remarks
334	CH 4995 : CH 5010	4.19	4.19	15.00	1.20	75.35	
335	CH 5010 : CH 5025	4.10	4.10	15.00	1.20	73.73	
336	CH 5025 : CH 5040	4.62	4.62	15.00	1.20	83.16	
337	CH 5040 : CH 5055	5.17	5.17	15.00	1.20	93.12	
338	CH 5055 : CH 5070	5.04	5.04	15.00	1.20	90.64	
339	CH 5070 : CH 5085	5.05	5.05	15.00	1.20	90.82	
340	CH 5085 : CH 5100	5.11	5.11	15.00	1.20	91.96	
341	CH 5100 : CH 5115	4.77	4.77	15.00	1.20	85.80	
342	CH 5115 : CH 5130	4.53	4.53	15.00	1.20	81.58	
343	CH 5130 : CH 5145	4.83	4.83	15.00	1.20	86.98	
344	CH 5145 : CH 5160	4.84	4.84	15.00	1.20	87.10	
345	CH 5160 : CH 5175	4.81	4.81	15.00	1.20	86.50	
346	CH 5175 : CH 5190	5.15	5.15	15.00	1.20	92.72	
347	CH 5190 : CH 5205	5.31	5.31	15.00	1.20	95.52	
348	CH 5205 : CH 5220	5.33	5.33	15.00	1.20	96.00	
349	CH 5220 : CH 5235	5.58	5.58	15.00	1.20	100.52	
350	CH 5235 : CH 5250	5.90	5.90	15.00	1.20	106.28	
351	CH 5250 : CH 5265	6.40	6.40	15.00	1.20	115.21	
352	CH 5265 : CH 5280	5.82	5.82	15.00	1.20	104.80	
353	CH 5280 : CH 5295	4.71	4.71	15.00	1.20	84.80	
354	CH 5295 : CH 5310	4.87	4.87	15.00	1.20	87.59	
355	CH 5310 : CH 5325	5.02	5.02	15.00	1.20	90.27	
356	CH 5325 : CH 5340	5.37	5.37	15.00	1.20	96.61	
357	CH 5340 : CH 5355	6.16	6.16	15.00	1.20	110.81	

Sl.No	Chainage	W (m)	Wd	L (m)	Assumed canal depth (m)	De-Silting Quantity (m3)	Remarks
358	CH 5355 : CH 5370	6.89	6.89	15.00	1.20	124.07	
359	CH 5370 : CH 5385	6.65	6.65	15.00	1.20	119.61	
360	CH 5385 : CH 5400	5.71	5.71	15.00	1.20	102.77	
361	CH 5400 : CH 5415	5.99	5.99	15.00	1.20	107.83	
362	CH 5415 : CH 5430	6.23	6.23	15.00	1.20	112.17	
363	CH 5430 : CH 5445	5.06	5.06	15.00	1.20	91.08	
364	CH 5445 : CH 5460	3.86	3.86	15.00	1.20	69.49	
365	CH 5460 : CH 5475	4.80	4.80	15.00	1.20	86.44	
366	CH 5475 : CH 5490	6.06	6.06	15.00	1.20	109.15	
367	CH 5490 : CH 5505	6.03	6.03	15.00	1.20	108.46	
368	CH 5505 : CH 5520	5.75	5.75	15.00	1.20	103.46	
369	CH 5520 : CH 5535	5.34	5.34	15.00	1.20	96.08	
370	CH 5535 : CH 5550	5.30	5.30	15.00	1.20	95.36	
371	CH 5550 : CH 5565	5.57	5.57	15.00	1.20	100.25	
372	CH 5565 : CH 5580	5.93	5.93	15.00	1.20	106.79	
373	CH 5580 : CH 5595	5.93	5.93	15.00	1.20	106.79	
374	CH 5595 : CH 5610	6.02	6.02	15.00	1.20	108.37	
375	CH 5610 : CH 5625	6.51	6.51	15.00	1.20	117.23	
376	CH 5625 : CH 5640	6.72	6.72	15.00	1.20	121.03	
377	CH 5640 : CH 5655	6.82	6.82	15.00	1.20	122.77	
378	CH 5655 : CH 5670	6.60	6.60	15.00	1.20	118.83	
379	CH 5670 : CH 5685	6.37	6.37	15.00	1.20	114.64	
380	CH 5685 : CH 5700	5.72	5.72	15.00	1.20	102.98	
381	CH 5700 : CH 5715	5.23	5.23	15.00	1.20	94.11	

Sl.No	Chainage	W (m)	Wd	L (m)	Assumed canal depth (m)	De-Silting Quantity (m3)	Remarks
382	CH 5715 : CH 5730	5.96	5.96	15.00	1.20	107.21	
383	CH 5730 : CH 5745	6.72	6.72	15.00	1.20	120.99	
384	CH 5745 : CH 5760	6.33	6.33	15.00	1.20	113.96	
385	CH 5760 : CH 5775	5.68	5.68	15.00	1.20	102.32	
386	CH 5775 : CH 5790	5.64	5.64	15.00	1.20	101.50	
387	CH 5790 : CH 5805	5.58	5.58	15.00	1.20	100.35	
388	CH 5805 : CH 5820	5.33	5.33	15.00	1.20	95.89	
389	CH 5820 : CH 5835	5.35	5.35	15.00	1.20	96.28	
390	CH 5835 : CH 5850	5.76	5.76	15.00	1.20	103.64	
391	CH 5850 : CH 5865	6.10	6.10	15.00	1.20	109.82	
392	CH 5865 : CH 5880	7.29	7.29	15.00	1.20	131.23	
393	CH 5880 : CH 5895	7.98	7.98	15.00	1.20	143.65	
394	CH 5895 : CH 5910	7.35	7.35	15.00	1.20	132.31	
395	CH 5910 : CH 5925	7.23	7.23	15.00	1.20	130.10	
396	CH 5925 : CH 5940	7.58	7.58	15.00	1.20	136.35	
397	CH 5940 : CH 5955	8.04	8.04	15.00	1.20	144.72	
398	CH 5955 : CH 5970	8.36	8.36	15.00	1.20	150.55	
399	CH 5970 : CH 5985	8.42	8.42	15.00	1.20	151.61	
400	CH 5985 : CH 6000	7.52	7.52	15.00	1.20	135.32	
401	CH 6000 : CH 6015	6.15	6.15	15.00	1.20	110.67	
402	CH 6015 : CH 6030	6.36	6.36	15.00	1.20	114.40	
403	CH 6030 : CH 6045	7.24	7.24	15.00	1.20	130.35	
404	CH 6045 : CH 6060	7.99	7.99	15.00	1.20	143.78	
405	CH 6060 : CH 6075	8.48	8.48	15.00	1.20	152.71	

Sl.No	Chainage	W (m)	Wd	L (m)	Assumed canal depth (m)	De-Silting Quantity (m3)	Remarks
406	CH 6075 : CH 6090	8.75	8.75	15.00	1.20	157.46	
407	CH 6090 : CH 6105	9.16	9.16	15.00	1.20	164.95	
408	CH 6105 : CH 6120	9.53	9.53	15.00	1.20	171.52	
409	CH 6120 : CH 6135	9.93	9.93	15.00	1.20	178.81	
410	CH 6135 : CH 6150	12.20	12.20	15.00	1.20	219.62	
411	CH 6150 : CH 6165	13.79	13.79	15.00	1.20	248.19	
412	CH 6165 : CH 6180	11.95	11.95	15.00	1.20	215.10	
413	CH 6180 : CH 6195	10.43	10.43	15.00	1.20	187.79	
414	CH 6195 : CH 6210	10.27	10.27	15.00	1.20	184.86	
415	CH 6210 : CH 6225	10.35	10.35	15.00	1.20	186.24	
416	CH 6225 : CH 6240	10.55	10.55	15.00	1.20	189.96	
417	CH 6240 : CH 6255	10.76	10.76	15.00	1.20	193.69	
418	CH 6255 : CH 6270	10.97	10.97	15.00	1.20	197.42	
419	CH 6270 : CH 6285	10.85	10.85	15.00	1.20	195.26	
420	CH 6285 : CH 6300	11.33	11.33	15.00	1.20	203.89	
421	CH 6300 : CH 6315	12.09	12.09	15.00	1.20	217.69	
422	CH 6315 : CH 6330	12.04	12.04	15.00	1.20	216.77	
423	CH 6330 : CH 6345	10.92	10.92	15.00	1.20	196.62	
424	CH 6345 : CH 6360	9.14	9.14	15.00	1.20	164.59	
425	CH 6360 : CH 6375	8.26	8.26	15.00	1.20	148.60	
426	CH 6375 : CH 6390	8.07	8.07	15.00	1.20	145.25	
427	CH 6390 : CH 6405	7.84	7.84	15.00	1.20	141.14	
428	CH 6405 : CH 6420	7.42	7.42	15.00	1.20	133.60	
429	CH 6420 : CH 6435	7.00	7.00	15.00	1.20	126.02	

Sl.No	Chainage	W (m)	Wd	L (m)	Assumed canal depth (m)	De-Silting Quantity (m3)	Remarks
430	CH 6435 : CH 6450	7.22	7.22	15.00	1.20	130.02	
431	CH 6450 : CH 6465	7.69	7.69	15.00	1.20	138.45	
432	CH 6465 : CH 6480	8.26	8.26	15.00	1.20	148.61	
433	CH 6480 : CH 6495	8.04	8.04	15.00	1.20	144.79	
434	CH 6495 : CH 6510	7.31	7.31	15.00	1.20	131.50	
435	CH 6510 : CH 6525	7.55	7.55	15.00	1.20	135.91	
436	CH 6525 : CH 6540	8.19	8.19	15.00	1.20	147.34	
437	CH 6540 : CH 6555	8.80	8.80	15.00	1.20	158.37	
438	CH 6555 : CH 6570	10.63	10.63	15.00	1.20	191.30	
439	CH 6570 : CH 6585	14.04	14.04	15.00	1.20	252.78	
440	CH 6585 : CH 6600	15.32	15.32	15.00	1.20	275.71	
441	CH 6600 : CH 6615	14.60	14.60	15.00	1.20	262.82	
442	CH 6615 : CH 6630	14.37	14.37	15.00	1.20	258.66	
443	CH 6630 : CH 6645	14.02	14.02	15.00	1.20	252.36	
444	CH 6645 : CH 6660	13.43	13.43	15.00	1.20	241.65	
445	CH 6660 : CH 6675	13.06	13.06	15.00	1.20	235.09	
446	CH 6675 : CH 6690	12.26	12.26	15.00	1.20	220.62	
447	CH 6690 : CH 6705	11.39	11.39	15.00	1.20	204.95	
448	CH 6705 : CH 6720	12.05	12.05	15.00	1.20	216.92	
449	CH 6720 : CH 6735	13.01	13.01	15.00	1.20	234.17	
450	CH 6735 : CH 6750	13.27	13.27	15.00	1.20	238.93	
451	CH 6750 : CH 6765	13.71	13.71	15.00	1.20	246.71	
452	CH 6765 : CH 6780	14.56	14.56	15.00	1.20	262.07	
453	CH 6780 : CH 6795	15.35	15.35	15.00	1.20	276.37	

Sl.No	Chainage	W (m)	Wd	L (m)	Assumed canal depth (m)	De-Silting Quantity (m3)	Remarks
454	CH 6795 : CH 6810	15.29	15.29	15.00	1.20	275.28	
455	CH 6810 : CH 6825	14.35	14.35	15.00	1.20	258.26	
456	CH 6825 : CH 6840	13.71	13.71	15.00	1.20	246.85	
457	CH 6840 : CH 6855	13.25	13.25	15.00	1.20	238.53	
458	CH 6855 : CH 6870	12.96	12.96	15.00	1.20	233.24	
459	CH 6870 : CH 6885	13.44	13.44	15.00	1.20	241.88	
460	CH 6885 : CH 6900	14.33	14.33	15.00	1.20	257.85	
461	CH 6900 : CH 6915	14.54	14.54	15.00	1.20	261.68	
462	CH 6915 : CH 6930	14.41	14.41	15.00	1.20	259.30	
463	CH 6930 : CH 6945	14.75	14.75	15.00	1.20	265.52	
464	CH 6945 : CH 6960	14.74	14.74	15.00	1.20	265.35	
465	CH 6960 : CH 6975	14.15	14.15	15.00	1.20	254.61	
466	CH 6975 : CH 6990	14.71	14.71	15.00	1.20	264.83	
467	CH 6990 : CH 7005	17.66	17.66	15.00	1.20	317.93	
468	CH 7005 : CH 7020	17.44	17.44	15.00	1.20	313.99	
469	CH 7020 : CH 7035	15.87	15.87	15.00	1.20	285.58	
470	CH 7035 : CH 7050	16.37	16.37	15.00	1.20	294.58	
471	CH 7050 : CH 7065	15.60	15.60	15.00	1.20	280.88	
472	CH 7065 : CH 7080	14.94	14.94	15.00	1.20	268.83	
473	CH 7080 : CH 7095	14.79	14.79	15.00	1.20	266.22	
474	CH 7095 : CH 7110	15.29	15.29	15.00	1.20	275.27	
475	CH 7110 : CH 7125	15.47	15.47	15.00	1.20	278.40	
476	CH 7125 : CH 7140	15.45	15.45	15.00	1.20	278.13	
477	CH 7140 : CH 7155	14.89	14.89	15.00	1.20	268.07	

Sl.No	Chainage	W (m)	Wd	L (m)	Assumed canal depth (m)	De-Silting Quantity (m3)	Remarks
478	CH 7155 : CH 7170	13.73	13.73	15.00	1.20	247.22	
479	CH 7170 : CH 7185	12.85	12.85	15.00	1.20	231.38	
480	CH 7185 : CH 7200	12.79	12.79	15.00	1.20	230.21	
481	CH 7200 : CH 7215	15.01	15.01	15.00	1.20	270.17	
482	CH 7215 : CH 7230	16.75	16.75	15.00	1.20	301.54	"
483	CH 7230 : CH 7245	22.85	22.85	15.00	1.20	411.32	"
484	CH 7245 : CH 7260	28.11	24.50	15.00	1.20	441.00	"
485	CH 7260 : CH 7275	17.48	17.48	15.00	1.20	314.56	
486	CH 7275 : CH 7290	12.84	12.84	15.00	1.20	231.05	
487	CH 7290 : CH 7305	9.40	9.40	15.00	1.20	169.17	
488	CH 7305 : CH 7320	9.09	9.09	15.00	1.20	163.54	
489	CH 7320 : CH 7335	10.59	10.59	15.00	1.20	190.63	
490	CH 7335 : CH 7350	11.93	11.93	15.00	1.20	214.81	
491	CH 7350 : CH 7365	14.62	14.62	15.00	1.20	263.12	
492	CH 7365 : CH 7380	18.72	18.72	15.00	1.20	337.01	
493	CH 7380 : CH 7395	18.20	18.20	15.00	1.20	327.66	
494	CH 7395 : CH 7410	14.11	14.11	15.00	1.20	253.91	
495	CH 7410 : CH 7425	13.98	13.98	15.00	1.20	251.66	
496	CH 7425 : CH 7440	15.54	15.54	15.00	1.20	279.77	
497	CH 7440 : CH 7455	15.19	15.19	15.00	1.20	273.41	
498	CH 7455 : CH 7470	15.40	15.40	15.00	1.20	277.22	
499	CH 7470 : CH 7485	14.59	14.59	15.00	1.20	262.67	
500	CH 7485 : CH 7500	13.05	13.05	15.00	1.20	234.84	
501	CH 7500 : CH 7515	14.34	14.34	15.00	1.20	258.05	

Sl.No	Chainage	W (m)	Wd	L (m)	Assumed canal depth (m)	De-Silting Quantity (m3)	Remarks
502	CH 7515 : CH 7530	15.30	15.30	15.00	1.20	275.47	
503	CH 7530 : CH 7545	15.58	15.58	15.00	1.20	280.37	
504	CH 7545 : CH 7560	16.14	16.14	15.00	1.20	290.57	
505	CH 7560 : CH 7575	16.07	16.07	15.00	1.20	289.22	
506	CH 7575 : CH 7590	16.02	16.02	15.00	1.20	288.41	
507	CH 7590 : CH 7605	16.49	16.49	15.00	1.20	296.76	
508	CH 7605 : CH 7620	16.33	16.33	15.00	1.20	293.90	
509	CH 7620 : CH 7635	16.41	16.41	15.00	1.20	295.45	
510	CH 7635 : CH 7650	16.60	16.60	15.00	1.20	298.80	
511	CH 7650 : CH 7665	14.60	14.60	15.00	1.20	262.84	
512	CH 7665 : CH 7680	11.01	11.01	15.00	1.20	198.23	
513	CH 7680 : CH 7695	10.26	10.26	15.00	1.20	184.64	
514	CH 7695 : CH 7710	12.10	12.10	15.00	1.20	217.85	
515	CH 7710 : CH 7725	13.07	13.07	15.00	1.20	235.27	
516	CH 7725 : CH 7740	13.22	13.22	15.00	1.20	237.87	
517	CH 7740 : CH 7755	12.99	12.99	15.00	1.20	233.79	
518	CH 7755 : CH 7770	12.64	12.64	15.00	1.20	227.43	
519	CH 7770 : CH 7785	12.28	12.28	15.00	1.20	221.00	
520	CH 7785 : CH 7800	12.32	12.32	15.00	1.20	221.71	
521	CH 7800 : CH 7815	12.44	12.44	15.00	1.20	223.98	
522	CH 7815 : CH 7830	12.30	12.30	15.00	1.20	221.42	
523	CH 7830 : CH 7845	12.39	12.39	15.00	1.20	223.08	
524	CH 7845 : CH 7860	12.66	12.66	15.00	1.20	227.92	
525	CH 7860 : CH 7875	12.79	12.79	15.00	1.20	230.23	

Sl.No	Chainage	W (m)	Wd	L (m)	Assumed canal depth (m)	De-Silting Quantity (m3)	Remarks
526	CH 7875 : CH 7890	12.76	12.76	15.00	1.20	229.59	
527	CH 7890 : CH 7905	12.60	12.60	15.00	1.20	226.77	
528	CH 7905 : CH 7920	12.52	12.52	15.00	1.20	225.42	
529	CH 7920 : CH 7935	12.51	12.51	15.00	1.20	225.11	
530	CH 7935 : CH 7950	12.47	12.47	15.00	1.20	224.54	
531	CH 7950 : CH 7965	12.49	12.49	15.00	1.20	224.75	
532	CH 7965 : CH 7980	12.51	12.51	15.00	1.20	225.21	
533	CH 7980 : CH 7995	12.54	12.54	15.00	1.20	225.77	
534	CH 7995 : CH 8010	12.37	12.37	15.00	1.20	222.57	
535	CH 8010 : CH 8025	11.18	11.18	15.00	1.20	201.15	
536	CH 8025 : CH 8040	10.33	10.33	15.00	1.20	185.86	
537	CH 8040 : CH 8055	10.27	10.27	15.00	1.20	184.90	
538	CH 8055 : CH 8070	9.91	9.91	15.00	1.20	178.42	
539	CH 8070 : CH 8085	9.64	9.64	15.00	1.20	173.45	
540	CH 8085 : CH 8100	9.48	9.48	15.00	1.20	170.64	
541	CH 8100 : CH 8115	10.19	10.19	15.00	1.20	183.39	
542	CH 8115 : CH 8130	18.38	18.38	15.00	1.20	330.75	
543	CH 8130 : CH 8145	18.52	18.52	15.00	1.20	333.41	
544	CH 8145 : CH 8160	9.59	9.59	15.00	1.20	172.62	
545	CH 8160 : CH 8175	7.94	7.94	15.00	1.20	142.83	
546	CH 8175 : CH 8190	7.95	7.95	15.00	1.20	143.12	
547	CH 8190 : CH 8205	8.08	8.08	15.00	1.20	145.45	
548	CH 8205 : CH 8220	8.37	8.37	15.00	1.20	150.58	
549	CH 8220 : CH 8235	8.51	8.51	15.00	1.20	153.26	

Sl.No	Chainage	W (m)	Wd	L (m)	Assumed canal depth (m)	De-Silting Quantity (m3)	Remarks
550	CH 8235 : CH 8250	8.25	8.25	15.00	1.20	148.47	
551	CH 8250 : CH 8265	8.27	8.27	15.00	1.20	148.83	
552	CH 8265 : CH 8280	8.13	8.13	15.00	1.20	146.35	
553	CH 8280 : CH 8295	7.87	7.87	15.00	1.20	141.62	
554	CH 8295 : CH 8310	9.35	9.35	15.00	1.20	168.34	
555	CH 8310 : CH 8325	11.07	11.07	15.00	1.20	199.21	
556	CH 8325 : CH 8340	11.46	11.46	15.00	1.20	206.30	
557	CH 8340 : CH 8355	11.41	11.41	15.00	1.20	205.33	
558	CH 8355 : CH 8370	11.30	11.30	15.00	1.20	203.36	
559	CH 8370 : CH 8385	11.16	11.16	15.00	1.20	200.85	
560	CH 8385 : CH 8400	10.36	10.36	15.00	1.20	186.42	
561	CH 8400 : CH 8415	9.47	9.47	15.00	1.20	170.52	
562	CH 8415 : CH 8430	9.06	9.06	15.00	1.20	163.11	
563	CH 8430 : CH 8445	8.42	8.42	15.00	1.20	151.47	
564	CH 8445 : CH 8460	8.58	8.58	15.00	1.20	154.44	
565	CH 8460 : CH 8475	9.37	9.37	15.00	1.20	168.73	
566	CH 8475 : CH 8490	9.36	9.36	15.00	1.20	168.41	
567	CH 8490 : CH 8505	9.33	9.33	15.00	1.20	167.90	
568	CH 8505 : CH 8520	9.79	9.79	15.00	1.20	176.25	
569	CH 8520 : CH 8535	10.30	10.30	15.00	1.20	185.39	
570	CH 8535 : CH 8550	8.86	8.86	15.00	1.20	159.50	
571	CH 8550 : CH 8565	7.83	7.83	15.00	1.20	140.86	
572	CH 8565 : CH 8580	8.72	8.72	15.00	1.20	156.99	
573	CH 8580 : CH 8595	9.07	9.07	15.00	1.20	163.18	

Sl.No	Chainage	W (m)	Wd	L (m)	Assumed canal depth (m)	De-Silting Quantity (m3)	Remarks
574	CH 8595 : CH 8610	9.34	9.34	15.00	1.20	168.05	
575	CH 8610 : CH 8625	9.84	9.84	15.00	1.20	177.18	
576	CH 8625 : CH 8640	10.15	10.15	15.00	1.20	182.75	
577	CH 8640 : CH 8655	10.03	10.03	15.00	1.20	180.45	
578	CH 8655 : CH 8670	9.98	9.98	15.00	1.20	179.57	
579	CH 8670 : CH 8685	10.15	10.15	15.00	1.20	182.64	
580	CH 8685 : CH 8700	10.50	10.50	15.00	1.20	189.04	
581	CH 8700 : CH 8715	11.05	11.05	15.00	1.20	198.88	
582	CH 8715 : CH 8730	11.77	11.77	15.00	1.20	211.77	
583	CH 8730 : CH 8745	12.44	12.44	15.00	1.20	224.00	
584	CH 8745 : CH 8760	12.73	12.73	15.00	1.20	229.19	
585	CH 8760 : CH 8775	12.74	12.74	15.00	1.20	229.29	
586	CH 8775 : CH 8790	8.61	8.61	15.00	1.20	154.97	
587	CH 8790 : CH 8805	6.53	6.53	15.00	1.20	117.49	
588	CH 8805 : CH 8820	8.62	8.62	15.00	1.20	155.21	
589	CH 8820 : CH 8835	8.93	8.93	15.00	1.20	160.72	
590	CH 8835 : CH 8850	9.67	9.67	15.00	1.20	174.03	
591	CH 8850 : CH 8865	7.65	7.65	15.00	1.20	137.70	
592	CH 8865 : CH 8880	8.75	8.75	15.00	1.20	157.48	
593	CH 8880 : CH 8895	28.73	24.50	15.00	1.00	367.50	
594	CH 8895 : CH 8910	45.14	24.50	15.00	0.70	257.25	"
595	CH 8910 : CH 8925	45.35	24.50	15.00	0.70	257.25	"
596	CH 8925 : CH 8940	53.12	24.50	15.00	0.70	257.25	"
597	CH 8940 : CH 8955	69.01	24.50	15.00	0.70	257.25	"

Sl.No	Chainage	W (m)	Wd	L (m)	Assumed canal depth (m)	De-Silting Quantity (m3)	Remarks
598	CH 8955 : CH 8970	74.80	24.50	15.00	0.70	257.25	"
599	CH 8970 : CH 8985	71.82	24.50	15.00	0.70	257.25	"
600	CH 8985 : CH 9000	71.44	24.50	15.00	0.70	257.25	"
601	CH 9000 : CH 9015	71.63	24.50	15.00	0.70	257.25	"
602	CH 9015 : CH 9030	71.91	24.50	15.00	0.70	257.25	"
603	CH 9030 : CH 9045	73.15	24.50	15.00	0.70	257.25	"
604	CH 9045 : CH 9060	72.67	24.50	15.00	0.70	257.25	"
605	CH 9060 : CH 9075	69.39	24.50	15.00	0.70	257.25	"
606	CH 9075 : CH 9090	66.64	24.50	15.00	0.70	257.25	"
607	CH 9090 : CH 9105	65.20	24.50	15.00	0.70	257.25	"
608	CH 9105 : CH 9120	65.51	24.50	15.00	0.70	257.25	"
609	CH 9120 : CH 9135	66.33	24.50	15.00	0.70	257.25	"
610	CH 9135 : CH 9150	67.38	24.50	15.00	0.70	257.25	"
611	CH 9150 : CH 9165	68.89	24.50	15.00	0.70	257.25	"
612	CH 9165 : CH 9180	72.09	24.50	15.00	0.70	257.25	"
613	CH 9180 : CH 9195	76.78	24.50	15.00	0.70	257.25	"
614	CH 9195 : CH 9210	80.56	24.50	15.00	0.70	257.25	"
615	CH 9210 : CH 9225	84.22	24.50	15.00	0.70	257.25	"
616	CH 9225 : CH 9240	87.33	24.50	15.00	0.70	257.25	"
617	CH 9240 : CH 9255	88.77	24.50	15.00	0.70	257.25	"
618	CH 9255 : CH 9270	90.25	24.50	15.00	0.70	257.25	"
619	CH 9270 : CH 9285	93.18	24.50	15.00	0.70	257.25	"
620	CH 9285 : CH 9300	95.57	24.50	15.00	0.70	257.25	"
621	CH 9300 : CH 9315	95.92	24.50	15.00	0.70	257.25	"

Sl.No	Chainage	W (m)	Wd	L (m)	Assumed canal depth (m)	De-Silting Quantity (m3)	Remarks
622	CH 9315 : CH 9330	95.65	24.50	15.00	0.70	257.25	"
623	CH 9330 : CH 9345	95.95	24.50	15.00	0.70	257.25	"
624	CH 9345 : CH 9360	93.67	24.50	15.00	0.70	257.25	"
625	CH 9360 : CH 9375	86.92	24.50	15.00	0.70	257.25	"
626	CH 9375 : CH 9390	91.45	24.50	15.00	0.70	257.25	"
627	CH 9390 : CH 9405	99.38	24.50	15.00	0.70	257.25	"
628	CH 9405 : CH 9420	96.29	24.50	15.00	0.70	257.25	"
629	CH 9420 : CH 9435	90.94	24.50	15.00	0.70	257.25	"
630	CH 9435 : CH 9450	88.15	24.50	15.00	0.70	257.25	"
631	CH 9450 : CH 9465	88.64	24.50	15.00	0.70	257.25	"
632	CH 9465 : CH 9480	87.56	24.50	15.00	0.70	257.25	"
633	CH 9480 : CH 9495	83.71	24.50	15.00	0.70	257.25	"
634	CH 9495 : CH 9510	77.89	24.50	15.00	0.70	257.25	"
635	CH 9510 : CH 9525	72.00	24.50	15.00	0.70	257.25	"
636	CH 9525 : CH 9540	66.20	24.50	15.00	0.70	257.25	"
637	CH 9540 : CH 9555	60.62	24.50	15.00	0.70	257.25	"
638	CH 9555 : CH 9570	54.40	24.50	15.00	0.70	257.25	"
639	CH 9570 : CH 9585	47.16	24.50	15.00	0.70	257.25	"
640	CH 9585 : CH 9600	41.04	24.50	15.00	0.70	257.25	"
641	CH 9600 : CH 9615	44.41	24.50	15.00	0.70	257.25	"
642	CH 9615 : CH 9630	60.63	24.50	15.00	0.70	257.25	"
643	CH 9630 : CH 9645	79.97	24.50	15.00	0.50	183.75	"
644	CH 9645 : CH 9660	90.19	24.50	15.00	0.50	183.75	"
645	CH 9660 : CH 9675	93.14	24.50	15.00	0.50	183.75	"

Sl.No	Chainage	W (m)	Wd	L (m)	Assumed canal depth (m)	De-Silting Quantity (m3)	Remarks
646	CH 9675 : CH 9690	97.81	24.50	15.00	0.50	183.75	"
647	CH 9690 : CH 9705	103.96	24.50	15.00	0.50	183.75	"
648	CH 9705 : CH 9720	111.06	24.50	15.00	0.50	183.75	"
649	CH 9720 : CH 9735	118.45	24.50	15.00	0.50	183.75	"
650	CH 9735 : CH 9750	123.13	24.50	15.00	0.50	183.75	"
651	CH 9750 : CH 9765	123.42	24.50	15.00	0.50	183.75	"
652	CH 9765 : CH 9780	122.01	24.50	15.00	0.50	183.75	"
653	CH 9780 : CH 9795	121.36	24.50	15.00	0.50	183.75	"
654	CH 9795 : CH 9810	121.07	24.50	15.00	0.50	183.75	"
655	CH 9810 : CH 9825	123.94	24.50	15.00	0.50	183.75	"
656	CH 9825 : CH 9840	129.23	24.50	15.00	0.50	183.75	"
657	CH 9840 : CH 9855	133.05	24.50	15.00	0.50	183.75	"
658	CH 9855 : CH 9870	135.95	24.50	15.00	0.50	183.75	"
659	CH 9870 : CH 9885	138.70	24.50	15.00	0.50	183.75	"
660	CH 9885 : CH 9900	142.48	24.50	15.00	0.50	183.75	"
661	CH 9900 : CH 9915	147.10	24.50	15.00	0.50	183.75	"
662	CH 9915 : CH 9930	154.03	24.50	15.00	0.50	183.75	"
663	CH 9930 : CH 9945	163.78	24.50	15.00	0.50	183.75	"
664	CH 9945 : CH 9960	198.86	24.50	15.00	0.50	183.75	"
665	CH 9960 : CH 9975	230.46	24.50	15.00	0.50	183.75	"
666	CH 9975 : CH 9990	234.72	24.50	15.00	0.50	183.75	"
667	CH 9990 : CH 10005	238.51	24.50	15.00	0.50	183.75	"
668	CH 10005 : CH 10020	241.81	24.50	15.00	0.50	183.75	"
669	CH 10020 : CH 10035	246.76	24.50	15.00	0.50	183.75	"

Sl.No	Chainage	W (m)	Wd	L (m)	Assumed canal depth (m)	De-Silting Quantity (m3)	Remarks
670	CH 10035 : CH 10050	243.21	24.50	15.00	0.50	183.75	"
671	CH 10050 : CH 10065	238.80	24.50	15.00	0.50	183.75	"
672	CH 10065 : CH 10080	244.57	24.50	15.00	0.50	183.75	"
673	CH 10080 : CH 10095	252.73	24.50	15.00	0.50	183.75	"
674	CH 10095 : CH 10110	259.00	24.50	15.00	0.50	183.75	"
675	CH 10110 : CH 10125	252.45	24.50	15.00	0.50	183.75	"
676	CH 10125 : CH 10140	228.10	24.50	15.00	0.50	183.75	"
677	CH 10140 : CH 10155	195.06	24.50	15.00	0.50	183.75	"
678	CH 10155 : CH 10170	172.57	24.50	15.00	0.50	183.75	"
679	CH 10170 : CH 10185	169.73	24.50	15.00	0.50	183.75	"
680	CH 10185 : CH 10200	177.30	24.50	15.00	0.50	183.75	"
681	CH 10200 : CH 10215	183.86	24.50	15.00	0.50	183.75	"
682	CH 10215 : CH 10230	187.13	24.50	15.00	0.50	183.75	"
683	CH 10230 : CH 10245	190.89	24.50	15.00	0.50	183.75	"
684	CH 10245 : CH 10260	193.99	24.50	15.00	0.50	183.75	"
685	CH 10260 : CH 10275	197.61	24.50	15.00	0.50	183.75	"
686	CH 10275 : CH 10290	203.15	24.50	15.00	0.50	183.75	"
687	CH 10290 : CH 10305	208.94	24.50	15.00	0.50	183.75	"
688	CH 10305 : CH 10320	214.11	24.50	15.00	0.50	183.75	"
689	CH 10320 : CH 10335	219.04	24.50	15.00	0.50	183.75	"
690	CH 10335 : CH 10350	223.37	24.50	15.00	0.50	183.75	"
691	CH 10350 : CH 10365	226.63	24.50	15.00	0.50	183.75	"
692	CH 10365 : CH 10380	229.60	24.50	15.00	0.50	183.75	"
693	CH 10380 : CH 10395	232.94	24.50	15.00	0.50	183.75	"

Sl.No	Chainage	W (m)	Wd	L (m)	Assumed canal depth (m)	De-Silting Quantity (m3)	Remarks
694	CH 10395 : CH 10410	236.24	24.50	15.00	0.50	183.75	"
695	CH 10410 : CH 10425	236.76	24.50	15.00	0.50	183.75	"
696	CH 10425 : CH 10440	235.76	24.50	15.00	0.50	183.75	"
697	CH 10440 : CH 10455	236.06	24.50	15.00	0.50	183.75	"
698	CH 10455 : CH 10470	237.04	24.50	15.00	0.50	183.75	"
699	CH 10470 : CH 10485	237.68	24.50	15.00	0.50	183.75	"
700	CH 10485 : CH 10500	236.91	24.50	15.00	0.50	183.75	"
701	CH 10500 : CH 10515	235.75	24.50	15.00	0.50	183.75	"
702	CH 10515 : CH 10530	232.99	24.50	15.00	0.50	183.75	"
703	CH 10530 : CH 10545	229.15	24.50	15.00	0.50	183.75	"
704	CH 10545 : CH 10560	225.20	24.50	15.00	0.50	183.75	"
705	CH 10560 : CH 10575	219.98	24.50	15.00	0.50	183.75	"
706	CH 10575 : CH 10590	219.61	24.50	15.00	0.50	183.75	"
707	CH 10590 : CH 10605	222.04	24.50	15.00	0.50	183.75	"
708	CH 10605 : CH 10620	223.67	24.50	15.00	0.50	183.75	"
709	CH 10620 : CH 10635	227.85	24.50	15.00	0.50	183.75	"
710	CH 10635 : CH 10650	232.74	24.50	15.00	0.50	183.75	"
711	CH 10650 : CH 10665	238.00	24.50	15.00	0.50	183.75	"
712	CH 10665 : CH 10680	241.35	24.50	15.00	0.50	183.75	"
713	CH 10680 : CH 10695	240.98	24.50	15.00	0.50	183.75	"
714	CH 10695 : CH 10710	239.69	24.50	15.00	0.50	183.75	"
715	CH 10710 : CH 10725	239.54	24.50	15.00	0.50	183.75	"
716	CH 10725 : CH 10740	240.78	24.50	15.00	0.50	183.75	"
717	CH 10740 : CH 10755	242.50	24.50	15.00	0.50	183.75	"

Sl.No	Chainage	W (m)	Wd	L (m)	Assumed canal depth (m)	De-Silting Quantity (m3)	Remarks
718	CH 10755 : CH 10770	244.55	24.50	15.00	0.50	183.75	"
719	CH 10770 : CH 10785	246.84	24.50	15.00	0.50	183.75	"
720	CH 10785 : CH 10800	246.99	24.50	15.00	0.50	183.75	"
721	CH 10800 : CH 10815	248.20	24.50	15.00	0.50	183.75	"
722	CH 10815 : CH 10830	254.53	24.50	15.00	0.50	183.75	"
723	CH 10830 : CH 10845	260.70	24.50	15.00	0.50	183.75	"
724	CH 10845 : CH 10860	265.08	24.50	15.00	0.50	183.75	"
725	CH 10860 : CH 10875	269.72	24.50	15.00	0.50	183.75	"
726	CH 10875 : CH 10890	274.46	24.50	15.00	0.50	183.75	"
727	CH 10890 : CH 10905	279.27	24.50	15.00	0.50	183.75	"
728	CH 10905 : CH 10920	284.08	24.50	15.00	0.50	183.75	"
729	CH 10920 : CH 10935	288.46	24.50	15.00	0.50	183.75	"
730	CH 10935 : CH 10950	292.25	24.50	15.00	0.50	183.75	"
731	CH 10950 : CH 10965	295.09	24.50	15.00	0.50	183.75	"
732	CH 10965 : CH 10980	295.35	24.50	15.00	0.50	183.75	"
733	CH 10980 : CH 10995	297.21	24.50	15.00	0.50	183.75	"
734	CH 10995 : CH 11010	302.48	24.50	15.00	0.50	183.75	"
735	CH 11010 : CH 11025	306.20	24.50	15.00	0.50	183.75	"
736	CH 11025 : CH 11040	306.73	24.50	15.00	0.50	183.75	"
737	CH 11040 : CH 11055	305.64	24.50	15.00	0.50	183.75	"
738	CH 11055 : CH 11070	302.00	24.50	15.00	0.50	183.75	"
739	CH 11070 : CH 11085	294.68	24.50	15.00	0.50	183.75	"
740	CH 11085 : CH 11100	288.17	24.50	15.00	0.50	183.75	"
741	CH 11100 : CH 11115	285.42	24.50	15.00	0.50	183.75	"

Sl.No	Chainage	W (m)	Wd	L (m)	Assumed canal depth (m)	De-Silting Quantity (m3)	Remarks
742	CH 11115 : CH 11130	284.35	24.50	15.00	0.50	183.75	"
743	CH 11130 : CH 11145	159.74	24.50	15.00	0.50	183.75	"
744	CH 11145 : CH 11150	33.88	24.50	5.00	0.50	61.25	"
	Total Quantity					**1,30,545.23**	
	Deepening quantity of subcanals (26 nos)	3.06		12042.00	0.30	11045.89	
	Grand Total					**1,41,591.12**	

1.3 Thevara_Perandoor canal

Table 4: Deepening Details of Thevara_Perandoor Canal

Sl.No	Chainage	W (m)	Wd (m)	L (m)	Assumed canal depth (m)	De-Silting Quantity (m3)	Remarks
1	CH 000 : CH 15	25.30	24.50	15.00	0.70	257.25	w>16.50
2	CH 15 : CH 30	49.30	24.50	15.00	0.70	257.25	"
3	CH 30 : CH 45	67.07	24.50	15.00	0.70	257.25	"
4	CH 45 : CH 60	64.31	24.50	15.00	0.70	257.25	"
5	CH 60 : CH 75	58.34	24.50	15.00	0.70	257.25	"
6	CH 75 : CH 90	53.13	24.50	15.00	0.70	257.25	"
7	CH 90 : CH 105	50.09	24.50	15.00	0.70	257.25	"
8	CH 105 : CH 120	48.44	24.50	15.00	0.70	257.25	"
9	CH 120 : CH 135	47.32	24.50	15.00	0.70	257.25	"
10	CH 135 : CH 150	43.11	24.50	15.00	0.70	257.25	"
11	CH 150 : CH 165	38.61	24.50	15.00	0.70	257.25	"
12	CH 165 : CH 180	37.13	24.50	15.00	0.70	257.25	"
13	CH 180 : CH 195	35.38	24.50	15.00	0.70	257.25	"
14	CH 195 : CH 210	33.55	24.50	15.00	0.70	257.25	"
15	CH 210 : CH 225	35.58	24.50	15.00	0.70	257.25	"
16	CH 225 : CH 240	45.02	24.50	15.00	0.70	257.25	"
17	CH 240 : CH 255	54.70	24.50	15.00	0.70	257.25	"
18	CH 255 : CH 270	61.94	24.50	15.00	0.70	257.25	"
19	CH 270 : CH 285	72.24	24.50	15.00	0.70	257.25	"
20	CH 285 : CH 300	84.74	24.50	15.00	0.70	257.25	"

21	CH 300 : CH 315	97.48	24.50	15.00	0.70	257.25	"
22	CH 315 : CH 330	109.16	24.50	15.00	0.70	257.25	"
23	CH 330 : CH 345	113.84	24.50	15.00	0.70	257.25	"
24	CH 345 : CH 360	110.19	24.50	15.00	0.70	257.25	"
25	CH 360 : CH 375	106.99	24.50	15.00	0.70	257.25	"
26	CH 375 : CH 390	107.36	24.50	15.00	0.70	257.25	"
27	CH 390 : CH 405	105.45	24.50	15.00	0.70	257.25	"
28	CH 405 : CH 420	99.31	24.50	15.00	0.70	257.25	"
29	CH 420 : CH 435	91.69	24.50	15.00	0.70	257.25	"
30	CH 435 : CH 450	82.75	24.50	15.00	0.70	257.25	"
31	CH 450 : CH 465	73.05	24.50	15.00	0.70	257.25	"
32	CH 465 : CH 480	66.41	24.50	15.00	0.70	257.25	"
33	CH 480 : CH 495	64.29	24.50	15.00	0.70	257.25	"
34	CH 495 : CH 510	63.95	24.50	15.00	0.70	257.25	"
35	CH 510 : CH 525	66.68	24.50	15.00	0.70	257.25	"
36	CH 525 : CH 540	72.52	24.50	15.00	0.70	257.25	"
37	CH 540 : CH 555	77.48	24.50	15.00	0.70	257.25	"
38	CH 555 : CH 570	79.59	24.50	15.00	0.70	257.25	"
39	CH 570 : CH 585	79.07	24.50	15.00	0.70	257.25	"
40	CH 585 : CH 600	78.42	24.50	15.00	0.70	257.25	"
41	CH 600 : CH 615	78.58	24.50	15.00	0.70	257.25	"
42	CH 615 : CH 630	77.31	24.50	15.00	0.70	257.25	"
43	CH 630 : CH 645	74.03	24.50	15.00	0.70	257.25	"
44	CH 645 : CH 660	70.41	24.50	15.00	0.70	257.25	"
45	CH 660 : CH 675	66.81	24.50	15.00	0.70	257.25	"
46	CH 675 : CH 690	63.26	24.50	15.00	0.70	257.25	"
47	CH 690 : CH 705	60.14	24.50	15.00	0.70	257.25	"

48	CH 705 : CH 720	57.73	24.50	15.00	0.70	257.25	"
49	CH 720 : CH 735	55.71	24.50	15.00	0.70	257.25	"
50	CH 735 : CH 750	54.23	24.50	15.00	0.70	257.25	"
51	CH 750 : CH 765	53.20	24.50	15.00	0.70	257.25	"
52	CH 765 : CH 780	52.46	24.50	15.00	0.70	257.25	"
53	CH 780 : CH 795	51.64	24.50	15.00	0.70	257.25	"
54	CH 795 : CH 810	50.61	24.50	15.00	0.70	257.25	"
55	CH 810 : CH 825	50.87	24.50	15.00	0.70	257.25	"
56	CH 825 : CH 840	51.96	24.50	15.00	0.70	257.25	"
57	CH 840 : CH 855	52.91	24.50	15.00	0.70	257.25	"
58	CH 855 : CH 870	54.95	24.50	15.00	0.70	257.25	"
59	CH 870 : CH 885	56.77	24.50	15.00	0.70	257.25	"
60	CH 885 : CH 900	54.49	24.50	15.00	0.70	257.25	"
61	CH 900 : CH 915	49.51	24.50	15.00	0.70	257.25	"
62	CH 915 : CH 930	46.68	24.50	15.00	0.70	257.25	"
63	CH 930 : CH 945	46.08	24.50	15.00	0.70	257.25	"
64	CH 945 : CH 960	46.45	24.50	15.00	0.70	257.25	"
65	CH 960 : CH 975	48.36	24.50	15.00	0.70	257.25	"
66	CH 975 : CH 990	50.81	24.50	15.00	0.70	257.25	"
67	CH 990 : CH 1005	52.51	24.50	15.00	0.70	257.25	"
68	CH 1005 : CH 1020	50.70	24.50	15.00	0.70	257.25	"
69	CH 1020 : CH 1035	45.11	24.50	15.00	0.70	257.25	"
70	CH 1035 : CH 1050	39.05	24.50	15.00	0.70	257.25	"
71	CH 1050 : CH 1065	33.40	24.50	15.00	0.70	257.25	"
72	CH 1065 : CH 1080	30.51	24.50	15.00	0.70	257.25	"
73	CH 1080 : CH 1095	30.80	24.50	15.00	0.70	257.25	"
74	CH 1095 : CH 1110	32.56	24.50	15.00	0.70	257.25	"

75	CH 1110 : CH 1125	32.79	24.50	15.00	0.70	257.25	"
76	CH 1125 : CH 1140	31.07	24.50	15.00	0.70	257.25	"
77	CH 1140 : CH 1155	31.90	24.50	15.00	0.70	257.25	"
78	CH 1155 : CH 1170	39.23	24.50	15.00	0.70	257.25	"
79	CH 1170 : CH 1185	52.13	24.50	15.00	0.70	257.25	"
80	CH 1185 : CH 1200	52.32	24.50	15.00	0.70	257.25	"
81	CH 1200 : CH 1215	49.13	24.50	15.00	0.70	257.25	"
82	CH 1215 : CH 1230	47.09	24.50	15.00	0.70	257.25	"
83	CH 1230 : CH 1245	48.96	24.50	15.00	0.70	257.25	"
84	CH 1245 : CH 1260	54.42	24.50	15.00	0.70	257.25	"
85	CH 1260 : CH 1275	54.95	24.50	15.00	0.70	257.25	"
86	CH 1275 : CH 1290	50.32	24.50	15.00	0.70	257.25	"
87	CH 1290 : CH 1305	48.22	24.50	15.00	0.70	257.25	"
88	CH 1305 : CH 1320	47.20	24.50	15.00	0.70	257.25	"
89	CH 1320 : CH 1335	43.99	24.50	15.00	0.70	257.25	"
90	CH 1335 : CH 1350	39.31	24.50	15.00	0.70	257.25	"
91	CH 1350 : CH 1365	35.56	24.50	15.00	0.70	257.25	"
92	CH 1365 : CH 1380	34.40	24.50	15.00	0.70	257.25	"
93	CH 1380 : CH 1395	35.29	24.50	15.00	0.70	257.25	"
94	CH 1395 : CH 1410	37.35	24.50	15.00	0.70	257.25	"
95	CH 1410 : CH 1425	40.04	24.50	15.00	0.70	257.25	"
96	CH 1425 : CH 1440	43.77	24.50	15.00	0.70	257.25	"
97	CH 1440 : CH 1455	47.00	24.50	15.00	0.70	257.25	"
98	CH 1455 : CH 1470	47.51	24.50	15.00	0.70	257.25	"
99	CH 1470 : CH 1485	46.26	24.50	15.00	0.70	257.25	"
100	CH 1485 : CH 1500	46.62	24.50	15.00	0.70	257.25	"
101	CH 1500 : CH 1515	45.56	24.50	15.00	0.70	257.25	"

102	CH 1515 : CH 1530	42.11	24.50	15.00	0.70	257.25	"
103	CH 1530 : CH 1545	38.74	24.50	15.00	0.70	257.25	"
104	CH 1545 : CH 1560	36.90	24.50	15.00	0.70	257.25	"
105	CH 1560 : CH 1575	36.53	24.50	15.00	0.70	257.25	"
106	CH 1575 : CH 1590	37.47	24.50	15.00	0.70	257.25	"
107	CH 1590 : CH 1605	42.37	24.50	15.00	0.70	257.25	"
108	CH 1605 : CH 1620	48.95	24.50	15.00	0.70	257.25	"
109	CH 1620 : CH 1635	54.54	24.50	15.00	0.70	257.25	"
110	CH 1635 : CH 1650	58.02	24.50	15.00	0.70	257.25	"
111	CH 1650 : CH 1665	60.78	24.50	15.00	0.70	257.25	"
112	CH 1665 : CH 1680	63.63	24.50	15.00	0.70	257.25	"
113	CH 1680 : CH 1695	67.95	24.50	15.00	0.70	257.25	"
114	CH 1695 : CH 1710	60.83	24.50	15.00	0.70	257.25	"
115	CH 1710 : CH 1725	45.46	24.50	15.00	0.70	257.25	"
116	CH 1725 : CH 1740	36.95	24.50	15.00	0.70	257.25	"
117	CH 1740 : CH 1755	36.28	24.50	15.00	0.70	257.25	"
118	CH 1755 : CH 1770	40.92	24.50	15.00	0.70	257.25	"
119	CH 1770 : CH 1785	40.78	24.50	15.00	0.70	257.25	"
120	CH 1785 : CH 1800	37.79	24.50	15.00	0.70	257.25	"
121	CH 1800 : CH 1815	36.01	24.50	15.00	0.70	257.25	"
122	CH 1815 : CH 1830	34.74	24.50	15.00	0.70	257.25	"
123	CH 1830 : CH 1845	33.26	24.50	15.00	0.70	257.25	"
124	CH 1845 : CH 1860	31.66	24.50	15.00	0.70	257.25	"
125	CH 1860 : CH 1875	31.74	24.50	15.00	0.70	257.25	"
126	CH 1875 : CH 1890	33.71	24.50	15.00	0.70	257.25	"
127	CH 1890 : CH 1905	35.89	24.50	15.00	0.70	257.25	"
128	CH 1905 : CH 1920	33.32	24.50	15.00	0.70	257.25	"

129	CH 1920 : CH 1935	30.38	24.50	15.00	0.70	257.25	"
130	CH 1935 : CH 1950	31.36	24.50	15.00	0.70	257.25	"
131	CH 1950 : CH 1965	30.72	24.50	15.00	0.70	257.25	"
132	CH 1965 : CH 1980	28.36	24.50	15.00	0.70	257.25	"
133	CH 1980 : CH 1995	26.91	24.50	15.00	0.70	257.25	"
134	CH 1995 : CH 2010	27.12	24.50	15.00	0.70	257.25	"
135	CH 2010 : CH 2025	28.12	24.50	15.00	0.70	257.25	"
136	CH 2025 : CH 2040	30.64	24.50	15.00	0.70	257.25	"
137	CH 2040 : CH 2055	32.85	24.50	15.00	0.70	257.25	"
138	CH 2055 : CH 2070	34.69	24.50	15.00	0.70	257.25	"
139	CH 2070 : CH 2085	27.28	24.50	15.00	0.70	257.25	"
140	CH 2085 : CH 2100	17.71	17.71	15.00	0.70	185.95	
141	CH 2100 : CH 2115	16.21	16.21	15.00	0.70	170.16	
142	CH 2115 : CH 2130	14.08	14.08	15.00	0.70	147.86	
143	CH 2130 : CH 2145	14.33	14.33	15.00	0.70	150.49	
144	CH 2145 : CH 2160	16.72	16.72	15.00	0.70	175.51	w>16.50
145	CH 2160 : CH 2175	18.04	18.04	15.00	0.70	189.43	"
146	CH 2175 : CH 2190	17.73	17.73	15.00	0.70	186.21	"
147	CH 2190 : CH 2205	18.18	18.18	15.00	0.70	190.88	"
148	CH 2205 : CH 2220	20.37	20.37	15.00	0.70	213.88	"
149	CH 2220 : CH 2235	22.16	22.16	15.00	0.70	232.72	"
150	CH 2235 : CH 2250	21.40	21.40	15.00	0.70	224.73	"
151	CH 2250 : CH 2265	19.76	19.76	15.00	0.70	207.44	"
152	CH 2265 : CH 2280	19.52	19.52	15.00	0.70	204.91	"
153	CH 2280 : CH 2295	19.57	19.57	15.00	0.70	205.53	"
154	CH 2295 : CH 2310	20.06	20.06	15.00	0.70	210.65	"
155	CH 2310 : CH 2325	20.84	20.84	15.00	0.70	218.80	"

156	CH 2325 : CH 2340	20.73	20.73	15.00	0.70	217.67	"
157	CH 2340 : CH 2355	19.88	19.88	15.00	0.70	208.76	"
158	CH 2355 : CH 2370	19.58	19.58	15.00	0.70	205.62	"
159	CH 2370 : CH 2385	19.32	19.32	15.00	0.70	202.86	"
160	CH 2385 : CH 2400	19.27	19.27	15.00	0.70	202.36	"
161	CH 2400 : CH 2415	20.64	20.64	15.00	0.70	216.70	"
162	CH 2415 : CH 2430	21.16	21.16	15.00	0.70	222.23	"
163	CH 2430 : CH 2445	21.62	21.62	15.00	0.70	226.97	"
164	CH 2445 : CH 2460	24.05	24.05	15.00	0.70	252.51	"
165	CH 2460 : CH 2475	24.44	24.44	15.00	0.70	256.66	"
166	CH 2475 : CH 2490	24.67	24.50	15.00	0.70	257.25	"
167	CH 2490 : CH 2505	25.07	24.50	15.00	0.70	257.25	"
168	CH 2505 : CH 2520	27.40	24.50	15.00	0.70	257.25	"
169	CH 2520 : CH 2535	23.59	23.59	15.00	0.70	247.71	"
170	CH 2535 : CH 2550	20.26	20.26	15.00	0.70	212.76	"
171	CH 2550 : CH 2565	33.32	24.50	15.00	0.70	257.25	"
172	CH 2565 : CH 2580	37.03	24.50	15.00	0.70	257.25	"
173	CH 2580 : CH 2595	25.38	24.50	15.00	0.70	257.25	"
174	CH 2595 : CH 2610	20.51	20.51	15.00	0.70	215.31	
175	CH 2610 : CH 2625	17.70	17.70	15.00	0.70	185.83	
176	CH 2625 : CH 2640	14.28	14.28	15.00	0.70	149.89	
177	CH 2640 : CH 2655	14.45	14.45	15.00	0.70	151.73	
178	CH 2655 : CH 2670	14.11	14.11	15.00	0.70	148.12	
179	CH 2670 : CH 2685	12.57	12.57	15.00	0.70	131.97	
180	CH 2685 : CH 2700	13.48	13.48	15.00	0.70	141.56	
181	CH 2700 : CH 2715	16.65	16.65	15.00	0.70	174.80	w>16.50
182	CH 2715 : CH 2730	18.48	18.48	15.00	0.70	194.02	

183	CH 2730 : CH 2745	18.93	18.93	15.00	0.70	198.78	
184	CH 2745 : CH 2760	13.93	13.93	15.00	0.70	146.29	
185	CH 2760 : CH 2775	11.35	11.35	15.00	0.70	119.18	
186	CH 2775 : CH 2790	10.78	10.78	15.00	0.70	113.14	
187	CH 2790 : CH 2805	10.53	10.53	15.00	0.70	110.54	
188	CH 2805 : CH 2820	10.65	10.65	15.00	0.70	111.85	
189	CH 2820 : CH 2835	14.76	14.76	15.00	0.70	155.02	
190	CH 2835 : CH 2850	14.04	14.04	15.00	0.70	147.39	
191	CH 2850 : CH 2865	17.50	17.50	15.00	0.70	183.78	
192	CH 2865 : CH 2880	18.65	18.65	15.00	0.70	195.85	
193	CH 2880 : CH 2895	14.25	14.25	15.00	0.70	149.64	
194	CH 2895 : CH 2910	12.74	12.74	15.00	0.70	133.76	
195	CH 2910 : CH 2925	12.40	12.40	15.00	0.70	130.18	
196	CH 2925 : CH 2940	11.22	11.22	15.00	0.70	117.78	
197	CH 2940 : CH 2955	10.75	10.75	15.00	0.70	112.92	
198	CH 2955 : CH 2970	9.02	9.02	15.00	0.70	94.70	
199	CH 2970 : CH 2985	8.01	8.01	15.00	0.70	84.14	
200	CH 2985 : CH 3000	10.35	10.35	15.00	0.70	108.65	
201	CH 3000 : CH 3015	11.84	11.84	15.00	0.70	124.34	
202	CH 3015 : CH 3030	11.67	11.67	15.00	0.70	122.52	
203	CH 3030 : CH 3045	12.09	12.09	15.00	0.70	126.97	
204	CH 3045 : CH 3060	12.91	12.91	15.00	0.70	135.56	
205	CH 3060 : CH 3075	14.78	14.78	15.00	0.70	155.22	
206	CH 3075 : CH 3090	15.54	15.54	15.00	0.70	163.20	
207	CH 3090 : CH 3105	16.50	16.50	15.00	0.70	173.30	
208	CH 3105 : CH 3120	16.63	16.63	15.00	0.70	174.58	
209	CH 3120 : CH 3135	12.09	12.09	15.00	0.70	126.99	

210	CH 3135 : CH 3150	9.09	9.09	15.00	0.70	95.43	
211	CH 3150 : CH 3165	8.41	8.41	15.00	0.70	88.33	
212	CH 3165 : CH 3180	9.40	9.40	15.00	0.70	98.66	
213	CH 3180 : CH 3195	10.06	10.06	15.00	0.70	105.63	
214	CH 3195 : CH 3210	8.90	8.90	15.00	0.70	93.44	
215	CH 3210 : CH 3225	8.98	8.98	15.00	0.70	94.33	
216	CH 3225 : CH 3240	8.64	8.64	15.00	0.70	90.70	
217	CH 3240 : CH 3255	7.87	7.87	15.00	0.70	82.67	
218	CH 3255 : CH 3270	7.81	7.81	15.00	0.70	81.95	
219	CH 3270 : CH 3285	8.01	8.01	15.00	0.70	84.12	
220	CH 3285 : CH 3300	7.84	7.84	15.00	0.70	82.30	
221	CH 3300 : CH 3315	7.03	7.03	15.00	0.70	73.76	
222	CH 3315 : CH 3330	8.10	8.10	15.00	0.70	85.00	
223	CH 3330 : CH 3345	8.34	8.34	15.00	0.70	87.56	
224	CH 3345 : CH 3360	6.83	6.83	15.00	0.70	71.76	
225	CH 3360 : CH 3375	6.75	6.75	15.00	0.70	70.87	
226	CH 3375 : CH 3390	6.64	6.64	15.00	0.70	69.67	
227	CH 3390 : CH 3405	6.33	6.33	15.00	0.70	66.50	
228	CH 3405 : CH 3420	5.61	5.61	15.00	0.70	58.87	
229	CH 3420 : CH 3435	5.12	5.12	15.00	0.70	53.73	
230	CH 3435 : CH 3450	5.37	5.37	15.00	0.70	56.35	
231	CH 3450 : CH 3465	6.42	6.42	15.00	0.70	67.43	
232	CH 3465 : CH 3480	8.10	8.10	15.00	0.70	85.01	
233	CH 3480 : CH 3495	7.58	7.58	15.00	0.70	79.61	
234	CH 3495 : CH 3510	6.35	6.35	15.00	0.70	66.63	
235	CH 3510 : CH 3525	6.81	6.81	15.00	0.70	71.49	
236	CH 3525 : CH 3540	7.53	7.53	15.00	0.70	79.04	

237	CH 3540 : CH 3555	8.74	8.74	15.00	0.70	91.81	
238	CH 3555 : CH 3570	9.85	9.85	15.00	0.70	103.38	
239	CH 3570 : CH 3585	9.93	9.93	15.00	0.70	104.31	
240	CH 3585 : CH 3600	9.54	9.54	15.00	0.70	100.13	
241	CH 3600 : CH 3615	9.25	9.25	15.00	0.70	97.16	
242	CH 3615 : CH 3630	8.82	8.82	15.00	0.70	92.57	
243	CH 3630 : CH 3645	8.05	8.05	15.00	0.70	84.54	
244	CH 3645 : CH 3660	7.15	7.15	15.00	0.70	75.11	
245	CH 3660 : CH 3675	6.84	6.84	15.00	0.70	71.82	
246	CH 3675 : CH 3690	7.42	7.42	15.00	0.70	77.94	
247	CH 3690 : CH 3705	8.08	8.08	15.00	0.70	84.89	
248	CH 3705 : CH 3720	7.25	7.25	15.00	0.70	76.17	
249	CH 3720 : CH 3735	6.23	6.23	15.00	0.70	65.45	
250	CH 3735 : CH 3750	6.56	6.56	15.00	0.70	68.86	
251	CH 3750 : CH 3765	7.00	7.00	15.00	0.70	73.49	
252	CH 3765 : CH 3780	7.69	7.69	15.00	0.70	80.72	
253	CH 3780 : CH 3795	8.25	8.25	15.00	0.70	86.58	
254	CH 3795 : CH 3810	8.27	8.27	15.00	0.70	86.78	
255	CH 3810 : CH 3825	7.31	7.31	15.00	0.70	76.80	
256	CH 3825 : CH 3840	6.18	6.18	15.00	0.70	64.91	
257	CH 3840 : CH 3855	6.11	6.11	15.00	0.70	64.19	
258	CH 3855 : CH 3870	6.26	6.26	15.00	0.70	65.72	
259	CH 3870 : CH 3885	6.45	6.45	15.00	0.70	67.68	
260	CH 3885 : CH 3900	6.82	6.82	15.00	0.70	71.60	
261	CH 3900 : CH 3915	6.56	6.56	15.00	0.70	68.91	
262	CH 3915 : CH 3930	5.92	5.92	15.00	0.70	62.13	
263	CH 3930 : CH 3945	5.32	5.32	15.00	0.70	55.86	

264	CH 3945 : CH 3960	4.98	4.98	15.00	0.70	52.28	
265	CH 3960 : CH 3975	4.83	4.83	15.00	0.70	50.68	
266	CH 3975 : CH 3990	4.71	4.71	15.00	0.70	49.45	
267	CH 3990 : CH 4005	4.93	4.93	15.00	0.70	51.77	
268	CH 4005 : CH 4020	5.45	5.45	15.00	0.70	57.18	
269	CH 4020 : CH 4035	6.32	6.32	15.00	0.70	66.41	
270	CH 4035 : CH 4050	6.45	6.45	15.00	0.70	67.71	
271	CH 4050 : CH 4065	5.89	5.89	15.00	0.70	61.82	
272	CH 4065 : CH 4080	5.64	5.64	15.00	0.70	59.24	
273	CH 4080 : CH 4095	5.47	5.47	15.00	0.70	57.39	
274	CH 4095 : CH 4110	5.93	5.93	15.00	0.70	62.24	
275	CH 4110 : CH 4125	6.63	6.63	15.00	0.70	69.61	
276	CH 4125 : CH 4140	6.74	6.74	15.00	0.70	70.82	
277	CH 4140 : CH 4155	6.23	6.23	15.00	0.70	65.37	
278	CH 4155 : CH 4170	5.77	5.77	15.00	0.70	60.57	
279	CH 4170 : CH 4185	6.39	6.39	15.00	0.70	67.14	
280	CH 4185 : CH 4200	7.00	7.00	15.00	0.70	73.55	
281	CH 4200 : CH 4215	6.87	6.87	15.00	0.70	72.15	
282	CH 4215 : CH 4230	6.83	6.83	15.00	0.70	71.68	
283	CH 4230 : CH 4245	6.68	6.68	15.00	0.70	70.13	
284	CH 4245 : CH 4260	6.43	6.43	15.00	0.70	67.51	
285	CH 4260 : CH 4275	6.76	6.76	15.00	0.70	71.01	
286	CH 4275 : CH 4290	6.42	6.42	15.00	0.70	67.43	
287	CH 4290 : CH 4305	5.95	5.95	15.00	0.70	62.44	
288	CH 4305 : CH 4320	6.98	6.98	15.00	0.70	73.31	
289	CH 4320 : CH 4335	7.69	7.69	15.00	0.70	80.73	
290	CH 4335 : CH 4350	6.98	6.98	15.00	0.70	73.33	

291	CH 4350 : CH 4365	6.14	6.14	15.00	0.70	64.49	
292	CH 4365 : CH 4380	6.07	6.07	15.00	0.70	63.74	
293	CH 4380 : CH 4395	6.95	6.95	15.00	0.70	72.92	
294	CH 4395 : CH 4410	8.02	8.02	15.00	0.70	84.24	
295	CH 4410 : CH 4425	8.78	8.78	15.00	0.70	92.15	
296	CH 4425 : CH 4440	9.32	9.32	15.00	0.70	97.81	
297	CH 4440 : CH 4455	9.26	9.26	15.00	0.70	97.28	
298	CH 4455 : CH 4470	8.84	8.84	15.00	0.70	92.80	
299	CH 4470 : CH 4485	8.61	8.61	15.00	0.70	90.45	
300	CH 4485 : CH 4500	8.78	8.78	15.00	0.70	92.24	
301	CH 4500 : CH 4515	8.92	8.92	15.00	0.70	93.69	
302	CH 4515 : CH 4530	8.75	8.75	15.00	0.70	91.89	
303	CH 4530 : CH 4545	8.83	8.83	15.00	0.70	92.76	
304	CH 4545 : CH 4560	8.90	8.90	15.00	0.70	93.43	
305	CH 4560 : CH 4575	8.68	8.68	15.00	0.70	91.13	
306	CH 4575 : CH 4590	8.36	8.36	15.00	0.70	87.76	
307	CH 4590 : CH 4605	8.04	8.04	15.00	0.70	84.41	
308	CH 4605 : CH 4620	7.92	7.92	15.00	0.70	83.12	
309	CH 4620 : CH 4635	8.07	8.07	15.00	0.70	84.77	
310	CH 4635 : CH 4650	7.72	7.72	15.00	0.70	81.02	
311	CH 4650 : CH 4665	6.81	6.81	15.00	0.70	71.46	
312	CH 4665 : CH 4680	7.05	7.05	15.00	0.70	73.97	
313	CH 4680 : CH 4695	7.61	7.61	15.00	0.70	79.89	
314	CH 4695 : CH 4710	7.41	7.41	15.00	0.70	77.77	
315	CH 4710 : CH 4725	7.13	7.13	15.00	0.70	74.88	
316	CH 4725 : CH 4740	7.14	7.14	15.00	0.70	74.95	
317	CH 4740 : CH 4755	7.57	7.57	15.00	0.70	79.53	

318	CH 4755 : CH 4770	7.65	7.65	15.00	0.70	80.34	
319	CH 4770 : CH 4785	7.29	7.29	15.00	0.70	76.58	
320	CH 4785 : CH 4800	7.02	7.02	15.00	0.70	73.70	
321	CH 4800 : CH 4815	6.54	6.54	15.00	0.70	68.66	
322	CH 4815 : CH 4830	6.31	6.31	15.00	0.70	66.21	
323	CH 4830 : CH 4845	6.78	6.78	15.00	0.70	71.16	
324	CH 4845 : CH 4860	6.68	6.68	15.00	0.70	70.19	
325	CH 4860 : CH 4875	6.36	6.36	15.00	0.70	66.81	
326	CH 4875 : CH 4890	6.76	6.76	15.00	0.70	70.97	
327	CH 4890 : CH 4905	7.13	7.13	15.00	0.70	74.88	
328	CH 4905 : CH 4920	7.32	7.32	15.00	0.70	76.87	
329	CH 4920 : CH 4935	7.18	7.18	15.00	0.70	75.36	
330	CH 4935 : CH 4950	6.69	6.69	15.00	0.70	70.25	
331	CH 4950 : CH 4965	6.54	6.54	15.00	0.70	68.66	
332	CH 4965 : CH 4980	7.39	7.39	15.00	0.70	77.57	
333	CH 4980 : CH 4995	8.02	8.02	15.00	0.70	84.26	
334	CH 4995 : CH 5010	8.08	8.08	15.00	0.70	84.85	
335	CH 5010 : CH 5025	8.36	8.36	15.00	0.70	87.74	
336	CH 5025 : CH 5040	8.62	8.62	15.00	0.70	90.53	
337	CH 5040 : CH 5055	8.79	8.79	15.00	0.70	92.26	
338	CH 5055 : CH 5070	8.92	8.92	15.00	0.70	93.62	
339	CH 5070 : CH 5085	9.09	9.09	15.00	0.70	95.42	
340	CH 5085 : CH 5100	9.22	9.22	15.00	0.70	96.83	
341	CH 5100 : CH 5115	9.37	9.37	15.00	0.70	98.37	
342	CH 5115 : CH 5130	9.41	9.41	15.00	0.70	98.79	
343	CH 5130 : CH 5145	9.32	9.32	15.00	0.70	97.90	
344	CH 5145 : CH 5160	9.22	9.22	15.00	0.70	96.76	

345	CH 5160 : CH 5175	9.19	9.19	15.00	0.70	96.45	
346	CH 5175 : CH 5190	9.32	9.32	15.00	0.70	97.81	
347	CH 5190 : CH 5205	9.49	9.49	15.00	0.70	99.69	
348	CH 5205 : CH 5220	9.60	9.60	15.00	0.70	100.83	
349	CH 5220 : CH 5235	8.10	8.10	15.00	0.70	85.03	
350	CH 5235 : CH 5250	6.71	6.71	15.00	0.70	70.45	
351	CH 5250 : CH 5265	7.14	7.14	15.00	0.70	74.99	
352	CH 5265 : CH 5280	7.18	7.18	15.00	0.70	75.40	
353	CH 5280 : CH 5295	6.97	6.97	15.00	0.70	73.15	
354	CH 5295 : CH 5310	7.30	7.30	15.00	0.70	76.64	
355	CH 5310 : CH 5325	7.88	7.88	15.00	0.70	82.71	
356	CH 5325 : CH 5340	2.32	2.32	15.00	0.70	24.36	
357	CH 5340 : CH 5355	0.00	0.00	15.00	0.70	0.00	
358	CH 5355 : CH 5370	0.00	0.00	15.00	0.70	0.00	
359	CH 5370 : CH 5385	0.95	0.95	15.00	0.70	9.95	
360	CH 5385 : CH 5400	4.54	4.54	15.00	0.70	47.63	
361	CH 5400 : CH 5415	7.70	7.70	15.00	0.70	80.88	
362	CH 5415 : CH 5430	8.25	8.25	15.00	0.70	86.57	
363	CH 5430 : CH 5445	8.35	8.35	15.00	0.70	87.63	
364	CH 5445 : CH 5460	8.18	8.18	15.00	0.70	85.90	
365	CH 5460 : CH 5475	7.34	7.34	15.00	0.70	77.02	
366	CH 5475 : CH 5490	5.82	5.82	15.00	0.70	61.06	
367	CH 5490 : CH 5505	5.48	5.48	15.00	0.70	57.50	
368	CH 5505 : CH 5520	6.62	6.62	15.00	0.70	69.51	
369	CH 5520 : CH 5535	7.28	7.28	15.00	0.70	76.42	
370	CH 5535 : CH 5550	7.38	7.38	15.00	0.70	77.53	
371	CH 5550 : CH 5565	7.31	7.31	15.00	0.70	76.74	

372	CH 5565 : CH 5580	8.20	8.20	15.00	0.70	86.15	
373	CH 5580 : CH 5595	10.06	10.06	15.00	0.70	105.61	
374	CH 5595 : CH 5610	7.62	7.62	15.00	0.70	80.00	
375	CH 5610 : CH 5625	5.97	5.97	15.00	0.70	62.65	
376	CH 5625 : CH 5640	6.14	6.14	15.00	0.70	64.48	
377	CH 5640 : CH 5655	6.30	6.30	15.00	0.70	66.18	
378	CH 5655 : CH 5670	6.28	6.28	15.00	0.70	65.97	
379	CH 5670 : CH 5685	6.11	6.11	15.00	0.70	64.19	
380	CH 5685 : CH 5700	6.12	6.12	15.00	0.70	64.23	
381	CH 5700 : CH 5715	6.34	6.34	15.00	0.70	66.53	
382	CH 5715 : CH 5730	6.63	6.63	15.00	0.70	69.59	
383	CH 5730 : CH 5745	6.44	6.44	15.00	0.70	67.58	
384	CH 5745 : CH 5760	5.24	5.24	15.00	0.70	54.99	
385	CH 5760 : CH 5775	7.81	7.81	15.00	0.70	82.01	
386	CH 5775 : CH 5790	11.50	11.50	15.00	0.70	120.73	
387	CH 5790 : CH 5805	13.57	13.57	15.00	0.70	142.43	
388	CH 5805 : CH 5820	12.29	12.29	15.00	0.70	129.03	
389	CH 5820 : CH 5835	8.53	8.53	15.00	0.70	89.59	
390	CH 5835 : CH 5850	8.22	8.22	15.00	0.70	86.30	
391	CH 5850 : CH 5865	8.20	8.20	15.00	0.70	86.06	
392	CH 5865 : CH 5880	9.04	9.04	15.00	0.70	94.91	
393	CH 5880 : CH 5895	9.71	9.71	15.00	0.70	101.91	
394	CH 5895 : CH 5910	9.57	9.57	15.00	0.70	100.53	
395	CH 5910 : CH 5925	9.72	9.72	15.00	0.70	102.11	
396	CH 5925 : CH 5940	10.35	10.35	15.00	0.70	108.69	
397	CH 5940 : CH 5955	11.47	11.47	15.00	0.70	120.40	
398	CH 5955 : CH 5970	13.47	13.47	15.00	0.70	141.46	

399	CH 5970 : CH 5985	15.60	15.60	15.00	0.70	163.79	
400	CH 5985 : CH 6000	15.20	15.20	15.00	0.70	159.64	
401	CH 6000 : CH 6015	14.13	14.13	15.00	0.70	148.41	
402	CH 6015 : CH 6030	14.17	14.17	15.00	0.70	148.81	
403	CH 6030 : CH 6045	14.01	14.01	15.00	0.70	147.15	
404	CH 6045 : CH 6060	13.66	13.66	15.00	0.70	143.44	
405	CH 6060 : CH 6075	13.25	13.25	15.00	0.70	139.12	
406	CH 6075 : CH 6090	13.57	13.57	15.00	0.70	142.50	
407	CH 6090 : CH 6105	13.88	13.88	15.00	0.70	145.71	
408	CH 6105 : CH 6120	12.96	12.96	15.00	0.70	136.11	
409	CH 6120 : CH 6135	12.17	12.17	15.00	0.70	127.79	
410	CH 6135 : CH 6150	13.63	13.63	15.00	0.70	143.13	
411	CH 6150 : CH 6165	14.95	14.95	15.00	0.70	157.01	
412	CH 6165 : CH 6180	14.19	14.19	15.00	0.70	148.97	
413	CH 6180 : CH 6195	12.51	12.51	15.00	0.70	131.32	
414	CH 6195 : CH 6210	11.53	11.53	15.00	0.70	121.02	
415	CH 6210 : CH 6225	12.16	12.16	15.00	0.70	127.70	
416	CH 6225 : CH 6240	13.12	13.12	15.00	0.70	137.79	
417	CH 6240 : CH 6255	12.42	12.42	15.00	0.70	130.40	
418	CH 6255 : CH 6270	11.27	11.27	15.00	0.70	118.34	
419	CH 6270 : CH 6285	11.67	11.67	15.00	0.70	122.55	
420	CH 6285 : CH 6300	12.68	12.68	15.00	0.70	133.19	
421	CH 6300 : CH 6315	14.28	14.28	15.00	0.70	149.90	
422	CH 6315 : CH 6330	15.78	15.78	15.00	0.70	165.66	w>16.50
423	CH 6330 : CH 6345	16.77	16.77	15.00	0.70	176.04	"
424	CH 6345 : CH 6360	17.47	17.47	15.00	0.70	183.41	"
425	CH 6360 : CH 6375	17.47	17.47	15.00	0.70	183.45	"

426	CH 6375 : CH 6390	17.02	17.02	15.00	0.70	178.66	
427	CH 6390 : CH 6405	16.52	16.52	15.00	0.70	173.42	
428	CH 6405 : CH 6420	16.02	16.02	15.00	0.70	168.18	
429	CH 6420 : CH 6435	15.52	15.52	15.00	0.70	162.95	
430	CH 6435 : CH 6450	15.02	15.02	15.00	0.70	157.71	
431	CH 6450 : CH 6465	14.52	14.52	15.00	0.70	152.47	
432	CH 6465 : CH 6480	14.02	14.02	15.00	0.70	147.24	
433	CH 6480 : CH 6495	13.42	13.42	15.00	0.70	140.90	
434	CH 6495 : CH 6510	12.66	12.66	15.00	0.70	132.88	
435	CH 6510 : CH 6525	10.60	10.60	15.00	0.70	111.28	
436	CH 6525 : CH 6540	8.11	8.11	15.00	0.70	85.20	
437	CH 6540 : CH 6555	9.15	9.15	15.00	0.70	96.08	
438	CH 6555 : CH 6570	12.23	12.23	15.00	0.70	128.46	
439	CH 6570 : CH 6585	13.65	13.65	15.00	0.70	143.28	
440	CH 6585 : CH 6600	12.07	12.07	15.00	0.70	126.72	
441	CH 6600 : CH 6615	9.66	9.66	15.00	0.70	101.44	
442	CH 6615 : CH 6630	10.45	10.45	15.00	0.70	109.77	
443	CH 6630 : CH 6645	12.03	12.03	15.00	0.70	126.27	
444	CH 6645 : CH 6660	12.55	12.55	15.00	0.70	131.82	
445	CH 6660 : CH 6675	11.94	11.94	15.00	0.70	125.32	
446	CH 6675 : CH 6690	11.22	11.22	15.00	0.70	117.76	
447	CH 6690 : CH 6705	11.59	11.59	15.00	0.70	121.68	
448	CH 6705 : CH 6720	12.79	12.79	15.00	0.70	134.26	
449	CH 6720 : CH 6735	14.62	14.62	15.00	0.70	153.52	
450	CH 6735 : CH 6750	16.25	16.25	15.00	0.70	170.59	
451	CH 6750 : CH 6765	16.50	16.50	15.00	0.70	173.23	
452	CH 6765 : CH 6780	16.17	16.17	15.00	0.70	169.81	

453	CH 6780 : CH 6795	16.44	16.44	15.00	0.70	172.65	
454	CH 6795 : CH 6810	16.26	16.26	15.00	0.70	170.69	
455	CH 6810 : CH 6825	15.94	15.94	15.00	0.70	167.40	
456	CH 6825 : CH 6840	15.12	15.12	15.00	0.70	158.74	
457	CH 6840 : CH 6855	13.27	13.27	15.00	0.70	139.34	
458	CH 6855 : CH 6870	12.05	12.05	15.00	0.70	126.51	
459	CH 6870 : CH 6885	12.69	12.69	15.00	0.70	133.21	
460	CH 6885 : CH 6900	14.78	14.78	15.00	0.70	155.14	
461	CH 6900 : CH 6915	16.45	16.45	15.00	0.70	172.77	w>16.50
462	CH 6915 : CH 6930	17.34	17.34	15.00	0.70	182.04	"
463	CH 6930 : CH 6945	17.34	17.34	15.00	0.70	182.09	
464	CH 6945 : CH 6960	16.51	16.51	15.00	0.70	173.36	
465	CH 6960 : CH 6975	16.19	16.19	15.00	0.70	170.03	
466	CH 6975 : CH 6990	15.71	15.71	15.00	0.70	164.94	
467	CH 6990 : CH 7005	15.27	15.27	15.00	0.70	160.29	
468	CH 7005 : CH 7020	15.55	15.55	15.00	0.70	163.25	
469	CH 7020 : CH 7035	15.88	15.88	15.00	0.70	166.75	
470	CH 7035 : CH 7050	15.46	15.46	15.00	0.70	162.30	
471	CH 7050 : CH 7065	14.85	14.85	15.00	0.70	155.94	
472	CH 7065 : CH 7080	14.42	14.42	15.00	0.70	151.42	
473	CH 7080 : CH 7095	13.98	13.98	15.00	0.70	146.74	
474	CH 7095 : CH 7110	13.53	13.53	15.00	0.70	142.09	
475	CH 7110 : CH 7125	13.19	13.19	15.00	0.70	138.51	
476	CH 7125 : CH 7140	13.57	13.57	15.00	0.70	142.52	
477	CH 7140 : CH 7155	14.41	14.41	15.00	0.70	151.26	
478	CH 7155 : CH 7170	13.49	13.49	15.00	0.70	141.68	
479	CH 7170 : CH 7185	12.33	12.33	15.00	0.70	129.46	

480	CH 7185 : CH 7200	13.29	13.29	15.00	0.70	139.52	
481	CH 7200 : CH 7215	13.72	13.72	15.00	0.70	144.01	
482	CH 7215 : CH 7230	12.95	12.95	15.00	0.70	135.99	
483	CH 7230 : CH 7245	12.27	12.27	15.00	0.70	128.82	
484	CH 7245 : CH 7260	13.08	13.08	15.00	0.70	137.32	
485	CH 7260 : CH 7275	14.51	14.51	15.00	0.70	152.37	
486	CH 7275 : CH 7290	14.67	14.67	15.00	0.70	154.02	
487	CH 7290 : CH 7305	14.26	14.26	15.00	0.70	149.74	
488	CH 7305 : CH 7320	14.12	14.12	15.00	0.70	148.21	
489	CH 7320 : CH 7335	14.71	14.71	15.00	0.70	154.49	
490	CH 7335 : CH 7350	14.97	14.97	15.00	0.70	157.20	
491	CH 7350 : CH 7365	14.37	14.37	15.00	0.70	150.93	
492	CH 7365 : CH 7380	13.36	13.36	15.00	0.70	140.25	
493	CH 7380 : CH 7395	12.52	12.52	15.00	0.70	131.49	
494	CH 7395 : CH 7410	12.69	12.69	15.00	0.70	133.21	
495	CH 7410 : CH 7425	13.70	13.70	15.00	0.70	143.81	
496	CH 7425 : CH 7440	14.91	14.91	15.00	0.70	156.52	
497	CH 7440 : CH 7455	16.15	16.15	15.00	0.70	169.56	w>16.50
498	CH 7455 : CH 7470	16.80	16.80	15.00	0.70	176.40	"
499	CH 7470 : CH 7485	16.65	16.65	15.00	0.70	174.84	
500	CH 7485 : CH 7500	16.31	16.31	15.00	0.70	171.24	
501	CH 7500 : CH 7515	15.96	15.96	15.00	0.70	167.57	
502	CH 7515 : CH 7530	15.61	15.61	15.00	0.70	163.86	
503	CH 7530 : CH 7545	14.73	14.73	15.00	0.70	154.66	
504	CH 7545 : CH 7560	13.38	13.38	15.00	0.70	140.47	
505	CH 7560 : CH 7575	12.11	12.11	15.00	0.70	127.12	
506	CH 7575 : CH 7590	11.49	11.49	15.00	0.70	120.68	

507	CH 7590 : CH 7605	12.20	12.20	15.00	0.70	128.11	
508	CH 7605 : CH 7620	12.94	12.94	15.00	0.70	135.82	
509	CH 7620 : CH 7635	12.98	12.98	15.00	0.70	136.31	
510	CH 7635 : CH 7650	13.01	13.01	15.00	0.70	136.56	
511	CH 7650 : CH 7665	12.91	12.91	15.00	0.70	135.52	
512	CH 7665 : CH 7680	12.81	12.81	15.00	0.70	134.54	
513	CH 7680 : CH 7695	13.15	13.15	15.00	0.70	138.06	
514	CH 7695 : CH 7710	14.53	14.53	15.00	0.70	152.60	
515	CH 7710 : CH 7725	15.87	15.87	15.00	0.70	166.64	
516	CH 7725 : CH 7740	15.26	15.26	15.00	0.70	160.21	
517	CH 7740 : CH 7755	15.53	15.53	15.00	0.70	163.11	w>16.50
518	CH 7755 : CH 7770	16.74	16.74	15.00	0.70	175.81	"
519	CH 7770 : CH 7785	16.81	16.81	15.00	0.70	176.48	"
520	CH 7785 : CH 7800	16.86	16.86	15.00	0.70	177.07	"
521	CH 7800 : CH 7815	16.99	16.99	15.00	0.70	178.39	"
522	CH 7815 : CH 7830	17.05	17.05	15.00	0.70	179.05	
523	CH 7830 : CH 7845	16.07	16.07	15.00	0.70	168.70	
524	CH 7845 : CH 7860	15.76	15.76	15.00	0.70	165.45	w>16.50
525	CH 7860 : CH 7875	16.49	16.49	15.00	0.70	173.11	
526	CH 7875 : CH 7890	16.45	16.45	15.00	0.70	172.71	
527	CH 7890 : CH 7905	16.03	16.03	15.00	0.70	168.29	
528	CH 7905 : CH 7920	15.50	15.50	15.00	0.70	162.71	
529	CH 7920 : CH 7935	15.07	15.07	15.00	0.70	158.21	
530	CH 7935 : CH 7950	14.83	14.83	15.00	0.70	155.75	
531	CH 7950 : CH 7965	14.66	14.66	15.00	0.70	153.96	
532	CH 7965 : CH 7980	14.53	14.53	15.00	0.70	152.58	
533	CH 7980 : CH 7995	14.44	14.44	15.00	0.70	151.59	

534	CH 7995 : CH 8010	14.34	14.34	15.00	0.70	150.56	
535	CH 8010 : CH 8025	14.34	14.34	15.00	0.70	150.55	
536	CH 8025 : CH 8040	13.63	13.63	15.00	0.70	143.14	
537	CH 8040 : CH 8055	13.29	13.29	15.00	0.70	139.50	
538	CH 8055 : CH 8070	13.62	13.62	15.00	0.70	143.02	
539	CH 8070 : CH 8085	14.04	14.04	15.00	0.70	147.41	
540	CH 8085 : CH 8100	14.36	14.36	15.00	0.70	150.80	
541	CH 8100 : CH 8115	13.96	13.96	15.00	0.70	146.58	
542	CH 8115 : CH 8130	15.05	15.05	15.00	0.70	157.99	
543	CH 8130 : CH 8145	15.96	15.96	15.00	0.70	167.55	
544	CH 8145 : CH 8160	15.62	15.62	15.00	0.70	163.96	
545	CH 8160 : CH 8175	16.04	16.04	15.00	0.70	168.39	w>16.50
546	CH 8175 : CH 8190	16.83	16.83	15.00	0.70	176.66	"
547	CH 8190 : CH 8205	17.19	17.19	15.00	0.70	180.48	"
548	CH 8205 : CH 8220	17.10	17.10	15.00	0.70	179.53	"
549	CH 8220 : CH 8235	17.24	17.24	15.00	0.70	181.01	"
550	CH 8235 : CH 8250	17.38	17.38	15.00	0.70	182.44	"
551	CH 8250 : CH 8265	17.67	17.67	15.00	0.70	185.57	"
552	CH 8265 : CH 8280	17.57	17.57	15.00	0.70	184.49	
553	CH 8280 : CH 8295	16.63	16.63	15.00	0.70	174.63	
554	CH 8295 : CH 8310	15.83	15.83	15.00	0.70	166.23	
555	CH 8310 : CH 8325	15.59	15.59	15.00	0.70	163.67	
556	CH 8325 : CH 8340	15.39	15.39	15.00	0.70	161.55	
557	CH 8340 : CH 8355	15.15	15.15	15.00	0.70	159.09	
558	CH 8355 : CH 8370	13.64	13.64	15.00	0.70	143.21	
559	CH 8370 : CH 8385	12.85	12.85	15.00	0.70	134.95	
560	CH 8385 : CH 8400	14.11	14.11	15.00	0.70	148.14	

561	CH 8400 : CH 8415	14.41	14.41	15.00	0.70	151.29	
562	CH 8415 : CH 8430	14.29	14.29	15.00	0.70	150.00	
563	CH 8430 : CH 8445	14.77	14.77	15.00	0.70	155.09	
564	CH 8445 : CH 8460	14.85	14.85	15.00	0.70	155.97	
565	CH 8460 : CH 8475	14.40	14.40	15.00	0.70	151.16	
566	CH 8475 : CH 8490	13.94	13.94	15.00	0.70	146.41	
567	CH 8490 : CH 8505	13.67	13.67	15.00	0.70	143.52	
568	CH 8505 : CH 8520	13.59	13.59	15.00	0.70	142.71	
569	CH 8520 : CH 8535	13.41	13.41	15.00	0.70	140.76	
570	CH 8535 : CH 8550	13.28	13.28	15.00	0.70	139.43	
571	CH 8550 : CH 8565	13.30	13.30	15.00	0.70	139.69	
572	CH 8565 : CH 8580	13.46	13.46	15.00	0.70	141.28	
573	CH 8580 : CH 8595	13.69	13.69	15.00	0.70	143.72	
574	CH 8595 : CH 8610	13.78	13.78	15.00	0.70	144.68	
575	CH 8610 : CH 8625	13.42	13.42	15.00	0.70	140.90	
576	CH 8625 : CH 8640	13.10	13.10	15.00	0.70	137.56	
577	CH 8640 : CH 8655	13.19	13.19	15.00	0.70	138.49	
578	CH 8655 : CH 8670	13.27	13.27	15.00	0.70	139.35	
579	CH 8670 : CH 8685	13.30	13.30	15.00	0.70	139.68	
580	CH 8685 : CH 8700	13.52	13.52	15.00	0.70	141.94	
581	CH 8700 : CH 8715	14.98	14.98	15.00	0.70	157.31	
582	CH 8715 : CH 8730	16.37	16.37	15.00	0.70	171.90	
583	CH 8730 : CH 8745	16.05	16.05	15.00	0.70	168.49	
584	CH 8745 : CH 8760	15.55	15.55	15.00	0.70	163.31	
585	CH 8760 : CH 8775	15.74	15.74	15.00	0.70	165.24	
586	CH 8775 : CH 8790	16.16	16.16	15.00	0.70	169.63	
587	CH 8790 : CH 8805	15.93	15.93	15.00	0.70	167.28	

588	CH 8805 : CH 8820	15.51	15.51	15.00	0.70	162.82	
589	CH 8820 : CH 8835	15.60	15.60	15.00	0.70	163.82	
590	CH 8835 : CH 8850	15.55	15.55	15.00	0.70	163.27	
591	CH 8850 : CH 8865	16.46	16.46	15.00	0.70	172.88	
592	CH 8865 : CH 8880	16.95	16.95	15.00	0.70	178.02	
593	CH 8880 : CH 8895	15.71	15.71	15.00	0.70	165.00	
594	CH 8895 : CH 8910	14.94	14.94	15.00	0.70	156.91	
595	CH 8910 : CH 8925	15.24	15.24	15.00	0.70	160.05	
596	CH 8925 : CH 8940	16.05	16.05	15.00	0.70	168.55	w>16.50
597	CH 8940 : CH 8955	16.91	16.91	15.00	0.70	177.56	"
598	CH 8955 : CH 8970	17.66	17.66	15.00	0.70	185.42	"
599	CH 8970 : CH 8985	18.09	18.09	15.00	0.70	189.96	"
600	CH 8985 : CH 9000	18.18	18.18	15.00	0.70	190.84	"
601	CH 9000 : CH 9015	17.97	17.97	15.00	0.70	188.73	"
602	CH 9015 : CH 9030	17.53	17.53	15.00	0.70	184.07	"
603	CH 9030 : CH 9045	19.86	19.86	15.00	0.70	208.54	"
604	CH 9045 : CH 9060	22.06	22.06	15.00	0.70	231.63	"
605	CH 9060 : CH 9075	22.27	22.27	15.00	0.70	233.80	"
606	CH 9075 : CH 9090	22.19	22.19	15.00	0.70	233.04	"
607	CH 9090 : CH 9105	19.34	19.34	15.00	0.70	203.06	"
608	CH 9105 : CH 9120	17.23	17.23	15.00	0.70	180.96	"
609	CH 9120 : CH 9135	17.32	17.32	15.00	0.70	181.81	"
610	CH 9135 : CH 9150	17.43	17.43	15.00	0.70	183.04	"
611	CH 9150 : CH 9165	17.81	17.81	15.00	0.70	187.03	"
612	CH 9165 : CH 9180	18.43	18.43	15.00	0.70	193.53	"
613	CH 9180 : CH 9195	18.86	18.86	15.00	0.70	198.07	"
614	CH 9195 : CH 9210	19.06	19.06	15.00	0.70	200.18	"

615	CH 9210 : CH 9225	19.11	19.11	15.00	0.70	200.62	"
616	CH 9225 : CH 9240	19.03	19.03	15.00	0.70	199.82	"
617	CH 9240 : CH 9255	18.40	18.40	15.00	0.70	193.16	
618	CH 9255 : CH 9270	16.98	16.98	15.00	0.70	178.27	
619	CH 9270 : CH 9285	15.50	15.50	15.00	0.70	162.79	
620	CH 9285 : CH 9300	14.67	14.67	15.00	0.70	154.00	
621	CH 9300 : CH 9315	14.53	14.53	15.00	0.70	152.52	
622	CH 9315 : CH 9330	14.68	14.68	15.00	0.70	154.09	
623	CH 9330 : CH 9345	14.95	14.95	15.00	0.70	156.94	
624	CH 9345 : CH 9360	14.91	14.91	15.00	0.70	156.60	
625	CH 9360 : CH 9375	14.58	14.58	15.00	0.70	153.14	
626	CH 9375 : CH 9390	14.32	14.32	15.00	0.70	150.40	
627	CH 9390 : CH 9405	14.12	14.12	15.00	0.70	148.28	
628	CH 9405 : CH 9420	14.17	14.17	15.00	0.70	148.73	
629	CH 9420 : CH 9435	14.41	14.41	15.00	0.70	151.33	
630	CH 9435 : CH 9450	14.63	14.63	15.00	0.70	153.64	
631	CH 9450 : CH 9465	14.93	14.93	15.00	0.70	156.72	
632	CH 9465 : CH 9480	15.43	15.43	15.00	0.70	161.99	
633	CH 9480 : CH 9495	15.78	15.78	15.00	0.70	165.72	
634	CH 9495 : CH 9510	15.60	15.60	15.00	0.70	163.77	
635	CH 9510 : CH 9525	15.07	15.07	15.00	0.70	158.24	
636	CH 9525 : CH 9540	14.78	14.78	15.00	0.70	155.23	
637	CH 9540 : CH 9555	14.79	14.79	15.00	0.70	155.26	
638	CH 9555 : CH 9570	15.64	15.64	15.00	0.70	164.21	w>16.50
639	CH 9570 : CH 9585	17.45	17.45	15.00	0.70	183.25	"
640	CH 9585 : CH 9600	18.87	18.87	15.00	0.70	198.10	"
641	CH 9600 : CH 9615	18.69	18.69	15.00	0.70	196.23	"

642	CH 9615 : CH 9630	18.03	18.03	15.00	0.70	189.32	"
643	CH 9630 : CH 9645	18.03	18.03	15.00	0.70	189.30	"
644	CH 9645 : CH 9660	18.18	18.18	15.00	0.70	190.92	"
645	CH 9660 : CH 9675	18.18	18.18	15.00	0.70	190.89	"
646	CH 9675 : CH 9690	17.97	17.97	15.00	0.70	188.69	"
647	CH 9690 : CH 9705	17.74	17.74	15.00	0.70	186.28	"
648	CH 9705 : CH 9720	17.36	17.36	15.00	0.70	182.30	"
649	CH 9720 : CH 9735	17.01	17.01	15.00	0.70	178.62	"
650	CH 9735 : CH 9750	16.94	16.94	15.00	0.70	177.83	"
651	CH 9750 : CH 9765	17.13	17.13	15.00	0.70	179.88	"
652	CH 9765 : CH 9780	17.40	17.40	15.00	0.70	182.66	"
653	CH 9780 : CH 9795	17.84	17.84	15.00	0.70	187.35	"
654	CH 9795 : CH 9810	18.35	18.35	15.00	0.70	192.63	"
655	CH 9810 : CH 9825	18.52	18.52	15.00	0.70	194.50	"
656	CH 9825 : CH 9840	17.69	17.69	15.00	0.70	185.77	"
657	CH 9840 : CH 9855	17.08	17.08	15.00	0.70	179.29	"
658	CH 9855 : CH 9870	16.90	16.90	15.00	0.70	177.50	"
659	CH 9870 : CH 9884.64	30.88	24.50	14.64	0.70	251.01	
	Total Quantity					**1,04,295.23**	
	De-silting quantity of sub canals (19 nos.)	3.32		10286.00		10243.93	
	Grand Total					**1,14,539.16**	

1.4 Thevara Canal

Table 5: Deepening Details of Thevara Canal

Sl.No	Chainage	W (m)	Length (m)	Assumed canal depth (m)	De-Silting Quantity (m3)	Remarks
1	CH 000 : CH 15	21.88	15.00	0.70	229.69	w>16.50
2	CH 15 : CH 30	20.45	15.00	0.70	214.67	"
3	CH 30 : CH 45	19.53	15.00	0.70	205.07	"
4	CH 45 : CH 60	18.94	15.00	0.70	198.87	"
5	CH 60 : CH 75	18.82	15.00	0.70	197.56	"
6	CH 75 : CH 90	17.64	15.00	0.70	185.17	
7	CH 90 : CH 105	16.26	15.00	0.70	170.68	
8	CH 105 : CH 120	15.42	15.00	0.70	161.86	
9	CH 120 : CH 135	14.60	15.00	0.70	153.30	
10	CH 135 : CH 150	15.92	15.00	0.70	167.11	
11	CH 150 : CH 165	18.39	15.00	0.70	193.10	"
12	CH 165 : CH 180	19.32	15.00	0.70	202.86	"
13	CH 180 : CH 195	19.24	15.00	0.70	201.97	"
14	CH 195 : CH 210	19.28	15.00	0.70	202.44	"
15	CH 210 : CH 225	19.18	15.00	0.70	201.39	"
16	CH 225 : CH 240	19.16	15.00	0.70	201.18	"
17	CH 240 : CH 255	19.39	15.00	0.70	203.60	"
18	CH 255 : CH 270	19.52	15.00	0.70	204.91	"
19	CH 270 : CH 285	19.50	15.00	0.70	204.75	"
20	CH 285 : CH 300	19.31	15.00	0.70	202.70	"
21	CH 300 : CH 315	18.93	15.00	0.70	198.77	"

Sl.No	Chainage	W (m)	Length (m)	Assumed canal depth (m)	De-Silting Quantity (m3)	Remarks
22	CH 315 : CH 330	18.93	15.00	0.70	198.71	"
23	CH 330 : CH 345	19.59	15.00	0.70	205.70	"
24	CH 345 : CH 360	20.02	15.00	0.70	210.16	"
25	CH 360 : CH 375	19.61	15.00	0.70	205.85	"
26	CH 375 : CH 390	18.86	15.00	0.70	198.03	"
27	CH 390 : CH 405	18.40	15.00	0.70	193.15	"
28	CH 405 : CH 420	18.63	15.00	0.70	195.56	"
29	CH 420 : CH 435	18.98	15.00	0.70	199.29	"
30	CH 435 : CH 450	19.22	15.00	0.70	201.81	"
31	CH 450 : CH 465	19.31	15.00	0.70	202.76	"
32	CH 465 : CH 480	19.28	15.00	0.70	202.44	"
33	CH 480 : CH 495	18.86	15.00	0.70	197.98	"
34	CH 495 : CH 510	17.13	15.00	0.70	179.81	
35	CH 510 : CH 525	15.93	15.00	0.70	167.21	
36	CH 525 : CH 540	15.82	15.00	0.70	166.11	
37	CH 540 : CH 555	15.68	15.00	0.70	164.64	
38	CH 555 : CH 570	15.71	15.00	0.70	164.90	
39	CH 570 : CH 585	16.43	15.00	0.70	172.52	
40	CH 585 : CH 600	17.08	15.00	0.70	179.34	"
41	CH 600 : CH 615	16.95	15.00	0.70	177.98	"
42	CH 615 : CH 630	16.24	15.00	0.70	170.47	
43	CH 630 : CH 645	16.04	15.00	0.70	168.42	
44	CH 645 : CH 660	16.49	15.00	0.70	173.15	

Sl.No	Chainage	W (m)	Length (m)	Assumed canal depth (m)	De-Silting Quantity (m3)	Remarks
45	CH 660 : CH 675	16.76	15.00	0.70	175.93	"
46	CH 675 : CH 690	17.06	15.00	0.70	179.08	"
47	CH 690 : CH 705	17.11	15.00	0.70	179.60	"
48	CH 705 : CH 720	15.96	15.00	0.70	167.58	
49	CH 720 : CH 735	14.35	15.00	0.70	150.68	
50	CH 735 : CH 750	13.67	15.00	0.70	143.54	
51	CH 750 : CH 765	13.25	15.00	0.70	139.13	
52	CH 765 : CH 780	14.73	15.00	0.70	154.67	
53	CH 780 : CH 795	17.77	15.00	0.70	186.59	
54	CH 795 : CH 810	18.48	15.00	0.70	194.04	"
55	CH 810 : CH 825	18.31	15.00	0.70	192.20	"
56	CH 825 : CH 840	20.35	15.00	0.70	213.62	"
57	CH 840 : CH 855	19.64	15.00	0.70	206.17	"
58	CH 855 : CH 870	17.96	15.00	0.70	188.58	"
59	CH 870 : CH 885	19.01	15.00	0.70	199.55	"
60	CH 885 : CH 900	19.93	15.00	0.70	209.21	"
61	CH 900 : CH 915	19.61	15.00	0.70	205.91	"
62	CH 915 : CH 930	18.57	15.00	0.70	194.99	"
63	CH 930 : CH 945	18.06	15.00	0.70	189.63	"
64	CH 945 : CH 960	17.62	15.00	0.70	185.01	"
65	CH 960 : CH 975	17.32	15.00	0.70	181.86	"
66	CH 975 : CH 990	16.69	15.00	0.70	175.19	"
67	CH 990 : CH 1005	16.67	15.00	0.70	175.04	"

Sl.No	Chainage	W (m)	Length (m)	Assumed canal depth (m)	De-Silting Quantity (m3)	Remarks
68	CH 1005 : CH 1020	16.81	15.00	0.70	176.45	"
69	CH 1020 : CH 1035	16.16	15.00	0.70	169.63	
70	CH 1035 : CH 1050	15.45	15.00	0.70	162.23	
71	CH 1050 : CH 1065	15.63	15.00	0.70	164.12	
72	CH 1065 : CH 1080	16.68	15.00	0.70	175.09	
73	CH 1080 : CH 1095	16.88	15.00	0.70	177.19	"
74	CH 1095 : CH 1110	16.97	15.00	0.70	178.19	"
75	CH 1110 : CH 1125	17.12	15.00	0.70	179.71	"
76	CH 1125 : CH 1140	17.31	15.00	0.70	181.76	"
77	CH 1140 : CH 1155	18.14	15.00	0.70	190.47	"
78	CH 1155 : CH 1170	19.76	15.00	0.70	207.48	"
79	CH 1170 : CH 1185	22.05	15.00	0.70	231.53	"
80	CH 1185 : CH 1200	24.05	15.00	0.70	252.47	"
81	CH 1200 : CH 1215	24.94	15.00	0.70	261.82	"
82	CH 1215 : CH 1230	24.70	15.00	0.70	259.30	"
83	CH 1230 : CH 1245	23.92	15.00	0.70	251.11	"
84	CH 1245 : CH 1260	22.67	15.00	0.70	237.98	"
85	CH 1260 : CH 1275	21.68	15.00	0.70	227.59	"
86	CH 1275 : CH 1290	21.09	15.00	0.70	221.39	"
87	CH 1290 : CH 1305	20.37	15.00	0.70	213.89	"
88	CH 1305 : CH 1320	19.54	15.00	0.70	205.12	"
89	CH 1320 : CH 1335	18.80	15.00	0.70	197.40	"
90	CH 1335 : CH 1350	18.14	15.00	0.70	190.47	"

Sl.No	Chainage	W (m)	Length (m)	Assumed canal depth (m)	De-Silting Quantity (m3)	Remarks
91	CH 1350 : CH 1365	17.60	15.00	0.70	184.75	"
92	CH 1365 : CH 1380	17.53	15.00	0.70	184.07	"
93	CH 1380 : CH 1395	17.66	15.00	0.70	185.38	"
94	CH 1395 : CH 1405	17.74	10.00	0.70	124.18	"
	Total Quantity				**17,976.07**	
	Deepening quantity of subcanals (2 nos)	17.25	1288.00		6665.40	
	Grand Total				**24,641.47**	

1.5 Market Canal

Table 6: Deepening Details of Market Canal

Sl.No	Chainage	W	Length (m)	Assumed canal depth (m)	De-Silting Quantity (m3)	Remarks
1	CH 0 : CH 15	15.46	15.00	0.70	162.33	
2	CH 15 : CH 30	14.00	15.00	0.70	147.00	
3	CH 30 : CH 45	13.97	15.00	0.70	146.63	
4	CH 45 : CH 60	14.07	15.00	0.70	147.74	
5	CH 60 : CH 75	14.01	15.00	0.70	147.11	
6	CH 75 : CH 90	15.03	15.00	0.70	157.82	
7	CH 90 : CH 105	15.84	15.00	0.70	166.32	
8	CH 105 : CH 120	13.75	15.00	0.70	144.38	
9	CH 120 : CH 135	12.18	15.00	0.70	127.84	
10	CH 135 : CH 150	12.32	15.00	0.70	129.36	
11	CH 150 : CH 165	12.32	15.00	0.70	129.36	
12	CH 165 : CH 180	12.37	15.00	0.70	129.89	
13	CH 180 : CH 195	12.31	15.00	0.70	129.20	
14	CH 195 : CH 210	12.37	15.00	0.70	129.89	
15	CH 210 : CH 225	12.78	15.00	0.70	134.19	
16	CH 225 : CH 240	13.08	15.00	0.70	137.34	
17	CH 240 : CH 255	13.14	15.00	0.70	137.97	
18	CH 255 : CH 270	13.07	15.00	0.70	137.24	
19	CH 270 : CH 285	13.11	15.00	0.70	137.66	
20	CH 285 : CH 300	13.30	15.00	0.70	139.60	
21	CH 300 : CH 315	19.94	15.00	0.70	209.34	
22	CH 315 : CH 330	31.56	15.00	0.70	331.33	w>16.50
23	CH 330 : CH 345	31.88	15.00	0.70	334.74	"
24	CH 345 : CH 360	27.46	15.00	0.70	288.28	"

Sl.No	Chainage	W	Length (m)	Assumed canal depth (m)	De-Silting Quantity (m3)	Remarks
25	CH 360 : CH 375	15.27	15.00	0.70	160.28	
26	CH 375 : CH 390	7.65	15.00	0.70	80.27	
27	CH 390 : CH 405	7.52	15.00	0.70	78.91	
28	CH 405 : CH 420	7.39	15.00	0.70	77.54	
29	CH 420 : CH 435	7.26	15.00	0.70	76.23	
30	CH 435 : CH 450	7.19	15.00	0.70	75.50	
31	CH 450 : CH 465	7.15	15.00	0.70	75.08	
32	CH 465 : CH 480	7.12	15.00	0.70	74.71	
33	CH 480 : CH 495	7.11	15.00	0.70	74.66	
34	CH 495 : CH 510	7.11	15.00	0.70	74.66	
35	CH 510 : CH 525	7.04	15.00	0.70	73.92	
36	CH 525 : CH 540	6.92	15.00	0.70	72.66	
37	CH 540 : CH 555	6.83	15.00	0.70	71.72	
38	CH 555 : CH 570	6.94	15.00	0.70	72.87	
39	CH 570 : CH 585	7.01	15.00	0.70	73.61	
40	CH 585 : CH 600	7.14	15.00	0.70	74.97	
41	CH 600 : CH 615	7.30	15.00	0.70	76.65	
42	CH 615 : CH 630	7.52	15.00	0.70	78.96	
43	CH 630 : CH 645	7.72	15.00	0.70	81.06	
44	CH 645 : CH 660	7.74	15.00	0.70	81.27	
45	CH 660 : CH 664	5.90	4.00	0.70	16.52	
	Total Quantity				**5,604.53**	
	Deepening quantity of sub canals (2 nos.)	1.43	2407.00	0.30	1028.99	
	Grand Total				**6,633.53**	

Table 1:Summary of Widening details of Canals

Sl. No	Name of the canal	Unit	Widening Quantity (cum)	Quantity to be filled (cum)	Quantity to be conveyed (cum)
1	Edappally	cum	46,768.34	9,353.67	37,414.67
2	Chilavanoor	cum	1,09,554.11	21,910.82	87,643.28
3	Thevara_Perandoor	cum	74,872.30	14,974.46	59,897.84
4	Thevara	cum	2,688.10	537.62	2,150.48
5	Market	cum	7,518.35	1,503.67	6,014.68
	Total Quantity		**2,41,401.18**	**48,280.24**	**1,93,120.95**

1.1 Edappally canal

Table 2: Widening Details of Edappally Canal

Sl. No	Chainage	W (m)	L (m)	Proposed canal width (m)	Assumed cutting depth (m)	Total Required Quantity (m3)	De-Silting Quantity (m3)	Balance Cutting Quantity to be required (m3)	Remarks
1	CH 000 : CH 15	13.23	15.00	16.50	1.20	297.00	138.88	158.12	
2	CH 15 : CH 30	11.77	15.00	16.50	1.20	297.00	123.57	173.43	
3	CH 30 : CH 45	9.03	15.00	16.50	1.20	297.00	94.83	202.17	
4	CH 45 : CH 60	7.05	15.00	16.50	1.20	297.00	74.03	222.98	
5	CH 60 : CH 75	7.48	15.00	16.50	1.20	297.00	78.51	218.50	
6	CH 75 : CH 90	6.53	15.00	16.50	1.20	297.00	68.51	228.49	
7	CH 90 : CH 105	7.00	15.00	16.50	1.20	297.00	73.50	223.50	
8	CH 105 : CH 120	7.45	15.00	16.50	1.20	297.00	78.23	218.78	
9	CH 120 : CH 135	7.10	15.00	16.50	1.20	297.00	74.59	222.42	
10	CH 135 : CH 150	7.70	15.00	16.50	1.20	297.00	80.80	216.20	
11	CH 150 : CH 165	9.37	15.00	16.50	1.20	297.00	98.39	198.62	
12	CH 165 : CH 180	10.35	15.00	16.50	1.20	297.00	108.68	188.33	
13	CH 180 : CH 195	7.66	15.00	16.50	1.20	297.00	80.43	216.57	
14	CH 195 : CH 210	7.09	15.00	16.50	1.20	297.00	74.39	222.61	
15	CH 210 : CH 225	7.60	15.00	16.50	1.20	297.00	79.77	217.24	
16	CH 225 : CH 240	7.16	15.00	16.50	1.20	297.00	75.13	221.87	
17	CH 240 : CH 255	10.36	15.00	16.50	1.20	297.00	108.73	188.27	
18	CH 255 : CH 270	15.50	15.00	16.50	1.20	297.00	162.75	134.25	
19	CH 270 : CH 285	11.10	15.00	16.50	1.20	297.00	116.55	180.45	

Sl. No	Chainage	W (m)	L (m)	Proposed canal width (m)	Assumed cutting depth (m)	Total Required Quantity (m3)	De-Silting Quantity (m3)	Balance Cutting Quantity to be required (m3)	Remarks
20	CH 285 : CH 300	6.23	15.00	16.50	1.20	297.00	65.36	231.64	
21	CH 300 : CH 315	5.99	15.00	16.50	1.20	297.00	62.90	234.11	
22	CH 315 : CH 330	6.34	15.00	16.50	1.20	297.00	66.52	230.48	
23	CH 330 : CH 345	6.13	15.00	16.50	1.20	297.00	64.31	232.69	
24	CH 345 : CH 360	6.33	15.00	16.50	1.20	297.00	66.47	230.54	
25	CH 360 : CH 375	6.18	15.00	16.50	1.20	297.00	64.84	232.16	
26	CH 375 : CH 390	6.15	15.00	16.50	1.20	297.00	64.58	232.43	
27	CH 390 : CH 405	7.20	15.00	16.50	1.20	297.00	75.60	221.40	
28	CH 405 : CH 420	8.22	15.00	16.50	1.20	297.00	86.28	210.73	
29	CH 420 : CH 435	8.50	15.00	16.50	1.20	297.00	89.25	207.75	
30	CH 435 : CH 450	10.90	15.00	16.50	1.20	297.00	114.40	182.60	
31	CH 450 : CH 465	12.14	15.00	16.50	1.20	297.00	127.42	169.58	
32	CH 465 : CH 480	11.42	15.00	16.50	1.20	297.00	119.91	177.09	
33	CH 480 : CH 495	11.09	15.00	16.50	1.20	297.00	116.39	180.61	
34	CH 495 : CH 510	11.19	15.00	16.50	1.20	297.00	117.53	179.47	
35	CH 510 : CH 525	10.05	15.00	16.50	1.20	297.00	105.53	191.48	
36	CH 525 : CH 540	9.34	15.00	16.50	1.20	297.00	98.07	198.93	
37	CH 540 : CH 555	9.59	15.00	16.50	1.20	297.00	100.64	196.36	
38	CH 555 : CH 570	10.22	15.00	16.50	1.20	297.00	107.31	189.69	
39	CH 570 : CH 585	10.95	15.00	16.50	1.20	297.00	114.94	182.06	
40	CH 585 : CH 600	11.08	15.00	16.50	1.20	297.00	116.34	180.66	
41	CH 600 : CH 615	11.85	15.00	16.50	1.20	297.00	124.43	172.58	

Sl. No	Chainage	W (m)	L (m)	Proposed canal width (m)	Assumed cutting depth (m)	Total Required Quantity (m3)	De-Silting Quantity (m3)	Balance Cutting Quantity to be required (m3)	Remarks
42	CH 615 : CH 630	12.96	15.00	16.50	1.20	297.00	136.03	160.97	
43	CH 630 : CH 645	13.09	15.00	16.50	1.20	297.00	137.39	159.61	
44	CH 645 : CH 660	12.91	15.00	16.50	1.20	297.00	135.56	161.45	
45	CH 660 : CH 675	13.17	15.00	16.50	1.20	297.00	138.23	158.77	
46	CH 675 : CH 690	12.87	15.00	16.50	1.20	297.00	135.14	161.87	
47	CH 690 : CH 705	11.70	15.00	16.50	1.20	297.00	122.85	174.15	
48	CH 705 : CH 720	9.48	15.00	16.50	1.20	297.00	99.49	197.51	
49	CH 720 : CH 735	8.01	15.00	16.50	1.20	297.00	84.05	212.95	
50	CH 735 : CH 750	7.84	15.00	16.50	1.20	297.00	82.27	214.73	
51	CH 750 : CH 765	7.40	15.00	16.50	1.20	297.00	77.65	219.35	
52	CH 765 : CH 780	7.52	15.00	16.50	1.20	297.00	78.96	218.04	
53	CH 780 : CH 795	8.07	15.00	16.50	1.20	297.00	84.68	212.32	
54	CH 795 : CH 810	7.85	15.00	16.50	1.20	297.00	82.37	214.63	
55	CH 810 : CH 825	8.02	15.00	16.50	1.20	297.00	84.21	212.79	
56	CH 825 : CH 840	8.67	15.00	16.50	1.20	297.00	90.98	206.02	
57	CH 840 : CH 855	10.20	15.00	16.50	1.20	297.00	107.07	189.94	
58	CH 855 : CH 870	10.98	15.00	16.50	1.20	297.00	115.24	181.76	
59	CH 870 : CH 885	10.03	15.00	16.50	1.20	297.00	105.32	191.69	
60	CH 885 : CH 900	9.30	15.00	16.50	1.20	297.00	97.60	199.40	
61	CH 900 : CH 915	9.51	15.00	16.50	1.20	297.00	99.89	197.11	
62	CH 915 : CH 930	8.28	15.00	16.50	1.20	297.00	86.89	210.11	
63	CH 930 : CH 945	8.61	15.00	16.50	1.20	297.00	90.41	206.60	

Sl. No	Chainage	W (m)	L (m)	Proposed canal width (m)	Assumed cutting depth (m)	Total Required Quantity (m3)	De-Silting Quantity (m3)	Balance Cutting Quantity to be required (m3)	Remarks
64	CH 945 : CH 960	8.59	15.00	16.50	1.20	297.00	90.20	206.81	
65	CH 960 : CH 975	8.02	15.00	16.50	1.20	297.00	84.16	212.84	
66	CH 975 : CH 990	8.52	15.00	16.50	1.20	297.00	89.46	207.54	
67	CH 990 : CH 1005	7.90	15.00	16.50	1.20	297.00	82.95	214.05	
68	CH 1005 : CH 1020	7.89	15.00	16.50	1.20	297.00	82.85	214.16	
69	CH 1020 : CH 1035	8.88	15.00	16.50	1.20	297.00	93.24	203.76	
70	CH 1035 : CH 1050	9.49	15.00	16.50	1.20	297.00	99.59	197.41	
71	CH 1050 : CH 1065	9.94	15.00	16.50	1.20	297.00	104.37	192.63	
72	CH 1065 : CH 1080	10.33	15.00	16.50	1.20	297.00	108.47	188.54	
73	CH 1080 : CH 1095	11.34	15.00	16.50	1.20	297.00	119.02	177.98	
74	CH 1095 : CH 1110	15.86	15.00	16.50	1.20	297.00	166.57	130.44	
75	CH 1110 : CH 1125	17.77	15.00	16.50	1.20	0.00	186.59	0.00	w>16.50
76	CH 1125 : CH 1140	17.54	15.00	16.50	1.20	0.00	184.12	0.00	"
77	CH 1140 : CH 1155	15.42	15.00	16.50	1.20	297.00	161.91	135.09	
78	CH 1155 : CH 1170	13.81	15.00	16.50	1.20	297.00	144.95	152.05	
79	CH 1170 : CH 1185	13.28	15.00	16.50	1.20	297.00	139.39	157.61	
80	CH 1185 : CH 1200	13.41	15.00	16.50	1.20	297.00	140.75	156.25	
81	CH 1200 : CH 1215	12.93	15.00	16.50	1.20	297.00	135.77	161.24	
82	CH 1215 : CH 1230	11.16	15.00	16.50	1.20	297.00	117.13	179.87	
83	CH 1230 : CH 1245	10.45	15.00	16.50	1.20	297.00	109.67	187.33	
84	CH 1245 : CH 1260	11.16	15.00	16.50	1.20	297.00	117.18	179.82	
85	CH 1260 : CH 1275	11.61	15.00	16.50	1.20	297.00	121.85	175.15	

Sl. No	Chainage	W (m)	L (m)	Proposed canal width (m)	Assumed cutting depth (m)	Total Required Quantity (m3)	De-Silting Quantity (m3)	Balance Cutting Quantity to be required (m3)	Remarks
86	CH 1275 : CH 1290	10.93	15.00	16.50	1.20	297.00	114.71	182.29	
87	CH 1290 : CH 1305	10.02	15.00	16.50	1.20	297.00	105.21	191.79	
88	CH 1305 : CH 1320	10.29	15.00	16.50	1.20	297.00	108.05	188.96	
89	CH 1320 : CH 1335	10.70	15.00	16.50	1.20	297.00	112.39	184.62	
90	CH 1335 : CH 1350	10.21	15.00	16.50	1.20	297.00	107.15	189.85	
91	CH 1350 : CH 1365	10.37	15.00	16.50	1.20	297.00	108.83	188.17	
92	CH 1365 : CH 1380	10.53	15.00	16.50	1.20	297.00	110.51	186.49	
93	CH 1380 : CH 1395	10.78	15.00	16.50	1.20	297.00	113.14	183.86	
94	CH 1395 : CH 1410	11.38	15.00	16.50	1.20	297.00	119.49	177.51	
95	CH 1410 : CH 1425	11.66	15.00	16.50	1.20	297.00	122.43	174.57	
96	CH 1425 : CH 1440	10.70	15.00	16.50	1.20	297.00	112.30	184.70	
97	CH 1440 : CH 1455	10.47	15.00	16.50	1.20	297.00	109.94	187.07	
98	CH 1455 : CH 1470	10.51	15.00	16.50	1.20	297.00	110.39	186.61	
99	CH 1470 : CH 1485	9.81	15.00	16.50	1.20	297.00	102.95	194.05	
100	CH 1485 : CH 1500	11.20	15.00	16.50	1.20	297.00	117.55	179.45	
101	CH 1500 : CH 1515	12.11	15.00	16.50	1.20	297.00	127.10	169.90	
102	CH 1515 : CH 1530	9.78	15.00	16.50	1.20	297.00	102.69	194.31	
103	CH 1530 : CH 1545	8.09	15.00	16.50	1.20	297.00	84.89	212.11	
104	CH 1545 : CH 1560	8.93	15.00	16.50	1.20	297.00	93.77	203.24	
105	CH 1560 : CH 1575	9.06	15.00	16.50	1.20	297.00	95.13	201.87	
106	CH 1575 : CH 1590	8.52	15.00	16.50	1.20	297.00	89.46	207.54	
107	CH 1590 : CH 1605	8.64	15.00	16.50	1.20	297.00	90.67	206.33	

Sl. No	Chainage	W (m)	L (m)	Proposed canal width (m)	Assumed cutting depth (m)	Total Required Quantity (m3)	De-Silting Quantity (m3)	Balance Cutting Quantity to be required (m3)	Remarks
108	CH 1605 : CH 1620	8.82	15.00	16.50	1.20	297.00	92.61	204.39	
109	CH 1620 : CH 1635	8.80	15.00	16.50	1.20	297.00	92.40	204.60	
110	CH 1635 : CH 1650	9.73	15.00	16.50	1.20	297.00	102.11	194.89	
111	CH 1650 : CH 1665	10.85	15.00	16.50	1.20	297.00	113.87	183.13	
112	CH 1665 : CH 1680	11.92	15.00	16.50	1.20	297.00	125.16	171.84	
113	CH 1680 : CH 1695	12.03	15.00	16.50	1.20	297.00	126.32	170.69	
114	CH 1695 : CH 1710	10.11	15.00	16.50	1.20	297.00	106.10	190.90	
115	CH 1710 : CH 1725	9.90	15.00	16.50	1.20	297.00	103.95	193.05	
116	CH 1725 : CH 1740	10.28	15.00	16.50	1.20	297.00	107.94	189.06	
117	CH 1740 : CH 1755	11.46	15.00	16.50	1.20	297.00	120.28	176.72	
118	CH 1755 : CH 1770	12.49	15.00	16.50	1.20	297.00	131.15	165.86	
119	CH 1770 : CH 1785	12.31	15.00	16.50	1.20	297.00	129.29	167.71	
120	CH 1785 : CH 1800	10.82	15.00	16.50	1.20	297.00	113.61	183.39	
121	CH 1800 : CH 1815	9.97	15.00	16.50	1.20	297.00	104.69	192.32	
122	CH 1815 : CH 1830	10.55	15.00	16.50	1.20	297.00	110.72	186.28	
123	CH 1830 : CH 1845	11.51	15.00	16.50	1.20	297.00	120.86	176.15	
124	CH 1845 : CH 1860	12.45	15.00	16.50	1.20	297.00	130.67	166.33	
125	CH 1860 : CH 1875	13.00	15.00	16.50	1.20	297.00	136.47	160.54	
126	CH 1875 : CH 1890	12.24	15.00	16.50	1.20	297.00	128.49	168.52	
127	CH 1890 : CH 1905	12.64	15.00	16.50	1.20	297.00	132.67	164.33	
128	CH 1905 : CH 1920	13.14	15.00	16.50	1.20	297.00	138.01	159.00	
129	CH 1920 : CH 1935	11.43	15.00	16.50	1.20	297.00	119.96	177.04	

Sl. No	Chainage	W (m)	L (m)	Proposed canal width (m)	Assumed cutting depth (m)	Total Required Quantity (m3)	De-Silting Quantity (m3)	Balance Cutting Quantity to be required (m3)	Remarks
130	CH 1935 : CH 1950	10.81	15.00	16.50	1.20	297.00	113.51	183.50	
131	CH 1950 : CH 1965	10.95	15.00	16.50	1.20	297.00	114.98	182.03	
132	CH 1965 : CH 1980	11.11	15.00	16.50	1.20	297.00	116.60	180.40	
133	CH 1980 : CH 1995	10.90	15.00	16.50	1.20	297.00	114.40	182.60	
134	CH 1995 : CH 2010	10.81	15.00	16.50	1.20	297.00	113.51	183.50	
135	CH 2010 : CH 2025	11.08	15.00	16.50	1.20	297.00	116.34	180.66	
136	CH 2025 : CH 2040	12.10	15.00	16.50	1.20	297.00	127.09	169.92	
137	CH 2040 : CH 2055	12.90	15.00	16.50	1.20	297.00	135.40	161.60	
138	CH 2055 : CH 2070	14.67	15.00	16.50	1.20	297.00	153.98	143.02	
139	CH 2070 : CH 2085	15.97	15.00	16.50	1.20	297.00	167.69	129.32	
140	CH 2085 : CH 2100	17.78	15.00	16.50	1.20	0.00	186.64	0.00	w>16.50
141	CH 2100 : CH 2115	20.81	15.00	16.50	1.20	0.00	215.25	0.00	"
142	CH 2115 : CH 2130	22.87	15.00	16.50	1.20	0.00	215.25	0.00	"
143	CH 2130 : CH 2145	19.57	15.00	16.50	1.20	0.00	205.43	0.00	"
144	CH 2145 : CH 2160	18.09	15.00	16.50	1.20	0.00	189.89	0.00	"
145	CH 2160 : CH 2175	19.51	15.00	16.50	1.20	0.00	204.86	0.00	"
146	CH 2175 : CH 2190	18.27	15.00	16.50	1.20	297.00	191.78	0.00	
147	CH 2190 : CH 2205	15.24	15.00	16.50	1.20	297.00	160.02	136.98	
148	CH 2205 : CH 2220	14.93	15.00	16.50	1.20	297.00	156.71	140.29	
149	CH 2220 : CH 2235	17.56	15.00	16.50	1.20	0.00	184.33	0.00	
150	CH 2235 : CH 2250	19.12	15.00	16.50	1.20	0.00	200.71	0.00	w>16.50
151	CH 2250 : CH 2265	19.14	15.00	16.50	1.20	0.00	200.97	0.00	"

Sl. No	Chainage	W (m)	L (m)	Proposed canal width (m)	Assumed cutting depth (m)	Total Required Quantity (m3)	De-Silting Quantity (m3)	Balance Cutting Quantity to be required (m3)	Remarks
152	CH 2265 : CH 2280	18.58	15.00	16.50	1.20	0.00	195.04	0.00	"
153	CH 2280 : CH 2295	17.33	15.00	16.50	1.20	0.00	181.91	0.00	"
154	CH 2295 : CH 2310	16.48	15.00	16.50	1.20	297.00	172.99	124.01	
155	CH 2310 : CH 2325	16.09	15.00	16.50	1.20	297.00	168.89	128.11	
156	CH 2325 : CH 2340	15.56	15.00	16.50	1.20	297.00	163.38	133.62	
157	CH 2340 : CH 2355	14.61	15.00	16.50	1.20	297.00	153.35	143.65	
158	CH 2355 : CH 2370	14.45	15.00	16.50	1.20	297.00	151.67	145.33	
159	CH 2370 : CH 2385	17.04	15.00	16.50	1.20	0.00	178.87	0.00	
160	CH 2385 : CH 2400	18.02	15.00	16.50	1.20	0.00	189.21	0.00	w>16.50
161	CH 2400 : CH 2415	16.43	15.00	16.50	1.20	297.00	172.46	124.54	
162	CH 2415 : CH 2430	17.03	15.00	16.50	1.20	0.00	178.82	0.00	w>16.50
163	CH 2430 : CH 2445	18.88	15.00	16.50	1.20	0.00	198.19	0.00	"
164	CH 2445 : CH 2460	20.09	15.00	16.50	1.20	0.00	210.89	0.00	"
165	CH 2460 : CH 2475	22.07	15.00	16.50	1.20	0.00	215.25	0.00	"
166	CH 2475 : CH 2490	23.83	15.00	16.50	1.20	0.00	215.25	0.00	"
167	CH 2490 : CH 2505	21.91	15.00	16.50	1.20	0.00	215.25	0.00	"
168	CH 2505 : CH 2520	17.51	15.00	16.50	1.20	0.00	183.86	0.00	
169	CH 2520 : CH 2535	14.88	15.00	16.50	1.20	297.00	156.24	140.76	
170	CH 2535 : CH 2550	15.12	15.00	16.50	1.20	297.00	158.76	138.24	
171	CH 2550 : CH 2565	16.16	15.00	16.50	1.20	297.00	169.68	127.32	
172	CH 2565 : CH 2580	16.15	15.00	16.50	1.20	297.00	169.52	127.48	
173	CH 2580 : CH 2595	16.19	15.00	16.50	1.20	297.00	170.00	127.01	

Sl. No	Chainage	W (m)	L (m)	Proposed canal width (m)	Assumed cutting depth (m)	Total Required Quantity (m3)	De-Silting Quantity (m3)	Balance Cutting Quantity to be required (m3)	Remarks
174	CH 2595 : CH 2610	16.63	15.00	16.50	1.20	0.00	174.62	0.00	w>16.50
175	CH 2610 : CH 2625	16.39	15.00	16.50	1.20	297.00	172.10	124.91	
176	CH 2625 : CH 2640	15.49	15.00	16.50	1.20	297.00	162.59	134.41	
177	CH 2640 : CH 2655	14.30	15.00	16.50	1.20	297.00	150.10	146.90	
178	CH 2655 : CH 2670	13.43	15.00	16.50	1.20	297.00	141.02	155.99	
179	CH 2670 : CH 2685	13.02	15.00	16.50	1.20	297.00	136.66	160.34	
180	CH 2685 : CH 2700	13.88	15.00	16.50	1.20	297.00	145.69	151.31	
181	CH 2700 : CH 2715	15.69	15.00	16.50	1.20	297.00	164.75	132.26	
182	CH 2715 : CH 2730	14.14	15.00	16.50	1.20	297.00	148.44	148.57	
183	CH 2730 : CH 2745	15.03	15.00	16.50	1.20	297.00	157.76	139.24	
184	CH 2745 : CH 2760	15.31	15.00	16.50	1.20	297.00	160.76	136.25	
185	CH 2760 : CH 2775	15.21	15.00	16.50	1.20	297.00	159.71	137.30	
186	CH 2775 : CH 2790	14.04	15.00	16.50	1.20	297.00	147.42	149.58	
187	CH 2790 : CH 2805	12.42	15.00	16.50	1.20	297.00	130.41	166.59	
188	CH 2805 : CH 2820	10.88	15.00	16.50	1.20	297.00	114.24	182.76	
189	CH 2820 : CH 2835	10.10	15.00	16.50	1.20	297.00	106.00	191.00	
190	CH 2835 : CH 2850	10.33	15.00	16.50	1.20	297.00	108.47	188.54	
191	CH 2850 : CH 2865	12.26	15.00	16.50	1.20	297.00	128.68	168.32	
192	CH 2865 : CH 2880	14.00	15.00	16.50	1.20	297.00	147.00	150.00	
193	CH 2880 : CH 2895	14.48	15.00	16.50	1.20	297.00	151.99	145.01	
194	CH 2895 : CH 2910	13.57	15.00	16.50	1.20	297.00	142.43	154.57	
195	CH 2910 : CH 2925	11.74	15.00	16.50	1.20	297.00	123.27	173.73	

Sl. No	Chainage	W (m)	L (m)	Proposed canal width (m)	Assumed cutting depth (m)	Total Required Quantity (m3)	De-Silting Quantity (m3)	Balance Cutting Quantity to be required (m3)	Remarks
196	CH 2925 : CH 2940	11.56	15.00	16.50	1.20	297.00	121.38	175.62	
197	CH 2940 : CH 2955	11.94	15.00	16.50	1.20	297.00	125.32	171.68	
198	CH 2955 : CH 2970	11.76	15.00	16.50	1.20	297.00	123.43	173.57	
199	CH 2970 : CH 2985	12.58	15.00	16.50	1.20	297.00	132.09	164.91	
200	CH 2985 : CH 3000	14.59	15.00	16.50	1.20	297.00	153.20	143.81	
201	CH 3000 : CH 3015	16.45	15.00	16.50	1.20	297.00	172.67	124.33	
202	CH 3015 : CH 3030	16.85	15.00	16.50	1.20	0.00	176.93	0.00	
203	CH 3030 : CH 3045	14.84	15.00	16.50	1.20	297.00	155.77	141.23	
204	CH 3045 : CH 3060	12.84	15.00	16.50	1.20	297.00	134.77	162.23	
205	CH 3060 : CH 3075	12.22	15.00	16.50	1.20	297.00	128.26	168.74	
206	CH 3075 : CH 3090	11.99	15.00	16.50	1.20	297.00	125.84	171.16	
207	CH 3090 : CH 3105	12.13	15.00	16.50	1.20	297.00	127.37	169.64	
208	CH 3105 : CH 3120	12.55	15.00	16.50	1.20	297.00	131.78	165.23	
209	CH 3120 : CH 3135	12.58	15.00	16.50	1.20	297.00	132.04	164.96	
210	CH 3135 : CH 3150	12.59	15.00	16.50	1.20	297.00	132.14	164.86	
211	CH 3150 : CH 3165	13.15	15.00	16.50	1.20	297.00	138.08	158.93	
212	CH 3165 : CH 3180	13.51	15.00	16.50	1.20	297.00	141.86	155.15	
213	CH 3180 : CH 3195	12.72	15.00	16.50	1.20	297.00	133.51	163.49	
214	CH 3195 : CH 3210	11.55	15.00	16.50	1.20	297.00	121.28	175.73	
215	CH 3210 : CH 3225	10.43	15.00	16.50	1.20	297.00	109.46	187.54	
216	CH 3225 : CH 3240	9.67	15.00	16.50	1.20	297.00	101.48	195.52	
217	CH 3240 : CH 3255	10.30	15.00	16.50	1.20	297.00	108.15	188.85	

Sl. No	Chainage	W (m)	L (m)	Proposed canal width (m)	Assumed cutting depth (m)	Total Required Quantity (m3)	De-Silting Quantity (m3)	Balance Cutting Quantity to be required (m3)	Remarks
218	CH 3255 : CH 3270	11.37	15.00	16.50	1.20	297.00	119.39	177.62	
219	CH 3270 : CH 3285	11.84	15.00	16.50	1.20	297.00	124.27	172.73	
220	CH 3285 : CH 3300	13.00	15.00	16.50	1.20	297.00	136.45	160.55	
221	CH 3300 : CH 3315	15.11	15.00	16.50	1.20	297.00	158.60	138.40	
222	CH 3315 : CH 3330	16.70	15.00	16.50	1.20	0.00	175.30	0.00	
223	CH 3330 : CH 3345	17.48	15.00	16.50	1.20	0.00	183.49	0.00	w>16.50
224	CH 3345 : CH 3360	17.48	15.00	16.50	1.20	0.00	183.49	0.00	"
225	CH 3360 : CH 3375	17.61	15.00	16.50	1.20	0.00	184.85	0.00	"
226	CH 3375 : CH 3390	17.83	15.00	16.50	1.20	0.00	187.22	0.00	"
227	CH 3390 : CH 3405	17.41	15.00	16.50	1.20	0.00	182.81	0.00	"
228	CH 3405 : CH 3420	16.78	15.00	16.50	1.20	0.00	176.14	0.00	"
229	CH 3420 : CH 3435	16.43	15.00	16.50	1.20	297.00	172.46	124.54	
230	CH 3435 : CH 3450	16.14	15.00	16.50	1.20	297.00	169.47	127.53	
231	CH 3450 : CH 3465	15.82	15.00	16.50	1.20	297.00	166.11	130.89	
232	CH 3465 : CH 3480	15.48	15.00	16.50	1.20	297.00	162.54	134.46	
233	CH 3480 : CH 3495	16.36	15.00	16.50	1.20	297.00	171.78	125.22	
234	CH 3495 : CH 3510	17.95	15.00	16.50	1.20	0.00	188.42	0.00	w>16.50
235	CH 3510 : CH 3525	16.15	15.00	16.50	1.20	297.00	169.52	127.48	
236	CH 3525 : CH 3540	12.70	15.00	16.50	1.20	297.00	133.39	163.62	
237	CH 3540 : CH 3555	12.96	15.00	16.50	1.20	297.00	136.03	160.97	
238	CH 3555 : CH 3570	13.25	15.00	16.50	1.20	297.00	139.07	157.93	
239	CH 3570 : CH 3585	13.11	15.00	16.50	1.20	297.00	137.66	159.35	

Sl. No	Chainage	W (m)	L (m)	Proposed canal width (m)	Assumed cutting depth (m)	Total Required Quantity (m3)	De-Silting Quantity (m3)	Balance Cutting Quantity to be required (m3)	Remarks
240	CH 3585 : CH 3600	12.96	15.00	16.50	1.20	297.00	136.03	160.97	
241	CH 3600 : CH 3615	12.06	15.00	16.50	1.20	297.00	126.63	170.37	
242	CH 3615 : CH 3630	10.60	15.00	16.50	1.20	297.00	111.25	185.75	
243	CH 3630 : CH 3645	10.15	15.00	16.50	1.20	297.00	106.58	190.43	
244	CH 3645 : CH 3660	10.47	15.00	16.50	1.20	297.00	109.88	187.12	
245	CH 3660 : CH 3675	10.49	15.00	16.50	1.20	297.00	110.15	186.86	
246	CH 3675 : CH 3690	10.51	15.00	16.50	1.20	297.00	110.36	186.65	
247	CH 3690 : CH 3705	10.79	15.00	16.50	1.20	297.00	113.30	183.71	
248	CH 3705 : CH 3720	10.80	15.00	16.50	1.20	297.00	113.35	183.65	
249	CH 3720 : CH 3735	10.66	15.00	16.50	1.20	297.00	111.88	185.12	
250	CH 3735 : CH 3750	11.16	15.00	16.50	1.20	297.00	117.13	179.87	
251	CH 3750 : CH 3765	12.29	15.00	16.50	1.20	297.00	128.99	168.01	
252	CH 3765 : CH 3780	13.55	15.00	16.50	1.20	297.00	142.28	154.73	
253	CH 3780 : CH 3795	14.78	15.00	16.50	1.20	297.00	155.14	141.86	
254	CH 3795 : CH 3810	15.25	15.00	16.50	1.20	297.00	160.07	136.93	
255	CH 3810 : CH 3825	15.28	15.00	16.50	1.20	297.00	160.39	136.61	
256	CH 3825 : CH 3840	16.19	15.00	16.50	1.20	297.00	170.00	127.01	
257	CH 3840 : CH 3855	16.21	15.00	16.50	1.20	297.00	170.15	126.85	
258	CH 3855 : CH 3870	15.55	15.00	16.50	1.20	297.00	163.22	133.78	
259	CH 3870 : CH 3885	16.23	15.00	16.50	1.20	297.00	170.42	126.59	
260	CH 3885 : CH 3900	18.01	15.00	16.50	1.20	0.00	189.05	0.00	w>16.50
261	CH 3900 : CH 3915	18.96	15.00	16.50	1.20	0.00	199.08	0.00	"

Sl. No	Chainage	W (m)	L (m)	Proposed canal width (m)	Assumed cutting depth (m)	Total Required Quantity (m3)	De-Silting Quantity (m3)	Balance Cutting Quantity to be required (m3)	Remarks
262	CH 3915 : CH 3930	17.60	15.00	16.50	1.20	0.00	184.80	0.00	"
263	CH 3930 : CH 3945	15.32	15.00	16.50	1.20	297.00	160.86	136.14	
264	CH 3945 : CH 3960	12.50	15.00	16.50	1.20	297.00	131.20	165.80	
265	CH 3960 : CH 3975	11.19	15.00	16.50	1.20	297.00	117.50	179.51	
266	CH 3975 : CH 3990	12.06	15.00	16.50	1.20	297.00	126.63	170.37	
267	CH 3990 : CH 4005	12.14	15.00	16.50	1.20	297.00	127.47	169.53	
268	CH 4005 : CH 4020	11.43	15.00	16.50	1.20	297.00	120.02	176.99	
269	CH 4020 : CH 4035	12.75	15.00	16.50	1.20	297.00	133.82	163.18	
270	CH 4035 : CH 4050	14.87	15.00	16.50	1.20	297.00	156.08	140.92	
271	CH 4050 : CH 4065	13.54	15.00	16.50	1.20	297.00	142.12	154.88	
272	CH 4065 : CH 4080	11.47	15.00	16.50	1.20	297.00	120.44	176.57	
273	CH 4080 : CH 4095	11.10	15.00	16.50	1.20	297.00	116.55	180.45	
274	CH 4095 : CH 4110	11.08	15.00	16.50	1.20	297.00	116.29	180.71	
275	CH 4110 : CH 4125	11.90	15.00	16.50	1.20	297.00	124.95	172.05	
276	CH 4125 : CH 4140	13.29	15.00	16.50	1.20	297.00	139.58	157.42	
277	CH 4140 : CH 4155	13.21	15.00	16.50	1.20	297.00	138.65	158.35	
278	CH 4155 : CH 4170	13.47	15.00	16.50	1.20	297.00	141.44	155.57	
279	CH 4170 : CH 4185	15.62	15.00	16.50	1.20	297.00	163.96	133.04	
280	CH 4185 : CH 4200	16.55	15.00	16.50	1.20	0.00	173.72	0.00	
281	CH 4200 : CH 4215	15.38	15.00	16.50	1.20	297.00	161.49	135.51	
282	CH 4215 : CH 4230	14.59	15.00	16.50	1.20	297.00	153.16	143.84	
283	CH 4230 : CH 4245	15.63	15.00	16.50	1.20	297.00	164.12	132.89	

Sl. No	Chainage	W (m)	L (m)	Proposed canal width (m)	Assumed cutting depth (m)	Total Required Quantity (m3)	De-Silting Quantity (m3)	Balance Cutting Quantity to be required (m3)	Remarks
284	CH 4245 : CH 4260	15.79	15.00	16.50	1.20	297.00	165.74	131.26	
285	CH 4260 : CH 4275	14.36	15.00	16.50	1.20	297.00	150.78	146.22	
286	CH 4275 : CH 4290	14.04	15.00	16.50	1.20	297.00	147.42	149.58	
287	CH 4290 : CH 4305	15.22	15.00	16.50	1.20	297.00	159.81	137.19	
288	CH 4305 : CH 4320	15.99	15.00	16.50	1.20	297.00	167.84	129.16	
289	CH 4320 : CH 4335	16.46	15.00	16.50	1.20	297.00	172.78	124.22	
290	CH 4335 : CH 4350	16.61	15.00	16.50	1.20	0.00	174.41	0.00	w>16.50
291	CH 4350 : CH 4365	16.24	15.00	16.50	1.20	297.00	170.52	126.48	
292	CH 4365 : CH 4380	15.61	15.00	16.50	1.20	297.00	163.85	133.15	
293	CH 4380 : CH 4395	15.51	15.00	16.50	1.20	297.00	162.80	134.20	
294	CH 4395 : CH 4410	15.94	15.00	16.50	1.20	297.00	167.32	129.68	
295	CH 4410 : CH 4425	16.59	15.00	16.50	1.20	297.00	174.20	122.81	
296	CH 4425 : CH 4440	17.44	15.00	16.50	1.20	0.00	183.07	0.00	w>16.50
297	CH 4440 : CH 4455	17.54	15.00	16.50	1.20	0.00	184.12	0.00	w>16.50
298	CH 4455 : CH 4470	17.14	15.00	16.50	1.20	0.00	179.97	0.00	w>16.50
299	CH 4470 : CH 4485	16.41	15.00	16.50	1.20	297.00	172.25	124.75	
300	CH 4485 : CH 4500	14.86	15.00	16.50	1.20	297.00	155.98	141.02	
301	CH 4500 : CH 4515	13.95	15.00	16.50	1.20	297.00	146.42	150.58	
302	CH 4515 : CH 4530	14.84	15.00	16.50	1.20	297.00	155.77	141.23	
303	CH 4530 : CH 4545	16.83	15.00	16.50	1.20	0.00	176.66	0.00	
304	CH 4545 : CH 4560	17.80	15.00	16.50	1.20	0.00	186.90	0.00	w>16.50
305	CH 4560 : CH 4575	18.79	15.00	16.50	1.20	0.00	197.30	0.00	"

Sl. No	Chainage	W (m)	L (m)	Proposed canal width (m)	Assumed cutting depth (m)	Total Required Quantity (m3)	De-Silting Quantity (m3)	Balance Cutting Quantity to be required (m3)	Remarks
306	CH 4575 : CH 4590	20.27	15.00	16.50	1.20	0.00	212.78	0.00	"
307	CH 4590 : CH 4605	20.30	15.00	16.50	1.20	0.00	213.15	0.00	"
308	CH 4605 : CH 4620	18.32	15.00	16.50	1.20	0.00	192.31	0.00	"
309	CH 4620 : CH 4635	16.56	15.00	16.50	1.20	0.00	173.88	0.00	"
310	CH 4635 : CH 4650	16.27	15.00	16.50	1.20	297.00	170.84	126.17	
311	CH 4650 : CH 4665	16.08	15.00	16.50	1.20	297.00	168.84	128.16	
312	CH 4665 : CH 4680	15.60	15.00	16.50	1.20	297.00	163.80	133.20	
313	CH 4680 : CH 4695	15.84	15.00	16.50	1.20	297.00	166.32	130.68	
314	CH 4695 : CH 4710	16.23	15.00	16.50	1.20	297.00	170.36	126.64	
315	CH 4710 : CH 4725	14.75	15.00	16.50	1.20	297.00	154.82	142.18	
316	CH 4725 : CH 4740	13.93	15.00	16.50	1.20	297.00	146.21	150.79	
317	CH 4740 : CH 4755	14.79	15.00	16.50	1.20	297.00	155.24	141.76	
318	CH 4755 : CH 4770	16.01	15.00	16.50	1.20	297.00	168.11	128.90	
319	CH 4770 : CH 4785	17.51	15.00	16.50	1.20	0.00	183.86	0.00	w>16.50
320	CH 4785 : CH 4800	18.52	15.00	16.50	1.20	0.00	194.46	0.00	"
321	CH 4800 : CH 4815	18.23	15.00	16.50	1.20	0.00	191.42	0.00	"
322	CH 4815 : CH 4830	17.31	15.00	16.50	1.20	0.00	181.76	0.00	"
323	CH 4830 : CH 4845	16.87	15.00	16.50	1.20	0.00	177.14	0.00	"
324	CH 4845 : CH 4860	17.34	15.00	16.50	1.20	0.00	182.02	0.00	"
325	CH 4860 : CH 4875	18.09	15.00	16.50	1.20	0.00	189.95	0.00	"
326	CH 4875 : CH 4890	18.39	15.00	16.50	1.20	0.00	193.10	0.00	"
327	CH 4890 : CH 4905	18.77	15.00	16.50	1.20	0.00	197.03	0.00	"

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328	CH 4905 : CH 4920	20.20	15.00	16.50	1.20	0.00	212.05	0.00	"
329	CH 4920 : CH 4935	21.75	15.00	16.50	1.20	0.00	215.25	0.00	"
330	CH 4935 : CH 4950	22.27	15.00	16.50	1.20	0.00	215.25	0.00	"
331	CH 4950 : CH 4965	22.30	15.00	16.50	1.20	0.00	215.25	0.00	"
332	CH 4965 : CH 4980	20.87	15.00	16.50	1.20	0.00	215.25	0.00	"
333	CH 4980 : CH 4995	18.84	15.00	16.50	1.20	0.00	197.82	0.00	"
334	CH 4995 : CH 5010	17.98	15.00	16.50	1.20	0.00	188.74	0.00	"
335	CH 5010 : CH 5025	17.67	15.00	16.50	1.20	0.00	185.54	0.00	"
336	CH 5025 : CH 5040	17.17	15.00	16.50	1.20	0.00	180.23	0.00	"
337	CH 5040 : CH 5055	16.63	15.00	16.50	1.20	0.00	174.62	0.00	"
338	CH 5055 : CH 5070	16.90	15.00	16.50	1.20	0.00	177.45	0.00	"
339	CH 5070 : CH 5085	17.59	15.00	16.50	1.20	0.00	184.64	0.00	"
340	CH 5085 : CH 5100	16.83	15.00	16.50	1.20	0.00	176.72	0.00	
341	CH 5100 : CH 5115	15.15	15.00	16.50	1.20	297.00	159.02	137.98	
342	CH 5115 : CH 5130	14.79	15.00	16.50	1.20	297.00	155.24	141.76	
343	CH 5130 : CH 5145	16.74	15.00	16.50	1.20	0.00	175.72	0.00	
344	CH 5145 : CH 5160	18.01	15.00	16.50	1.20	0.00	189.11	0.00	w>16.50
345	CH 5160 : CH 5175	16.69	15.00	16.50	1.20	0.00	175.25	0.00	"
346	CH 5175 : CH 5190	15.60	15.00	16.50	1.20	297.00	163.75	133.25	
347	CH 5190 : CH 5205	16.85	15.00	16.50	1.20	0.00	176.93	0.00	
348	CH 5205 : CH 5220	19.46	15.00	16.50	1.20	0.00	204.28	0.00	w>16.50
349	CH 5220 : CH 5235	21.14	15.00	16.50	1.20	0.00	215.25	0.00	"

Sl. No	Chainage	W (m)	L (m)	Proposed canal width (m)	Assumed cutting depth (m)	Total Required Quantity (m3)	De-Silting Quantity (m3)	Balance Cutting Quantity to be required (m3)	Remarks
350	CH 5235 : CH 5250	21.47	15.00	16.50	1.20	0.00	215.25	0.00	"
351	CH 5250 : CH 5265	21.01	15.00	16.50	1.20	0.00	215.25	0.00	"
352	CH 5265 : CH 5280	21.10	15.00	16.50	1.20	0.00	215.25	0.00	"
353	CH 5280 : CH 5295	21.56	15.00	16.50	1.20	0.00	215.25	0.00	"
354	CH 5295 : CH 5310	21.95	15.00	16.50	1.20	0.00	215.25	0.00	"
355	CH 5310 : CH 5325	22.46	15.00	16.50	1.20	0.00	215.25	0.00	"
356	CH 5325 : CH 5340	22.89	15.00	16.50	1.20	0.00	215.25	0.00	"
357	CH 5340 : CH 5355	23.02	15.00	16.50	1.20	0.00	215.25	0.00	"
358	CH 5355 : CH 5370	22.53	15.00	16.50	1.20	0.00	215.25	0.00	"
359	CH 5370 : CH 5385	21.61	15.00	16.50	1.20	0.00	215.25	0.00	"
360	CH 5385 : CH 5400	20.63	15.00	16.50	1.20	0.00	215.25	0.00	"
361	CH 5400 : CH 5415	19.51	15.00	16.50	1.20	0.00	204.80	0.00	"
362	CH 5415 : CH 5430	19.63	15.00	16.50	1.20	0.00	206.06	0.00	"
363	CH 5430 : CH 5445	20.56	15.00	16.50	1.20	0.00	215.25	0.00	"
364	CH 5445 : CH 5460	22.15	15.00	16.50	1.20	0.00	215.25	0.00	"
365	CH 5460 : CH 5475	23.23	15.00	16.50	1.20	0.00	215.25	0.00	"
366	CH 5475 : CH 5490	24.26	15.00	16.50	1.20	0.00	215.25	0.00	"
367	CH 5490 : CH 5505	25.36	15.00	16.50	1.20	0.00	215.25	0.00	"
368	CH 5505 : CH 5520	24.80	15.00	16.50	1.20	0.00	215.25	0.00	"
369	CH 5520 : CH 5535	24.03	15.00	16.50	1.20	0.00	215.25	0.00	"
370	CH 5535 : CH 5550	22.43	15.00	16.50	1.20	0.00	215.25	0.00	"
371	CH 5550 : CH 5565	21.20	15.00	16.50	1.20	0.00	215.25	0.00	"

Sl. No	Chainage	W (m)	L (m)	Proposed canal width (m)	Assumed cutting depth (m)	Total Required Quantity (m3)	De-Silting Quantity (m3)	Balance Cutting Quantity to be required (m3)	Remarks
372	CH 5565 : CH 5580	19.71	15.00	16.50	1.20	0.00	206.96	0.00	"
373	CH 5580 : CH 5595	17.97	15.00	16.50	1.20	0.00	188.69	0.00	"
374	CH 5595 : CH 5610	18.82	15.00	16.50	1.20	0.00	197.61	0.00	"
375	CH 5610 : CH 5625	19.44	15.00	16.50	1.20	0.00	204.12	0.00	"
376	CH 5625 : CH 5640	19.72	15.00	16.50	1.20	0.00	207.01	0.00	"
377	CH 5640 : CH 5655	20.09	15.00	16.50	1.20	0.00	210.89	0.00	"
378	CH 5655 : CH 5670	19.79	15.00	16.50	1.20	0.00	207.80	0.00	"
379	CH 5670 : CH 5685	20.42	15.00	16.50	1.20	0.00	214.41	0.00	"
380	CH 5685 : CH 5700	22.00	15.00	16.50	1.20	0.00	215.25	0.00	"
381	CH 5700 : CH 5715	22.98	15.00	16.50	1.20	0.00	215.25	0.00	"
382	CH 5715 : CH 5730	22.80	15.00	16.50	1.20	0.00	215.25	0.00	"
383	CH 5730 : CH 5745	22.42	15.00	16.50	1.20	0.00	215.25	0.00	"
384	CH 5745 : CH 5760	21.82	15.00	16.50	1.20	0.00	215.25	0.00	"
385	CH 5760 : CH 5775	21.64	15.00	16.50	1.20	0.00	215.25	0.00	"
386	CH 5775 : CH 5790	22.17	15.00	16.50	1.20	0.00	215.25	0.00	"
387	CH 5790 : CH 5805	23.21	15.00	16.50	1.20	0.00	215.25	0.00	"
388	CH 5805 : CH 5820	24.07	15.00	16.50	1.20	0.00	215.25	0.00	"
389	CH 5820 : CH 5835	23.64	15.00	16.50	1.20	0.00	215.25	0.00	"
390	CH 5835 : CH 5850	22.26	15.00	16.50	1.20	0.00	215.25	0.00	"
391	CH 5850 : CH 5865	21.71	15.00	16.50	1.20	0.00	215.25	0.00	"
392	CH 5865 : CH 5880	21.52	15.00	16.50	1.20	0.00	215.25	0.00	"
393	CH 5880 : CH 5895	19.64	15.00	16.50	1.20	0.00	206.17	0.00	"

Sl. No	Chainage	W (m)	L (m)	Proposed canal width (m)	Assumed cutting depth (m)	Total Required Quantity (m3)	De-Silting Quantity (m3)	Balance Cutting Quantity to be required (m3)	Remarks
394	CH 5895 : CH 5910	16.91	15.00	16.50	1.20	0.00	177.50	0.00	
395	CH 5910 : CH 5925	15.24	15.00	16.50	1.20	297.00	160.02	136.98	
396	CH 5925 : CH 5940	16.85	15.00	16.50	1.20	0.00	176.87	0.00	
397	CH 5940 : CH 5955	21.03	15.00	16.50	1.20	0.00	215.25	0.00	w>16.50
398	CH 5955 : CH 5970	22.96	15.00	16.50	1.20	0.00	215.25	0.00	"
399	CH 5970 : CH 5985	24.13	15.00	16.50	1.20	0.00	215.25	0.00	"
400	CH 5985 : CH 6000	25.55	15.00	16.50	1.20	0.00	215.25	0.00	"
401	CH 6000 : CH 6015	25.51	15.00	16.50	1.20	0.00	215.25	0.00	"
402	CH 6015 : CH 6030	26.13	15.00	16.50	1.20	0.00	215.25	0.00	"
403	CH 6030 : CH 6045	27.31	15.00	16.50	1.20	0.00	215.25	0.00	"
404	CH 6045 : CH 6060	27.38	15.00	16.50	1.20	0.00	215.25	0.00	"
405	CH 6060 : CH 6075	26.16	15.00	16.50	1.20	0.00	215.25	0.00	"
406	CH 6075 : CH 6090	25.36	15.00	16.50	1.20	0.00	215.25	0.00	"
407	CH 6090 : CH 6105	26.30	15.00	16.50	1.20	0.00	215.25	0.00	"
408	CH 6105 : CH 6120	28.11	15.00	16.50	1.20	0.00	215.25	0.00	"
409	CH 6120 : CH 6135	31.04	15.00	16.50	1.20	0.00	215.25	0.00	"
410	CH 6135 : CH 6150	33.51	15.00	16.50	1.20	0.00	215.25	0.00	"
411	CH 6150 : CH 6165	32.16	15.00	16.50	1.20	0.00	215.25	0.00	"
412	CH 6165 : CH 6180	28.96	15.00	16.50	1.20	0.00	215.25	0.00	"
413	CH 6180 : CH 6195	27.98	15.00	16.50	1.20	0.00	215.25	0.00	"
414	CH 6195 : CH 6210	27.60	15.00	16.50	1.20	0.00	215.25	0.00	"
415	CH 6210 : CH 6225	25.18	15.00	16.50	1.20	0.00	215.25	0.00	"

Sl. No	Chainage	W (m)	L (m)	Proposed canal width (m)	Assumed cutting depth (m)	Total Required Quantity (m3)	De-Silting Quantity (m3)	Balance Cutting Quantity to be required (m3)	Remarks
416	CH 6225 : CH 6240	22.73	15.00	16.50	1.20	0.00	215.25	0.00	"
417	CH 6240 : CH 6255	21.03	15.00	16.50	1.20	0.00	215.25	0.00	"
418	CH 6255 : CH 6270	20.45	15.00	16.50	1.20	0.00	214.73	0.00	"
419	CH 6270 : CH 6285	21.39	15.00	16.50	1.20	0.00	215.25	0.00	"
420	CH 6285 : CH 6300	22.92	15.00	16.50	1.20	0.00	215.25	0.00	"
421	CH 6300 : CH 6315	25.16	15.00	16.50	1.20	0.00	215.25	0.00	"
422	CH 6315 : CH 6330	26.96	15.00	16.50	1.20	0.00	215.25	0.00	"
423	CH 6330 : CH 6345	26.18	15.00	16.50	1.20	0.00	215.25	0.00	"
424	CH 6345 : CH 6360	25.20	15.00	16.50	1.20	0.00	215.25	0.00	"
425	CH 6360 : CH 6375	25.44	15.00	16.50	1.20	0.00	215.25	0.00	"
426	CH 6375 : CH 6390	25.64	15.00	16.50	1.20	0.00	215.25	0.00	"
427	CH 6390 : CH 6405	26.70	15.00	16.50	1.20	0.00	215.25	0.00	"
428	CH 6405 : CH 6420	28.20	15.00	16.50	1.20	0.00	215.25	0.00	"
429	CH 6420 : CH 6435	29.18	15.00	16.50	1.20	0.00	215.25	0.00	"
430	CH 6435 : CH 6450	27.85	15.00	16.50	1.20	0.00	215.25	0.00	"
431	CH 6450 : CH 6465	25.68	15.00	16.50	1.20	0.00	215.25	0.00	"
432	CH 6465 : CH 6480	27.81	15.00	16.50	1.20	0.00	215.25	0.00	"
433	CH 6480 : CH 6495	30.65	15.00	16.50	1.20	0.00	215.25	0.00	"
434	CH 6495 : CH 6510	31.33	15.00	16.50	1.20	0.00	215.25	0.00	"
435	CH 6510 : CH 6525	30.77	15.00	16.50	1.20	0.00	215.25	0.00	"
436	CH 6525 : CH 6540	25.96	15.00	16.50	1.20	0.00	215.25	0.00	"
437	CH 6540 : CH 6555	20.33	15.00	16.50	1.20	0.00	213.41	0.00	"

Sl. No	Chainage	W (m)	L (m)	Proposed canal width (m)	Assumed cutting depth (m)	Total Required Quantity (m3)	De-Silting Quantity (m3)	Balance Cutting Quantity to be required (m3)	Remarks
438	CH 6555 : CH 6570	17.77	15.00	16.50	1.20	0.00	186.53	0.00	"
439	CH 6570 : CH 6585	17.22	15.00	16.50	1.20	0.00	180.81	0.00	"
440	CH 6585 : CH 6600	18.54	15.00	16.50	1.20	0.00	194.67	0.00	"
441	CH 6600 : CH 6615	21.38	15.00	16.50	1.20	0.00	215.25	0.00	"
442	CH 6615 : CH 6630	23.41	15.00	16.50	1.20	0.00	215.25	0.00	"
443	CH 6630 : CH 6645	24.06	15.00	16.50	1.20	0.00	215.25	0.00	"
444	CH 6645 : CH 6660	24.69	15.00	16.50	1.20	0.00	215.25	0.00	"
445	CH 6660 : CH 6675	24.29	15.00	16.50	1.20	0.00	215.25	0.00	"
446	CH 6675 : CH 6690	22.91	15.00	16.50	1.20	0.00	215.25	0.00	"
447	CH 6690 : CH 6705	22.32	15.00	16.50	1.20	0.00	215.25	0.00	"
448	CH 6705 : CH 6720	22.58	15.00	16.50	1.20	0.00	215.25	0.00	"
449	CH 6720 : CH 6735	22.88	15.00	16.50	1.20	0.00	215.25	0.00	"
450	CH 6735 : CH 6750	24.92	15.00	16.50	1.20	0.00	215.25	0.00	"
451	CH 6750 : CH 6765	27.08	15.00	16.50	1.20	0.00	215.25	0.00	"
452	CH 6765 : CH 6780	27.70	15.00	16.50	1.20	0.00	215.25	0.00	"
453	CH 6780 : CH 6795	25.98	15.00	16.50	1.20	0.00	215.25	0.00	"
454	CH 6795 : CH 6810	25.43	15.00	16.50	1.20	0.00	215.25	0.00	"
455	CH 6810 : CH 6825	28.13	15.00	16.50	1.20	0.00	215.25	0.00	"
456	CH 6825 : CH 6840	30.28	15.00	16.50	1.20	0.00	215.25	0.00	"
457	CH 6840 : CH 6855	31.35	15.00	16.50	1.20	0.00	215.25	0.00	"
458	CH 6855 : CH 6870	30.16	15.00	16.50	1.20	0.00	215.25	0.00	"
459	CH 6870 : CH 6885	29.32	15.00	16.50	1.20	0.00	215.25	0.00	"

Sl. No	Chainage	W (m)	L (m)	Proposed canal width (m)	Assumed cutting depth (m)	Total Required Quantity (m3)	De-Silting Quantity (m3)	Balance Cutting Quantity to be required (m3)	Remarks
460	CH 6885 : CH 6900	30.99	15.00	16.50	1.20	0.00	215.25	0.00	"
461	CH 6900 : CH 6915	33.40	15.00	16.50	1.20	0.00	215.25	0.00	"
462	CH 6915 : CH 6930	34.06	15.00	16.50	1.20	0.00	215.25	0.00	"
463	CH 6930 : CH 6945	32.19	15.00	16.50	1.20	0.00	215.25	0.00	"
464	CH 6945 : CH 6960	29.79	15.00	16.50	1.20	0.00	215.25	0.00	"
465	CH 6960 : CH 6975	28.41	15.00	16.50	1.20	0.00	215.25	0.00	"
466	CH 6975 : CH 6990	27.25	15.00	16.50	1.20	0.00	215.25	0.00	"
467	CH 6990 : CH 7005	26.02	15.00	16.50	1.20	0.00	215.25	0.00	"
468	CH 7005 : CH 7020	26.37	15.00	16.50	1.20	0.00	215.25	0.00	"
469	CH 7020 : CH 7035	26.18	15.00	16.50	1.20	0.00	215.25	0.00	"
470	CH 7035 : CH 7050	25.02	15.00	16.50	1.20	0.00	215.25	0.00	"
471	CH 7050 : CH 7065	24.90	15.00	16.50	1.20	0.00	215.25	0.00	"
472	CH 7065 : CH 7080	24.07	15.00	16.50	1.20	0.00	215.25	0.00	"
473	CH 7080 : CH 7095	22.65	15.00	16.50	1.20	0.00	215.25	0.00	"
474	CH 7095 : CH 7110	21.07	15.00	16.50	1.20	0.00	215.25	0.00	"
475	CH 7110 : CH 7125	24.43	15.00	16.50	1.20	0.00	215.25	0.00	"
476	CH 7125 : CH 7140	31.75	15.00	16.50	1.20	0.00	215.25	0.00	"
477	CH 7140 : CH 7155	36.44	15.00	16.50	1.20	0.00	215.25	0.00	"
478	CH 7155 : CH 7170	40.43	15.00	16.50	1.20	0.00	215.25	0.00	"
479	CH 7170 : CH 7185	38.78	15.00	16.50	1.20	0.00	215.25	0.00	"
480	CH 7185 : CH 7200	35.19	15.00	16.50	1.20	0.00	215.25	0.00	"
481	CH 7200 : CH 7215	33.31	15.00	16.50	1.20	0.00	215.25	0.00	"

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482	CH 7215 : CH 7230	30.07	15.00	16.50	1.20	0.00	215.25	0.00	"
483	CH 7230 : CH 7245	28.86	15.00	16.50	1.20	0.00	215.25	0.00	"
484	CH 7245 : CH 7260	25.38	15.00	16.50	1.20	0.00	215.25	0.00	"
485	CH 7260 : CH 7275	23.07	15.00	16.50	1.20	0.00	215.25	0.00	"
486	CH 7275 : CH 7290	25.23	15.00	16.50	1.20	0.00	215.25	0.00	"
487	CH 7290 : CH 7305	27.32	15.00	16.50	1.20	0.00	215.25	0.00	"
488	CH 7305 : CH 7320	29.60	15.00	16.50	1.20	0.00	215.25	0.00	"
489	CH 7320 : CH 7335	31.18	15.00	16.50	1.20	0.00	215.25	0.00	"
490	CH 7335 : CH 7350	31.90	15.00	16.50	1.20	0.00	215.25	0.00	"
491	CH 7350 : CH 7365	32.63	15.00	16.50	1.20	0.00	215.25	0.00	"
492	CH 7365 : CH 7380	33.60	15.00	16.50	1.20	0.00	215.25	0.00	"
493	CH 7380 : CH 7395	33.81	15.00	16.50	1.20	0.00	215.25	0.00	"
494	CH 7395 : CH 7410	32.98	15.00	16.50	1.20	0.00	215.25	0.00	"
495	CH 7410 : CH 7425	32.10	15.00	16.50	1.20	0.00	215.25	0.00	"
496	CH 7425 : CH 7440	31.62	15.00	16.50	1.20	0.00	215.25	0.00	"
497	CH 7440 : CH 7455	31.66	15.00	16.50	1.20	0.00	215.25	0.00	"
498	CH 7455 : CH 7470	31.95	15.00	16.50	1.20	0.00	215.25	0.00	"
499	CH 7470 : CH 7485	32.38	15.00	16.50	1.20	0.00	215.25	0.00	"
500	CH 7485 : CH 7500	32.82	15.00	16.50	1.20	0.00	215.25	0.00	"
501	CH 7500 : CH 7515	33.93	15.00	16.50	1.20	0.00	215.25	0.00	"
502	CH 7515 : CH 7530	36.05	15.00	16.50	1.20	0.00	215.25	0.00	"
503	CH 7530 : CH 7545	37.49	15.00	16.50	1.20	0.00	215.25	0.00	"

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504	CH 7545 : CH 7560	37.40	15.00	16.50	1.20	0.00	215.25	0.00	"
505	CH 7560 : CH 7575	37.17	15.00	16.50	1.20	0.00	215.25	0.00	"
506	CH 7575 : CH 7590	36.05	15.00	16.50	1.20	0.00	215.25	0.00	"
507	CH 7590 : CH 7605	34.35	15.00	16.50	1.20	0.00	215.25	0.00	"
508	CH 7605 : CH 7620	33.28	15.00	16.50	1.20	0.00	215.25	0.00	"
509	CH 7620 : CH 7635	32.58	15.00	16.50	1.20	0.00	215.25	0.00	"
510	CH 7635 : CH 7650	30.59	15.00	16.50	1.20	0.00	215.25	0.00	"
511	CH 7650 : CH 7665	28.09	15.00	16.50	1.20	0.00	215.25	0.00	"
512	CH 7665 : CH 7680	27.23	15.00	16.50	1.20	0.00	215.25	0.00	"
513	CH 7680 : CH 7695	29.32	15.00	16.50	1.20	0.00	215.25	0.00	"
514	CH 7695 : CH 7710	34.59	15.00	16.50	1.20	0.00	215.25	0.00	"
515	CH 7710 : CH 7725	39.65	15.00	16.50	1.20	0.00	215.25	0.00	"
516	CH 7725 : CH 7740	40.30	15.00	16.50	1.20	0.00	215.25	0.00	"
517	CH 7740 : CH 7755	35.88	15.00	16.50	1.20	0.00	215.25	0.00	"
518	CH 7755 : CH 7770	31.74	15.00	16.50	1.20	0.00	215.25	0.00	"
519	CH 7770 : CH 7785	30.17	15.00	16.50	1.20	0.00	215.25	0.00	"
520	CH 7785 : CH 7800	28.29	15.00	16.50	1.20	0.00	215.25	0.00	"
521	CH 7800 : CH 7815	26.49	15.00	16.50	1.20	0.00	215.25	0.00	"
522	CH 7815 : CH 7830	27.25	15.00	16.50	1.20	0.00	215.25	0.00	"
523	CH 7830 : CH 7845	30.46	15.00	16.50	1.20	0.00	215.25	0.00	"
524	CH 7845 : CH 7860	33.49	15.00	16.50	1.20	0.00	215.25	0.00	"
525	CH 7860 : CH 7875	34.32	15.00	16.50	1.20	0.00	215.25	0.00	"

Sl. No	Chainage	W (m)	L (m)	Proposed canal width (m)	Assumed cutting depth (m)	Total Required Quantity (m3)	De-Silting Quantity (m3)	Balance Cutting Quantity to be required (m3)	Remarks
526	CH 7875 : CH 7890	35.31	15.00	16.50	1.20	0.00	215.25	0.00	"
527	CH 7890 : CH 7905	37.48	15.00	16.50	1.20	0.00	215.25	0.00	"
528	CH 7905 : CH 7920	37.60	15.00	16.50	1.20	0.00	215.25	0.00	"
529	CH 7920 : CH 7935	35.09	15.00	16.50	1.20	0.00	215.25	0.00	"
530	CH 7935 : CH 7950	31.74	15.00	16.50	1.20	0.00	215.25	0.00	"
531	CH 7950 : CH 7965	29.69	15.00	16.50	1.20	0.00	215.25	0.00	"
532	CH 7965 : CH 7980	28.84	15.00	16.50	1.20	0.00	215.25	0.00	"
533	CH 7980 : CH 7995	27.60	15.00	16.50	1.20	0.00	215.25	0.00	"
534	CH 7995 : CH 8010	26.35	15.00	16.50	1.20	0.00	215.25	0.00	"
535	CH 8010 : CH 8025	26.52	15.00	16.50	1.20	0.00	215.25	0.00	"
536	CH 8025 : CH 8040	28.13	15.00	16.50	1.20	0.00	215.25	0.00	"
537	CH 8040 : CH 8055	28.86	15.00	16.50	1.20	0.00	215.25	0.00	"
538	CH 8055 : CH 8070	28.56	15.00	16.50	1.20	0.00	215.25	0.00	"
539	CH 8070 : CH 8085	27.95	15.00	16.50	1.20	0.00	215.25	0.00	"
540	CH 8085 : CH 8100	27.15	15.00	16.50	1.20	0.00	215.25	0.00	"
541	CH 8100 : CH 8115	26.84	15.00	16.50	1.20	0.00	215.25	0.00	"
542	CH 8115 : CH 8130	27.19	15.00	16.50	1.20	0.00	215.25	0.00	"
543	CH 8130 : CH 8145	28.29	15.00	16.50	1.20	0.00	215.25	0.00	"
544	CH 8145 : CH 8160	30.64	15.00	16.50	1.20	0.00	215.25	0.00	"
545	CH 8160 : CH 8175	32.75	15.00	16.50	1.20	0.00	215.25	0.00	"
546	CH 8175 : CH 8190	32.74	15.00	16.50	1.20	0.00	215.25	0.00	"
547	CH 8190 : CH 8205	31.49	15.00	16.50	1.20	0.00	215.25	0.00	"

Sl. No	Chainage	W (m)	L (m)	Proposed canal width (m)	Assumed cutting depth (m)	Total Required Quantity (m3)	De-Silting Quantity (m3)	Balance Cutting Quantity to be required (m3)	Remarks
548	CH 8205 : CH 8220	30.26	15.00	16.50	1.20	0.00	215.25	0.00	"
549	CH 8220 : CH 8235	29.95	15.00	16.50	1.20	0.00	215.25	0.00	"
550	CH 8235 : CH 8250	32.06	15.00	16.50	1.20	0.00	215.25	0.00	"
551	CH 8250 : CH 8265	33.65	15.00	16.50	1.20	0.00	215.25	0.00	"
552	CH 8265 : CH 8280	33.13	15.00	16.50	1.20	0.00	215.25	0.00	"
553	CH 8280 : CH 8295	33.43	15.00	16.50	1.20	0.00	215.25	0.00	"
554	CH 8295 : CH 8310	33.12	15.00	16.50	1.20	0.00	215.25	0.00	"
555	CH 8310 : CH 8325	31.11	15.00	16.50	1.20	0.00	215.25	0.00	"
556	CH 8325 : CH 8340	30.83	15.00	16.50	1.20	0.00	215.25	0.00	"
557	CH 8340 : CH 8355	35.54	15.00	16.50	1.20	0.00	215.25	0.00	"
558	CH 8355 : CH 8370	43.52	15.00	16.50	1.20	0.00	215.25	0.00	"
559	CH 8370 : CH 8385	54.40	15.00	16.50	1.20	0.00	215.25	0.00	"
560	CH 8385 : CH 8400	59.05	15.00	16.50	1.20	0.00	215.25	0.00	"
561	CH 8400 : CH 8415	54.58	15.00	16.50	1.20	0.00	215.25	0.00	"
562	CH 8415 : CH 8430	53.32	15.00	16.50	1.20	0.00	215.25	0.00	"
563	CH 8430 : CH 8445	55.61	15.00	16.50	1.20	0.00	215.25	0.00	"
564	CH 8445 : CH 8460	55.62	15.00	16.50	1.20	0.00	215.25	0.00	"
565	CH 8460 : CH 8475	55.62	15.00	16.50	1.20	0.00	215.25	0.00	"
566	CH 8475 : CH 8490	58.77	15.00	16.50	1.20	0.00	215.25	0.00	"
567	CH 8490 : CH 8505	62.18	15.00	16.50	1.20	0.00	215.25	0.00	"
568	CH 8505 : CH 8520	62.69	15.00	16.50	1.20	0.00	215.25	0.00	"
569	CH 8520 : CH 8535	59.54	15.00	16.50	1.20	0.00	215.25	0.00	"

Sl. No	Chainage	W (m)	L (m)	Proposed canal width (m)	Assumed cutting depth (m)	Total Required Quantity (m3)	De-Silting Quantity (m3)	Balance Cutting Quantity to be required (m3)	Remarks
570	CH 8535 : CH 8550	56.89	15.00	16.50	1.20	0.00	215.25	0.00	"
571	CH 8550 : CH 8565	55.98	15.00	16.50	1.20	0.00	215.25	0.00	"
572	CH 8565 : CH 8580	54.77	15.00	16.50	1.20	0.00	215.25	0.00	"
573	CH 8580 : CH 8595	54.40	15.00	16.50	1.20	0.00	215.25	0.00	"
574	CH 8595 : CH 8610	55.37	15.00	16.50	1.20	0.00	215.25	0.00	"
575	CH 8610 : CH 8625	56.34	15.00	16.50	1.20	0.00	215.25	0.00	"
576	CH 8625 : CH 8640	57.13	15.00	16.50	1.20	0.00	215.25	0.00	"
577	CH 8640 : CH 8655	55.99	15.00	16.50	1.20	0.00	215.25	0.00	"
578	CH 8655 : CH 8670	52.77	15.00	16.50	1.20	0.00	215.25	0.00	"
579	CH 8670 : CH 8685	52.29	15.00	16.50	1.20	0.00	215.25	0.00	"
580	CH 8685 : CH 8700	54.38	15.00	16.50	1.20	0.00	215.25	0.00	"
581	CH 8700 : CH 8715	56.59	15.00	16.50	1.20	0.00	215.25	0.00	"
582	CH 8715 : CH 8730	57.65	15.00	16.50	1.20	0.00	215.25	0.00	"
583	CH 8730 : CH 8745	60.41	15.00	16.50	1.20	0.00	215.25	0.00	"
584	CH 8745 : CH 8760	72.49	15.00	16.50	1.20	0.00	215.25	0.00	"
585	CH 8760 : CH 8775	104.23	15.00	16.50	1.20	0.00	215.25	0.00	"
586	CH 8775 : CH 8790	151.67	15.00	16.50	1.20	0.00	215.25	0.00	"
587	CH 8790 : CH 8805	170.85	15.00	16.50	1.20	0.00	215.25	0.00	"
588	CH 8805 : CH 8820	123.65	15.00	16.50	1.20	0.00	215.25	0.00	"
589	CH 8820 : CH 8835	85.75	15.00	16.50	1.20	0.00	215.25	0.00	"
590	CH 8835 : CH 8850	77.10	15.00	16.50	1.20	0.00	215.25	0.00	"
591	CH 8850 : CH 8865	75.48	15.00	16.50	1.20	0.00	215.25	0.00	"

Sl. No	Chainage	W (m)	L (m)	Proposed canal width (m)	Assumed cutting depth (m)	Total Required Quantity (m3)	De-Silting Quantity (m3)	Balance Cutting Quantity to be required (m3)	Remarks
592	CH 8865 : CH 8880	76.00	15.00	16.50	1.20	0.00	215.25	0.00	"
593	CH 8880 : CH 8895	76.90	15.00	16.50	1.20	0.00	215.25	0.00	"
594	CH 8895 : CH 8910	75.81	15.00	16.50	1.20	0.00	215.25	0.00	"
595	CH 8910 : CH 8925	73.30	15.00	16.50	1.20	0.00	215.25	0.00	"
596	CH 8925 : CH 8940	71.93	15.00	16.50	1.20	0.00	215.25	0.00	"
597	CH 8940 : CH 8955	69.95	15.00	16.50	1.20	0.00	215.25	0.00	"
598	CH 8955 : CH 8970	66.09	15.00	16.50	1.20	0.00	215.25	0.00	"
599	CH 8970 : CH 8985	59.97	15.00	16.50	1.20	0.00	215.25	0.00	"
600	CH 8985 : CH 9000	54.43	15.00	16.50	1.20	0.00	215.25	0.00	"
601	CH 9000 : CH 9015	57.70	15.00	16.50	1.20	0.00	215.25	0.00	"
602	CH 9015 : CH 9030	67.51	15.00	16.50	1.20	0.00	215.25	0.00	"
603	CH 9030 : CH 9045	81.22	15.00	16.50	1.20	0.00	215.25	0.00	"
604	CH 9045 : CH 9060	109.44	15.00	16.50	1.20	0.00	215.25	0.00	"
605	CH 9060 : CH 9075	130.75	15.00	16.50	1.20	0.00	215.25	0.00	"
606	CH 9075 : CH 9090	134.15	15.00	16.50	1.20	0.00	215.25	0.00	"
607	CH 9090 : CH 9105	135.61	15.00	16.50	1.20	0.00	215.25	0.00	"
608	CH 9105 : CH 9120	137.19	15.00	16.50	1.20	0.00	215.25	0.00	"
609	CH 9120 : CH 9135	119.75	15.00	16.50	1.20	0.00	215.25	0.00	"
610	CH 9135 : CH 9150	90.99	15.00	16.50	1.20	0.00	215.25	0.00	"
611	CH 9150 : CH 9165	76.87	15.00	16.50	1.20	0.00	215.25	0.00	"
612	CH 9165 : CH 9180	69.45	15.00	16.50	1.20	0.00	215.25	0.00	"
613	CH 9180 : CH 9195	65.55	15.00	16.50	1.20	0.00	215.25	0.00	"

Sl. No	Chainage	W (m)	L (m)	Proposed canal width (m)	Assumed cutting depth (m)	Total Required Quantity (m3)	De-Silting Quantity (m3)	Balance Cutting Quantity to be required (m3)	Remarks
614	CH 9195 : CH 9210	63.63	15.00	16.50	1.20	0.00	215.25	0.00	"
615	CH 9210 : CH 9225	61.47	15.00	16.50	1.20	0.00	215.25	0.00	"
616	CH 9225 : CH 9240	58.99	15.00	16.50	1.20	0.00	215.25	0.00	"
617	CH 9240 : CH 9255	57.22	15.00	16.50	1.20	0.00	215.25	0.00	"
618	CH 9255 : CH 9270	57.36	15.00	16.50	1.20	0.00	215.25	0.00	"
619	CH 9270 : CH 9285	54.06	15.00	16.50	1.20	0.00	215.25	0.00	"
620	CH 9285 : CH 9300	50.88	15.00	16.50	1.20	0.00	215.25	0.00	"
621	CH 9300 : CH 9315	52.38	15.00	16.50	1.20	0.00	215.25	0.00	"
622	CH 9315 : CH 9330	53.14	15.00	16.50	1.20	0.00	215.25	0.00	"
623	CH 9330 : CH 9345	53.63	15.00	16.50	1.20	0.00	215.25	0.00	"
624	CH 9345 : CH 9360	53.80	15.00	16.50	1.20	0.00	215.25	0.00	"
625	CH 9360 : CH 9375	53.55	15.00	16.50	1.20	0.00	215.25	0.00	"
626	CH 9375 : CH 9390	52.78	15.00	16.50	1.20	0.00	215.25	0.00	"
627	CH 9390 : CH 9405	51.34	15.00	16.50	1.20	0.00	215.25	0.00	"
628	CH 9405 : CH 9420	51.09	15.00	16.50	1.20	0.00	215.25	0.00	"
629	CH 9420 : CH 9435	53.12	15.00	16.50	1.20	0.00	215.25	0.00	"
630	CH 9435 : CH 9450	56.15	15.00	16.50	1.20	0.00	215.25	0.00	"
631	CH 9450 : CH 9465	57.10	15.00	16.50	1.20	0.00	215.25	0.00	"
632	CH 9465 : CH 9480	55.42	15.00	16.50	1.20	0.00	215.25	0.00	"
633	CH 9480 : CH 9495	51.78	15.00	16.50	1.20	0.00	215.25	0.00	"
634	CH 9495 : CH 9510	48.21	15.00	16.50	1.20	0.00	215.25	0.00	"
635	CH 9510 : CH 9525	46.71	15.00	16.50	1.20	0.00	215.25	0.00	"

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636	CH 9525 : CH 9540	47.83	15.00	16.50	1.20	0.00	215.25	0.00	"
637	CH 9540 : CH 9555	49.60	15.00	16.50	1.20	0.00	215.25	0.00	"
638	CH 9555 : CH 9570	49.72	15.00	16.50	1.20	0.00	215.25	0.00	"
639	CH 9570 : CH 9585	49.51	15.00	16.50	1.20	0.00	215.25	0.00	"
640	CH 9585 : CH 9600	50.16	15.00	16.50	1.20	0.00	215.25	0.00	"
641	CH 9600 : CH 9615	51.15	15.00	16.50	1.20	0.00	215.25	0.00	"
642	CH 9615 : CH 9630	51.80	15.00	16.50	1.20	0.00	215.25	0.00	"
643	CH 9630 : CH 9645	52.38	15.00	16.50	1.20	0.00	215.25	0.00	"
644	CH 9645 : CH 9660	52.92	15.00	16.50	1.20	0.00	215.25	0.00	"
645	CH 9660 : CH 9675	53.42	15.00	16.50	1.20	0.00	215.25	0.00	"
646	CH 9675 : CH 9690	53.90	15.00	16.50	1.20	0.00	215.25	0.00	"
647	CH 9690 : CH 9705	54.16	15.00	16.50	1.20	0.00	215.25	0.00	"
648	CH 9705 : CH 9720	53.65	15.00	16.50	1.20	0.00	215.25	0.00	"
649	CH 9720 : CH 9735	52.49	15.00	16.50	1.20	0.00	215.25	0.00	"
650	CH 9735 : CH 9750	51.68	15.00	16.50	1.20	0.00	215.25	0.00	"
651	CH 9750 : CH 9765	51.52	15.00	16.50	1.20	0.00	215.25	0.00	"
652	CH 9765 : CH 9780	52.07	15.00	16.50	1.20	0.00	215.25	0.00	"
653	CH 9780 : CH 9795	52.24	15.00	16.50	1.20	0.00	215.25	0.00	"
654	CH 9795 : CH 9810	50.76	15.00	16.50	1.20	0.00	215.25	0.00	"
655	CH 9810 : CH 9825	48.37	15.00	16.50	1.20	0.00	215.25	0.00	"
656	CH 9825 : CH 9840	47.51	15.00	16.50	1.20	0.00	215.25	0.00	"
657	CH 9840 : CH 9855	49.73	15.00	16.50	1.20	0.00	215.25	0.00	"

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658	CH 9855 : CH 9870	53.46	15.00	16.50	1.20	0.00	215.25	0.00	"
659	CH 9870 : CH 9885	56.92	15.00	16.50	1.20	0.00	215.25	0.00	"
660	CH 9885 : CH 9900	58.96	15.00	16.50	1.20	0.00	215.25	0.00	"
661	CH 9900 : CH 9915	57.04	15.00	16.50	1.20	0.00	215.25	0.00	"
662	CH 9915 : CH 9930	56.69	15.00	16.50	1.20	0.00	215.25	0.00	"
663	CH 9930 : CH 9945	56.62	15.00	16.50	1.20	0.00	215.25	0.00	"
664	CH 9945 : CH 9960	53.61	15.00	16.50	1.20	0.00	215.25	0.00	"
665	CH 9960 : CH 9975	53.16	15.00	16.50	1.20	0.00	215.25	0.00	"
666	CH 9975 : CH 9990	57.48	15.00	16.50	1.20	0.00	215.25	0.00	"
667	CH 9990 : CH 10005	60.38	15.00	16.50	1.20	0.00	215.25	0.00	"
668	CH 10005 : CH 10020	61.92	15.00	16.50	1.20	0.00	215.25	0.00	"
669	CH 10020 : CH 10035	64.26	15.00	16.50	1.20	0.00	215.25	0.00	"
670	CH 10035 : CH 10050	65.02	15.00	16.50	1.20	0.00	215.25	0.00	"
671	CH 10050 : CH 10065	62.78	15.00	16.50	1.20	0.00	215.25	0.00	"
672	CH 10065 : CH 10080	60.81	15.00	16.50	1.20	0.00	215.25	0.00	"
673	CH 10080 : CH 10095	57.15	15.00	16.50	1.20	0.00	215.25	0.00	"
674	CH 10095 : CH 10110	51.61	15.00	16.50	1.20	0.00	215.25	0.00	"
675	CH 10110 : CH 10125	47.21	15.00	16.50	1.20	0.00	215.25	0.00	"
676	CH 10125 : CH 10140	45.93	15.00	16.50	1.20	0.00	215.25	0.00	"
677	CH 10140 : CH 10155	46.08	15.00	16.50	1.20	0.00	215.25	0.00	"
678	CH 10155 : CH 10170	46.44	15.00	16.50	1.20	0.00	215.25	0.00	"
679	CH 10170 : CH 10185	48.74	15.00	16.50	1.20	0.00	215.25	0.00	"

Sl. No	Chainage	W (m)	L (m)	Proposed canal width (m)	Assumed cutting depth (m)	Total Required Quantity (m3)	De-Silting Quantity (m3)	Balance Cutting Quantity to be required (m3)	Remarks
680	CH 10185 : CH 10200	51.79	15.00	16.50	1.20	0.00	215.25	0.00	"
681	CH 10200 : CH 10215	54.59	15.00	16.50	1.20	0.00	215.25	0.00	"
682	CH 10215 : CH 10230	56.04	15.00	16.50	1.20	0.00	215.25	0.00	"
683	CH 10230 : CH 10245	56.17	15.00	16.50	1.20	0.00	215.25	0.00	"
684	CH 10245 : CH 10260	57.95	15.00	16.50	1.20	0.00	215.25	0.00	"
685	CH 10260 : CH 10275	55.06	15.00	16.50	1.20	0.00	215.25	0.00	"
686	CH 10275 : CH 10290	52.91	15.00	16.50	1.20	0.00	215.25	0.00	"
687	CH 10290 : CH 10305	54.13	15.00	16.50	1.20	0.00	215.25	0.00	"
688	CH 10305 : CH 10320	52.86	15.00	16.50	1.20	0.00	215.25	0.00	"
689	CH 10320 : CH 10335	52.69	15.00	16.50	1.20	0.00	215.25	0.00	"
690	CH 10335 : CH 10350	51.89	15.00	16.50	1.20	0.00	215.25	0.00	"
691	CH 10350 : CH 10365	52.13	15.00	16.50	1.20	0.00	215.25	0.00	"
692	CH 10365 : CH 10380	53.94	15.00	16.50	1.20	0.00	215.25	0.00	"
693	CH 10380 : CH 10395	54.60	15.00	16.50	1.20	0.00	215.25	0.00	"
694	CH 10395 : CH 10410	54.10	15.00	16.50	1.20	0.00	215.25	0.00	"
695	CH 10410 : CH 10425	51.91	15.00	16.50	1.20	0.00	215.25	0.00	"
696	CH 10425 : CH 10440	51.34	15.00	16.50	1.20	0.00	215.25	0.00	"
697	CH 10440 : CH 10455	52.68	15.00	16.50	1.20	0.00	215.25	0.00	"
698	CH 10455 : CH 10470	53.79	15.00	16.50	1.20	0.00	215.25	0.00	"
699	CH 10470 : CH 10485	55.46	15.00	16.50	1.20	0.00	215.25	0.00	"
700	CH 10485 : CH 10500	55.82	15.00	16.50	1.20	0.00	215.25	0.00	"
701	CH 10500 : CH 10515	55.04	15.00	16.50	1.20	0.00	215.25	0.00	"

Sl. No	Chainage	W (m)	L (m)	Proposed canal width (m)	Assumed cutting depth (m)	Total Required Quantity (m3)	De-Silting Quantity (m3)	Balance Cutting Quantity to be required (m3)	Remarks
702	CH 10515 : CH 10530	55.55	15.00	16.50	1.20	0.00	215.25	0.00	"
703	CH 10530 : CH 10545	55.62	15.00	16.50	1.20	0.00	215.25	0.00	"
704	CH 10545 : CH 10560	55.13	15.00	16.50	1.20	0.00	215.25	0.00	"
705	CH 10560 : CH 10575	59.01	15.00	16.50	1.20	0.00	215.25	0.00	"
706	CH 10575 : CH 10590	59.79	15.00	16.50	1.20	0.00	215.25	0.00	"
707	CH 10590 : CH 10605	55.46	15.00	16.50	1.20	0.00	215.25	0.00	"
708	CH 10605 : CH 10620	55.63	15.00	16.50	1.20	0.00	215.25	0.00	"
709	CH 10620 : CH 10635	57.68	15.00	16.50	1.20	0.00	215.25	0.00	"
710	CH 10635 : CH 10650	57.25	15.00	16.50	1.20	0.00	215.25	0.00	"
711	CH 10650 : CH 10665	56.52	15.00	16.50	1.20	0.00	215.25	0.00	"
712	CH 10665 : CH 10680	56.77	15.00	16.50	1.20	0.00	215.25	0.00	"
713	CH 10680 : CH 10695	58.15	15.00	16.50	1.20	0.00	215.25	0.00	"
714	CH 10695 : CH 10710	60.01	15.00	16.50	1.20	0.00	215.25	0.00	"
715	CH 10710 : CH 10725	60.64	15.00	16.50	1.20	0.00	215.25	0.00	"
716	CH 10725 : CH 10740	61.17	15.00	16.50	1.20	0.00	215.25	0.00	"
717	CH 10740 : CH 10755	62.15	15.00	16.50	1.20	0.00	215.25	0.00	"
718	CH 10755 : CH 10770	59.80	15.00	16.50	1.20	0.00	215.25	0.00	"
719	CH 10770 : CH 10785	58.50	15.00	16.50	1.20	0.00	215.25	0.00	"
720	CH 10785 : CH 10800	60.70	15.00	16.50	1.20	0.00	215.25	0.00	"
721	CH 10800 : CH 10815	62.81	15.00	16.50	1.20	0.00	215.25	0.00	"
722	CH 10815 : CH 10830	66.72	15.00	16.50	1.20	0.00	215.25	0.00	"
723	CH 10830 : CH 10845	68.60	15.00	16.50	1.20	0.00	215.25	0.00	"

Sl. No	Chainage	W (m)	L (m)	Proposed canal width (m)	Assumed cutting depth (m)	Total Required Quantity (m3)	De-Silting Quantity (m3)	Balance Cutting Quantity to be required (m3)	Remarks
724	CH 10845 : CH 10860	66.62	15.00	16.50	1.20	0.00	215.25	0.00	"
725	CH 10860 : CH 10875	65.68	15.00	16.50	1.20	0.00	215.25	0.00	"
726	CH 10875 : CH 10890	64.89	15.00	16.50	1.20	0.00	215.25	0.00	"
727	CH 10890 : CH 10905	63.02	15.00	16.50	1.20	0.00	215.25	0.00	"
728	CH 10905 : CH 10920	62.80	15.00	16.50	1.20	0.00	215.25	0.00	"
729	CH 10920 : CH 10935	63.22	15.00	16.50	1.20	0.00	215.25	0.00	"
730	CH 10935 : CH 10950	64.11	15.00	16.50	1.20	0.00	215.25	0.00	"
731	CH 10950 : CH 10965	68.17	15.00	16.50	1.20	0.00	215.25	0.00	"
732	CH 10965 : CH 10980	76.45	15.00	16.50	1.20	0.00	215.25	0.00	"
733	CH 10980 : CH 10995	88.04	15.00	16.50	1.20	0.00	215.25	0.00	"
734	CH 10995 : CH 11010	94.56	15.00	16.50	1.20	0.00	215.25	0.00	"
735	CH 11010 : CH 11025	95.31	15.00	16.50	1.20	0.00	215.25	0.00	"
736	CH 11025 : CH 11040	99.38	15.00	16.50	1.20	0.00	215.25	0.00	"
737	CH 11040 : CH 11055	106.00	15.00	16.50	1.20	0.00	215.25	0.00	"
738	CH 11055 : CH 11070	112.14	15.00	16.50	1.20	0.00	215.25	0.00	"
739	CH 11070 : CH 11085	99.65	15.00	16.50	1.20	0.00	215.25	0.00	"
740	CH 11085 : CH 11100	77.99	15.00	16.50	1.20	0.00	215.25	0.00	"
741	CH 11100 : CH 11115	65.67	15.00	16.50	1.20	0.00	215.25	0.00	"
742	CH 11115 : CH 11130	51.92	15.00	16.50	1.20	0.00	215.25	0.00	"
743	CH 11130 : CH 11145	43.00	15.00	16.50	1.20	0.00	215.25	0.00	"
744	CH 11145 : CH 11160	40.66	15.00	16.50	1.20	0.00	215.25	0.00	"
745	CH 11160 : CH 11175	41.17	15.00	16.50	1.20	0.00	215.25	0.00	"

Sl. No	Chainage	W (m)	L (m)	Proposed canal width (m)	Assumed cutting depth (m)	Total Required Quantity (m3)	De-Silting Quantity (m3)	Balance Cutting Quantity to be required (m3)	Remarks
746	CH 11175 : CH 11190	47.27	15.00	16.50	1.20	0.00	215.25	0.00	"
747	CH 11190 : CH 11205	55.83	15.00	16.50	1.20	0.00	215.25	0.00	"
748	CH 11205 : CH 11220	64.05	15.00	16.50	1.20	0.00	215.25	0.00	"
749	CH 11220 : CH 11231	80.60	11.00	16.50	1.20	0.00	157.85	0.00	"
	Total Quantity							**46,768.34**	

1.2 Chilavanoor canal

Table 3: Widening Details of Chilavanoor Canal

Sl. No	Chainage	W (m)	L (m)	Proposed canal width (m)	Assumed cutting depth (m)	Total Required Quantity (m3)	De-Silting Quantity (m3)	Net Cutting Quantity to be required (m3)	Remarks
1	CH 0 : CH 15	51.29	15	16.5	1.2	0.00	538.49	0.00	w>16.50
2	CH 15 : CH 30	42.05	15	16.5	1.2	0.00	441.49	0.00	"
3	CH 30 : CH 45	29.99	15	16.5	1.2	0.00	314.93	0.00	"
4	CH 45 : CH 60	22.39	15	16.5	1.2	0.00	235.11	0.00	"
5	CH 60 : CH 75	20.58	15	16.5	1.2	0.00	216.05	0.00	"
6	CH 75 : CH 90	21.77	15	16.5	1.2	0.00	228.63	0.00	"
7	CH 90 : CH 105	23.82	15	16.5	1.2	0.00	250.16	0.00	"
8	CH 105 : CH 120	25.31	15	16.5	1.2	0.00	265.74	0.00	"
9	CH 120 : CH 135	27.15	15	16.5	1.2	0.00	285.10	0.00	"
10	CH 135 : CH 150	29.08	15	16.5	1.2	0.00	305.29	0.00	"
11	CH 150 : CH 165	30.42	15	16.5	1.2	0.00	319.38	0.00	"
12	CH 165 : CH 180	29.31	15	16.5	1.2	0.00	307.73	0.00	"
13	CH 180 : CH 195	24.12	15	16.5	1.2	0.00	253.29	0.00	"
14	CH 195 : CH 210	18.15	15	16.5	1.2	0.00	190.60	0.00	
15	CH 210 : CH 225	16.50	15	16.5	1.2	0.00	173.23	0.00	
16	CH 225 : CH 240	16.93	15	16.5	1.2	0.00	177.79	0.00	"
17	CH 240 : CH 255	17.00	15	16.5	1.2	0.00	178.45	0.00	"

Sl. No	Chainage	W (m)	L (m)	Proposed canal width (m)	Assumed cutting depth (m)	Total Required Quantity (m3)	De-Silting Quantity (m3)	Net Cutting Quantity to be required (m3)	Remarks
18	CH 255 : CH 270	17.07	15	16.5	1.2	0.00	179.27	0.00	"
19	CH 270 : CH 285	18.97	15	16.5	1.2	0.00	199.21	0.00	"
20	CH 285 : CH 300	20.54	15	16.5	1.2	0.00	215.64	0.00	"
21	CH 300 : CH 315	19.79	15	16.5	1.2	0.00	207.78	0.00	"
22	CH 315 : CH 330	19.15	15	16.5	1.2	0.00	201.12	0.00	"
23	CH 330 : CH 345	20.83	15	16.5	1.2	0.00	218.69	0.00	"
24	CH 345 : CH 360	22.09	15	16.5	1.2	0.00	231.90	0.00	"
25	CH 360 : CH 375	17.48	15	16.5	1.2	0.00	183.51	0.00	
26	CH 375 : CH 390	13.66	15	16.5	1.2	297.00	143.38	153.62	
27	CH 390 : CH 405	11.85	15	16.5	1.2	297.00	124.47	172.53	
28	CH 405 : CH 420	17.18	15	16.5	1.2	0.00	180.35	0.00	
29	CH 420 : CH 435	18.56	15	16.5	1.2	0.00	194.88	0.00	"
30	CH 435 : CH 450	18.85	15	16.5	1.2	0.00	197.97	0.00	"
31	CH 450 : CH 465	19.43	15	16.5	1.2	0.00	203.96	0.00	"
32	CH 465 : CH 480	20.37	15	16.5	1.2	0.00	213.91	0.00	"
33	CH 480 : CH 495	20.83	15	16.5	1.2	0.00	218.66	0.00	"
34	CH 495 : CH 510	18.48	15	16.5	1.2	0.00	194.05	0.00	"
35	CH 510 : CH 525	19.74	15	16.5	1.2	0.00	207.30	0.00	"
36	CH 525 : CH 540	26.37	15	16.5	1.2	0.00	276.85	0.00	"
37	CH 540 : CH 555	29.15	15	16.5	1.2	0.00	306.12	0.00	"
38	CH 555 : CH 570	28.47	15	16.5	1.2	0.00	298.91	0.00	"
39	CH 570 : CH 585	27.46	15	16.5	1.2	0.00	288.29	0.00	"

Sl. No	Chainage	W (m)	L (m)	Proposed canal width (m)	Assumed cutting depth (m)	Total Required Quantity (m3)	De-Silting Quantity (m3)	Net Cutting Quantity to be required (m3)	Remarks
40	CH 585 : CH 600	26.20	15	16.5	1.2	0.00	275.06	0.00	"
41	CH 600 : CH 615	24.68	15	16.5	1.2	0.00	259.13	0.00	"
42	CH 615 : CH 630	24.59	15	16.5	1.2	0.00	258.20	0.00	"
43	CH 630 : CH 645	24.35	15	16.5	1.2	0.00	255.70	0.00	"
44	CH 645 : CH 660	22.08	15	16.5	1.2	0.00	231.85	0.00	"
45	CH 660 : CH 675	18.79	15	16.5	1.2	0.00	197.30	0.00	"
46	CH 675 : CH 690	16.30	15	16.5	1.2	297.00	171.17	125.83	
47	CH 690 : CH 705	15.60	15	16.5	1.2	297.00	163.85	133.15	
48	CH 705 : CH 720	14.02	15	16.5	1.2	297.00	147.20	149.80	
49	CH 720 : CH 735	13.23	15	16.5	1.2	297.00	138.92	158.09	
50	CH 735 : CH 750	14.39	15	16.5	1.2	297.00	151.08	145.92	
51	CH 750 : CH 765	15.36	15	16.5	1.2	297.00	161.25	135.75	
52	CH 765 : CH 780	15.37	15	16.5	1.2	297.00	161.37	135.63	
53	CH 780 : CH 795	15.51	15	16.5	1.2	297.00	162.88	134.12	
54	CH 795 : CH 810	15.68	15	16.5	1.2	297.00	164.62	132.38	
55	CH 810 : CH 825	15.58	15	16.5	1.2	297.00	163.63	133.37	
56	CH 825 : CH 840	15.47	15	16.5	1.2	297.00	162.45	134.55	
57	CH 840 : CH 855	15.38	15	16.5	1.2	297.00	161.46	135.54	
58	CH 855 : CH 870	15.73	15	16.5	1.2	297.00	165.14	131.86	
59	CH 870 : CH 885	16.75	15	16.5	1.2	0.00	175.89	0.00	
60	CH 885 : CH 900	17.08	15	16.5	1.2	0.00	179.30	0.00	"
61	CH 900 : CH 915	16.25	15	16.5	1.2	297.00	170.64	126.36	

Sl. No	Chainage	W (m)	L (m)	Proposed canal width (m)	Assumed cutting depth (m)	Total Required Quantity (m3)	De-Silting Quantity (m3)	Net Cutting Quantity to be required (m3)	Remarks
62	CH 915 : CH 930	15.66	15	16.5	1.2	297.00	164.45	132.55	
63	CH 930 : CH 945	15.54	15	16.5	1.2	297.00	163.19	133.81	
64	CH 945 : CH 960	17.53	15	16.5	1.2	0.00	184.11	0.00	
65	CH 960 : CH 975	19.95	15	16.5	1.2	0.00	209.46	0.00	"
66	CH 975 : CH 990	18.49	15	16.5	1.2	0.00	194.15	0.00	"
67	CH 990 : CH 1005	15.62	15	16.5	1.2	297.00	164.04	132.96	
68	CH 1005 : CH 1020	13.86	15	16.5	1.2	297.00	145.54	151.46	
69	CH 1020 : CH 1035	13.52	15	16.5	1.2	297.00	141.93	155.07	
70	CH 1035 : CH 1050	14.22	15	16.5	1.2	297.00	149.31	147.69	
71	CH 1050 : CH 1065	14.35	15	16.5	1.2	297.00	150.64	146.36	
72	CH 1065 : CH 1080	13.77	15	16.5	1.2	297.00	144.61	152.39	
73	CH 1080 : CH 1095	13.04	15	16.5	1.2	297.00	136.91	160.09	
74	CH 1095 : CH 1110	12.50	15	16.5	1.2	297.00	131.22	165.78	
75	CH 1110 : CH 1125	12.02	15	16.5	1.2	297.00	126.25	170.75	
76	CH 1125 : CH 1140	11.41	15	16.5	1.2	297.00	119.83	177.17	
77	CH 1140 : CH 1155	11.46	15	16.5	1.2	297.00	120.28	176.72	
78	CH 1155 : CH 1170	12.60	15	16.5	1.2	297.00	132.26	164.74	
79	CH 1170 : CH 1185	14.03	15	16.5	1.2	297.00	147.33	149.67	
80	CH 1185 : CH 1200	15.37	15	16.5	1.2	297.00	161.40	135.60	
81	CH 1200 : CH 1215	16.89	15	16.5	1.2	0.00	177.31	0.00	
82	CH 1215 : CH 1230	17.82	15	16.5	1.2	0.00	187.16	0.00	"
83	CH 1230 : CH 1245	16.72	15	16.5	1.2	0.00	175.58	0.00	

Sl. No	Chainage	W (m)	L (m)	Proposed canal width (m)	Assumed cutting depth (m)	Total Required Quantity (m3)	De-Silting Quantity (m3)	Net Cutting Quantity to be required (m3)	Remarks
84	CH 1245 : CH 1260	15.29	15	16.5	1.2	297.00	160.59	136.41	
85	CH 1260 : CH 1275	14.23	15	16.5	1.2	297.00	149.41	147.59	
86	CH 1275 : CH 1290	13.40	15	16.5	1.2	297.00	140.73	156.27	
87	CH 1290 : CH 1305	13.59	15	16.5	1.2	297.00	142.70	154.30	
88	CH 1305 : CH 1320	14.40	15	16.5	1.2	297.00	151.18	145.82	
89	CH 1320 : CH 1335	16.36	15	16.5	1.2	297.00	171.73	125.27	
90	CH 1335 : CH 1350	20.22	15	16.5	1.2	0.00	212.31	0.00	"
91	CH 1350 : CH 1365	18.57	15	16.5	1.2	0.00	195.03	0.00	
92	CH 1365 : CH 1380	12.24	15	16.5	1.2	297.00	128.51	168.49	
93	CH 1380 : CH 1395	9.83	15	16.5	1.2	297.00	103.18	193.82	
94	CH 1395 : CH 1410	9.42	15	16.5	1.2	297.00	98.88	198.12	
95	CH 1410 : CH 1425	9.92	15	16.5	1.2	297.00	104.18	192.82	
96	CH 1425 : CH 1440	11.30	15	16.5	1.2	297.00	118.61	178.39	
97	CH 1440 : CH 1455	11.56	15	16.5	1.2	297.00	121.39	175.61	
98	CH 1455 : CH 1470	10.54	15	16.5	1.2	297.00	110.63	186.37	
99	CH 1470 : CH 1485	9.35	15	16.5	1.2	297.00	98.15	198.85	
100	CH 1485 : CH 1500	8.96	15	16.5	1.2	297.00	94.09	202.91	
101	CH 1500 : CH 1515	8.98	15	16.5	1.2	297.00	94.32	202.68	
102	CH 1515 : CH 1530	9.77	15	16.5	1.2	297.00	102.62	194.38	
103	CH 1530 : CH 1545	10.74	15	16.5	1.2	297.00	112.81	184.19	
104	CH 1545 : CH 1560	11.20	15	16.5	1.2	297.00	117.59	179.41	
105	CH 1560 : CH 1575	12.88	15	16.5	1.2	297.00	135.23	161.77	

Sl. No	Chainage	W (m)	L (m)	Proposed canal width (m)	Assumed cutting depth (m)	Total Required Quantity (m3)	De-Silting Quantity (m3)	Net Cutting Quantity to be required (m3)	Remarks
106	CH 1575 : CH 1590	14.52	15	16.5	1.2	297.00	152.49	144.51	
107	CH 1590 : CH 1605	15.35	15	16.5	1.2	297.00	161.17	135.83	
108	CH 1605 : CH 1620	16.03	15	16.5	1.2	297.00	168.34	128.66	
109	CH 1620 : CH 1635	16.47	15	16.5	1.2	297.00	172.94	124.06	
110	CH 1635 : CH 1650	16.31	15	16.5	1.2	297.00	171.28	125.72	
111	CH 1650 : CH 1665	15.26	15	16.5	1.2	297.00	160.19	136.81	
112	CH 1665 : CH 1680	13.84	15	16.5	1.2	297.00	145.33	151.67	
113	CH 1680 : CH 1695	12.98	15	16.5	1.2	297.00	136.32	160.68	
114	CH 1695 : CH 1710	12.51	15	16.5	1.2	297.00	131.37	165.63	
115	CH 1710 : CH 1725	11.53	15	16.5	1.2	297.00	121.05	175.95	
116	CH 1725 : CH 1740	11.12	15	16.5	1.2	297.00	116.80	180.20	
117	CH 1740 : CH 1755	11.51	15	16.5	1.2	297.00	120.81	176.19	
118	CH 1755 : CH 1770	11.41	15	16.5	1.2	297.00	119.75	177.25	
119	CH 1770 : CH 1785	11.59	15	16.5	1.2	297.00	121.71	175.29	
120	CH 1785 : CH 1800	12.29	15	16.5	1.2	297.00	129.00	168.00	
121	CH 1800 : CH 1815	12.42	15	16.5	1.2	297.00	130.39	166.61	
122	CH 1815 : CH 1830	12.06	15	16.5	1.2	297.00	126.63	170.37	
123	CH 1830 : CH 1845	11.43	15	16.5	1.2	297.00	120.04	176.96	
124	CH 1845 : CH 1860	10.59	15	16.5	1.2	297.00	111.22	185.78	
125	CH 1860 : CH 1875	10.04	15	16.5	1.2	297.00	105.44	191.56	
126	CH 1875 : CH 1890	9.13	15	16.5	1.2	297.00	95.84	201.16	
127	CH 1890 : CH 1905	8.62	15	16.5	1.2	297.00	90.48	206.52	

Sl. No	Chainage	W (m)	L (m)	Proposed canal width (m)	Assumed cutting depth (m)	Total Required Quantity (m3)	De-Silting Quantity (m3)	Net Cutting Quantity to be required (m3)	Remarks
128	CH 1905 : CH 1920	8.70	15	16.5	1.2	297.00	91.32	205.68	
129	CH 1920 : CH 1935	8.62	15	16.5	1.2	297.00	90.47	206.53	
130	CH 1935 : CH 1950	8.78	15	16.5	1.2	297.00	92.15	204.85	
131	CH 1950 : CH 1965	8.96	15	16.5	1.2	297.00	94.07	202.93	
132	CH 1965 : CH 1980	8.99	15	16.5	1.2	297.00	94.42	202.58	
133	CH 1980 : CH 1995	8.47	15	16.5	1.2	297.00	88.98	208.02	
134	CH 1995 : CH 2010	7.58	15	16.5	1.2	297.00	79.61	217.39	
135	CH 2010 : CH 2025	6.69	15	16.5	1.2	297.00	70.27	226.73	
136	CH 2025 : CH 2040	5.97	15	16.5	1.2	297.00	62.65	234.35	
137	CH 2040 : CH 2055	6.11	15	16.5	1.2	297.00	64.14	232.86	
138	CH 2055 : CH 2070	6.74	15	16.5	1.2	297.00	70.74	226.26	
139	CH 2070 : CH 2085	6.53	15	16.5	1.2	297.00	68.59	228.41	
140	CH 2085 : CH 2100	6.19	15	16.5	1.2	297.00	65.04	231.96	
141	CH 2100 : CH 2115	6.26	15	16.5	1.2	297.00	65.72	231.28	
142	CH 2115 : CH 2130	6.03	15	16.5	1.2	297.00	63.36	233.64	
143	CH 2130 : CH 2145	5.52	15	16.5	1.2	297.00	57.92	239.08	
144	CH 2145 : CH 2160	5.50	15	16.5	1.2	297.00	57.79	239.21	
145	CH 2160 : CH 2175	5.46	15	16.5	1.2	297.00	57.34	239.66	
146	CH 2175 : CH 2190	5.18	15	16.5	1.2	297.00	54.42	242.58	
147	CH 2190 : CH 2205	5.72	15	16.5	1.2	297.00	60.01	236.99	
148	CH 2205 : CH 2220	6.07	15	16.5	1.2	297.00	63.76	233.24	
149	CH 2220 : CH 2235	6.03	15	16.5	1.2	297.00	63.35	233.65	

Sl. No	Chainage	W (m)	L (m)	Proposed canal width (m)	Assumed cutting depth (m)	Total Required Quantity (m3)	De-Silting Quantity (m3)	Net Cutting Quantity to be required (m3)	Remarks
150	CH 2235 : CH 2250	5.28	15	16.5	1.2	297.00	55.39	241.61	
151	CH 2250 : CH 2265	5.47	15	16.5	1.2	297.00	57.44	239.57	
152	CH 2265 : CH 2280	6.25	15	16.5	1.2	297.00	65.60	231.40	
153	CH 2280 : CH 2295	5.53	15	16.5	1.2	297.00	58.10	238.90	
154	CH 2295 : CH 2310	5.72	15	16.5	1.2	297.00	60.08	236.92	
155	CH 2310 : CH 2325	6.14	15	16.5	1.2	297.00	64.49	232.51	
156	CH 2325 : CH 2340	6.11	15	16.5	1.2	297.00	64.18	232.82	
157	CH 2340 : CH 2355	6.42	15	16.5	1.2	297.00	67.37	229.63	
158	CH 2355 : CH 2370	5.67	15	16.5	1.2	297.00	59.52	237.48	
159	CH 2370 : CH 2385	4.56	15	16.5	1.2	297.00	47.91	249.09	
160	CH 2385 : CH 2400	4.53	15	16.5	1.2	297.00	47.58	249.42	
161	CH 2400 : CH 2415	5.10	15	16.5	1.2	297.00	53.57	243.43	
162	CH 2415 : CH 2430	5.10	15	16.5	1.2	297.00	53.57	243.43	
163	CH 2430 : CH 2445	4.43	15	16.5	1.2	297.00	46.47	250.53	
164	CH 2445 : CH 2460	4.71	15	16.5	1.2	297.00	49.44	247.56	
165	CH 2460 : CH 2475	5.03	15	16.5	1.2	297.00	52.76	244.24	
166	CH 2475 : CH 2490	4.51	15	16.5	1.2	297.00	47.31	249.69	
167	CH 2490 : CH 2505	4.42	15	16.5	1.2	297.00	46.37	250.63	
168	CH 2505 : CH 2520	5.17	15	16.5	1.2	297.00	54.32	242.68	
169	CH 2520 : CH 2535	5.41	15	16.5	1.2	297.00	56.83	240.17	
170	CH 2535 : CH 2550	4.82	15	16.5	1.2	297.00	50.59	246.41	
171	CH 2550 : CH 2565	4.82	15	16.5	1.2	297.00	50.60	246.40	

Sl. No	Chainage	W (m)	L (m)	Proposed canal width (m)	Assumed cutting depth (m)	Total Required Quantity (m3)	De-Silting Quantity (m3)	Net Cutting Quantity to be required (m3)	Remarks
172	CH 2565 : CH 2580	5.28	15	16.5	1.2	297.00	55.46	241.54	
173	CH 2580 : CH 2595	5.48	15	16.5	1.2	297.00	57.58	239.42	
174	CH 2595 : CH 2610	5.36	15	16.5	1.2	297.00	56.25	240.75	
175	CH 2610 : CH 2625	5.28	15	16.5	1.2	297.00	55.42	241.58	
176	CH 2625 : CH 2640	5.00	15	16.5	1.2	297.00	52.54	244.46	
177	CH 2640 : CH 2655	4.92	15	16.5	1.2	297.00	51.61	245.39	
178	CH 2655 : CH 2670	5.44	15	16.5	1.2	297.00	57.15	239.85	
179	CH 2670 : CH 2685	5.44	15	16.5	1.2	297.00	57.14	239.86	
180	CH 2685 : CH 2700	4.51	15	16.5	1.2	297.00	47.36	249.65	
181	CH 2700 : CH 2715	3.92	15	16.5	1.2	297.00	41.19	255.81	
182	CH 2715 : CH 2730	4.12	15	16.5	1.2	297.00	43.22	253.78	
183	CH 2730 : CH 2745	4.24	15	16.5	1.2	297.00	44.56	252.44	
184	CH 2745 : CH 2760	3.92	15	16.5	1.2	297.00	41.19	255.81	
185	CH 2760 : CH 2775	3.55	15	16.5	1.2	297.00	37.25	259.75	
186	CH 2775 : CH 2790	3.50	15	16.5	1.2	297.00	36.74	260.26	
187	CH 2790 : CH 2805	3.77	15	16.5	1.2	297.00	39.57	257.43	
188	CH 2805 : CH 2820	3.86	15	16.5	1.2	297.00	40.54	256.46	
189	CH 2820 : CH 2835	3.72	15	16.5	1.2	297.00	39.10	257.90	
190	CH 2835 : CH 2850	3.66	15	16.5	1.2	297.00	38.40	258.60	
191	CH 2850 : CH 2865	3.73	15	16.5	1.2	297.00	39.12	257.88	
192	CH 2865 : CH 2880	3.82	15	16.5	1.2	297.00	40.10	256.90	
193	CH 2880 : CH 2895	3.57	15	16.5	1.2	297.00	37.45	259.55	

Sl. No	Chainage	W (m)	L (m)	Proposed canal width (m)	Assumed cutting depth (m)	Total Required Quantity (m3)	De-Silting Quantity (m3)	Net Cutting Quantity to be required (m3)	Remarks
194	CH 2895 : CH 2910	3.40	15	16.5	1.2	297.00	35.65	261.35	
195	CH 2910 : CH 2925	3.30	15	16.5	1.2	297.00	34.63	262.37	
196	CH 2925 : CH 2940	3.42	15	16.5	1.2	297.00	35.92	261.08	
197	CH 2940 : CH 2955	3.72	15	16.5	1.2	297.00	39.10	257.90	
198	CH 2955 : CH 2970	3.70	15	16.5	1.2	297.00	38.86	258.14	
199	CH 2970 : CH 2985	3.65	15	16.5	1.2	297.00	38.28	258.72	
200	CH 2985 : CH 3000	3.62	15	16.5	1.2	297.00	37.97	259.03	
201	CH 3000 : CH 3015	3.57	15	16.5	1.2	297.00	37.50	259.50	
202	CH 3015 : CH 3030	3.40	15	16.5	1.2	297.00	35.68	261.32	
203	CH 3030 : CH 3045	3.12	15	16.5	1.2	297.00	32.74	264.26	
204	CH 3045 : CH 3060	3.31	15	16.5	1.2	297.00	34.74	262.26	
205	CH 3060 : CH 3075	3.75	15	16.5	1.2	297.00	39.37	257.63	
206	CH 3075 : CH 3090	3.54	15	16.5	1.2	297.00	37.18	259.82	
207	CH 3090 : CH 3105	3.13	15	16.5	1.2	297.00	32.90	264.10	
208	CH 3105 : CH 3120	3.11	15	16.5	1.2	297.00	32.63	264.37	
209	CH 3120 : CH 3135	3.20	15	16.5	1.2	297.00	33.57	263.43	
210	CH 3135 : CH 3150	3.08	15	16.5	1.2	297.00	32.38	264.62	
211	CH 3150 : CH 3165	3.02	15	16.5	1.2	297.00	31.66	265.34	
212	CH 3165 : CH 3180	3.21	15	16.5	1.2	297.00	33.67	263.33	
213	CH 3180 : CH 3195	3.32	15	16.5	1.2	297.00	34.81	262.19	
214	CH 3195 : CH 3210	3.07	15	16.5	1.2	297.00	32.27	264.73	
215	CH 3210 : CH 3225	3.12	15	16.5	1.2	297.00	32.71	264.29	

Sl. No	Chainage	W (m)	L (m)	Proposed canal width (m)	Assumed cutting depth (m)	Total Required Quantity (m3)	De-Silting Quantity (m3)	Net Cutting Quantity to be required (m3)	Remarks
216	CH 3225 : CH 3240	3.11	15	16.5	1.2	297.00	32.63	264.37	
217	CH 3240 : CH 3255	3.05	15	16.5	1.2	297.00	32.03	264.97	
218	CH 3255 : CH 3270	3.13	15	16.5	1.2	297.00	32.91	264.09	
219	CH 3270 : CH 3285	3.17	15	16.5	1.2	297.00	33.29	263.72	
220	CH 3285 : CH 3300	3.27	15	16.5	1.2	297.00	34.30	262.70	
221	CH 3300 : CH 3315	3.24	15	16.5	1.2	297.00	34.07	262.93	
222	CH 3315 : CH 3330	3.03	15	16.5	1.2	297.00	31.81	265.19	
223	CH 3330 : CH 3345	3.22	15	16.5	1.2	297.00	33.86	263.14	
224	CH 3345 : CH 3360	3.38	15	16.5	1.2	297.00	35.51	261.49	
225	CH 3360 : CH 3375	2.86	15	16.5	1.2	297.00	30.05	266.95	
226	CH 3375 : CH 3390	2.77	15	16.5	1.2	297.00	29.09	267.91	
227	CH 3390 : CH 3405	3.39	15	16.5	1.2	297.00	35.60	261.40	
228	CH 3405 : CH 3420	3.72	15	16.5	1.2	297.00	39.04	257.96	
229	CH 3420 : CH 3435	2.82	15	16.5	1.2	297.00	29.64	267.36	
230	CH 3435 : CH 3450	2.31	15	16.5	1.2	297.00	24.20	272.80	
231	CH 3450 : CH 3465	2.27	15	16.5	1.2	297.00	23.81	273.19	
232	CH 3465 : CH 3480	2.29	15	16.5	1.2	297.00	24.01	272.99	
233	CH 3480 : CH 3495	2.51	15	16.5	1.2	297.00	26.32	270.68	
234	CH 3495 : CH 3510	2.57	15	16.5	1.2	297.00	26.99	270.01	
235	CH 3510 : CH 3525	2.49	15	16.5	1.2	297.00	26.13	270.87	
236	CH 3525 : CH 3540	2.43	15	16.5	1.2	297.00	25.52	271.49	
237	CH 3540 : CH 3555	2.56	15	16.5	1.2	297.00	26.87	270.13	

Sl. No	Chainage	W (m)	L (m)	Proposed canal width (m)	Assumed cutting depth (m)	Total Required Quantity (m3)	De-Silting Quantity (m3)	Net Cutting Quantity to be required (m3)	Remarks
238	CH 3555 : CH 3570	2.48	15	16.5	1.2	297.00	25.99	271.01	
239	CH 3570 : CH 3585	2.52	15	16.5	1.2	297.00	26.50	270.50	
240	CH 3585 : CH 3600	2.59	15	16.5	1.2	297.00	27.20	269.80	
241	CH 3600 : CH 3615	2.43	15	16.5	1.2	297.00	25.48	271.52	
242	CH 3615 : CH 3630	2.20	15	16.5	1.2	297.00	23.06	273.94	
243	CH 3630 : CH 3645	2.14	15	16.5	1.2	297.00	22.50	274.50	
244	CH 3645 : CH 3660	2.11	15	16.5	1.2	297.00	22.11	274.89	
245	CH 3660 : CH 3675	2.01	15	16.5	1.2	297.00	21.08	275.92	
246	CH 3675 : CH 3690	2.40	15	16.5	1.2	297.00	25.20	271.80	
247	CH 3690 : CH 3705	2.99	15	16.5	1.2	297.00	31.44	265.56	
248	CH 3705 : CH 3720	3.16	15	16.5	1.2	297.00	33.13	263.87	
249	CH 3720 : CH 3735	2.61	15	16.5	1.2	297.00	27.37	269.63	
250	CH 3735 : CH 3750	2.10	15	16.5	1.2	297.00	22.00	275.00	
251	CH 3750 : CH 3765	2.12	15	16.5	1.2	297.00	22.22	274.78	
252	CH 3765 : CH 3780	2.82	15	16.5	1.2	297.00	29.60	267.40	
253	CH 3780 : CH 3795	3.47	15	16.5	1.2	297.00	36.41	260.59	
254	CH 3795 : CH 3810	3.54	15	16.5	1.2	297.00	37.20	259.80	
255	CH 3810 : CH 3825	3.46	15	16.5	1.2	297.00	36.30	260.70	
256	CH 3825 : CH 3840	3.10	15	16.5	1.2	297.00	32.52	264.48	
257	CH 3840 : CH 3855	2.78	15	16.5	1.2	297.00	29.22	267.78	
258	CH 3855 : CH 3870	2.76	15	16.5	1.2	297.00	29.02	267.98	
259	CH 3870 : CH 3885	3.39	15	16.5	1.2	297.00	35.59	261.41	

Sl. No	Chainage	W (m)	L (m)	Proposed canal width (m)	Assumed cutting depth (m)	Total Required Quantity (m3)	De-Silting Quantity (m3)	Net Cutting Quantity to be required (m3)	Remarks
260	CH 3885 : CH 3900	3.27	15	16.5	1.2	297.00	34.28	262.72	
261	CH 3900 : CH 3915	2.63	15	16.5	1.2	297.00	27.65	269.35	
262	CH 3915 : CH 3930	2.63	15	16.5	1.2	297.00	27.66	269.34	
263	CH 3930 : CH 3945	2.60	15	16.5	1.2	297.00	27.31	269.69	
264	CH 3945 : CH 3960	2.65	15	16.5	1.2	297.00	27.80	269.20	
265	CH 3960 : CH 3975	2.70	15	16.5	1.2	297.00	28.33	268.67	
266	CH 3975 : CH 3990	2.64	15	16.5	1.2	297.00	27.71	269.29	
267	CH 3990 : CH 4005	2.63	15	16.5	1.2	297.00	27.61	269.39	
268	CH 4005 : CH 4020	2.62	15	16.5	1.2	297.00	27.54	269.46	
269	CH 4020 : CH 4035	2.60	15	16.5	1.2	297.00	27.27	269.73	
270	CH 4035 : CH 4050	2.67	15	16.5	1.2	297.00	28.04	268.96	
271	CH 4050 : CH 4065	2.73	15	16.5	1.2	297.00	28.66	268.34	
272	CH 4065 : CH 4080	2.68	15	16.5	1.2	297.00	28.11	268.89	
273	CH 4080 : CH 4095	2.68	15	16.5	1.2	297.00	28.19	268.81	
274	CH 4095 : CH 4110	2.74	15	16.5	1.2	297.00	28.75	268.25	
275	CH 4110 : CH 4125	2.64	15	16.5	1.2	297.00	27.69	269.31	
276	CH 4125 : CH 4140	1.27	15	16.5	1.2	297.00	13.33	283.67	"
277	CH 4140 : CH 4155	0.00	15	16.5	1.2	0.00	0.00	0.00	"
278	CH 4155 : CH 4170	0.00	15	16.5	1.2	0.00	0.00	0.00	"
279	CH 4170 : CH 4185	0.00	15	16.5	1.2	0.00	0.00	0.00	"
280	CH 4185 : CH 4200	0.00	15	16.5	1.2	0.00	0.00	0.00	"
281	CH 4200 : CH 4215	0.00	15	16.5	1.2	0.00	0.00	0.00	"

Sl. No	Chainage	W (m)	L (m)	Proposed canal width (m)	Assumed cutting depth (m)	Total Required Quantity (m3)	De-Silting Quantity (m3)	Net Cutting Quantity to be required (m3)	Remarks
282	CH 4215 : CH 4230	0.00	15	16.5	1.2	0.00	0.00	0.00	"
283	CH 4230 : CH 4245	0.00	15	16.5	1.2	0.00	0.00	0.00	"
284	CH 4245 : CH 4260	0.00	15	16.5	1.2	0.00	0.00	0.00	"
285	CH 4260 : CH 4275	0.00	15	16.5	1.2	0.00	0.00	0.00	"
286	CH 4275 : CH 4290	2.01	15	16.5	1.2	297.00	21.13	275.87	
287	CH 4290 : CH 4305	3.96	15	16.5	1.2	297.00	41.60	255.40	
288	CH 4305 : CH 4320	4.02	15	16.5	1.2	297.00	42.18	254.82	
289	CH 4320 : CH 4335	4.17	15	16.5	1.2	297.00	43.81	253.19	
290	CH 4335 : CH 4350	4.14	15	16.5	1.2	297.00	43.45	253.55	
291	CH 4350 : CH 4365	4.34	15	16.5	1.2	297.00	45.53	251.47	
292	CH 4365 : CH 4380	4.49	15	16.5	1.2	297.00	47.19	249.81	
293	CH 4380 : CH 4395	4.46	15	16.5	1.2	297.00	46.84	250.16	
294	CH 4395 : CH 4410	4.55	15	16.5	1.2	297.00	47.75	249.25	
295	CH 4410 : CH 4425	4.33	15	16.5	1.2	297.00	45.49	251.51	
296	CH 4425 : CH 4440	4.15	15	16.5	1.2	297.00	43.56	253.44	
297	CH 4440 : CH 4455	4.24	15	16.5	1.2	297.00	44.50	252.50	
298	CH 4455 : CH 4470	4.19	15	16.5	1.2	297.00	44.04	252.96	
299	CH 4470 : CH 4485	4.24	15	16.5	1.2	297.00	44.47	252.53	
300	CH 4485 : CH 4500	4.24	15	16.5	1.2	297.00	44.49	252.51	
301	CH 4500 : CH 4515	4.39	15	16.5	1.2	297.00	46.14	250.86	
302	CH 4515 : CH 4530	4.51	15	16.5	1.2	297.00	47.30	249.70	
303	CH 4530 : CH 4545	4.21	15	16.5	1.2	297.00	44.17	252.83	

Sl. No	Chainage	W (m)	L (m)	Proposed canal width (m)	Assumed cutting depth (m)	Total Required Quantity (m3)	De-Silting Quantity (m3)	Net Cutting Quantity to be required (m3)	Remarks
304	CH 4545 : CH 4560	4.17	15	16.5	1.2	297.00	43.77	253.23	
305	CH 4560 : CH 4575	4.26	15	16.5	1.2	297.00	44.70	252.30	
306	CH 4575 : CH 4590	4.27	15	16.5	1.2	297.00	44.78	252.22	
307	CH 4590 : CH 4605	4.43	15	16.5	1.2	297.00	46.49	250.51	
308	CH 4605 : CH 4620	4.07	15	16.5	1.2	297.00	42.69	254.31	
309	CH 4620 : CH 4635	4.08	15	16.5	1.2	297.00	42.82	254.18	
310	CH 4635 : CH 4650	4.51	15	16.5	1.2	297.00	47.40	249.60	
311	CH 4650 : CH 4665	4.08	15	16.5	1.2	297.00	42.88	254.12	
312	CH 4665 : CH 4680	3.92	15	16.5	1.2	297.00	41.14	255.86	
313	CH 4680 : CH 4695	4.24	15	16.5	1.2	297.00	44.50	252.50	
314	CH 4695 : CH 4710	4.00	15	16.5	1.2	297.00	42.01	254.99	
315	CH 4710 : CH 4725	3.36	15	16.5	1.2	297.00	35.24	261.76	
316	CH 4725 : CH 4740	3.49	15	16.5	1.2	297.00	36.68	260.32	
317	CH 4740 : CH 4755	3.67	15	16.5	1.2	297.00	38.54	258.46	
318	CH 4755 : CH 4770	3.38	15	16.5	1.2	297.00	35.48	261.52	
319	CH 4770 : CH 4785	3.28	15	16.5	1.2	297.00	34.48	262.52	
320	CH 4785 : CH 4800	3.30	15	16.5	1.2	297.00	34.68	262.32	
321	CH 4800 : CH 4815	3.79	15	16.5	1.2	297.00	39.78	257.22	
322	CH 4815 : CH 4830	4.26	15	16.5	1.2	297.00	44.73	252.27	
323	CH 4830 : CH 4845	4.27	15	16.5	1.2	297.00	44.80	252.20	
324	CH 4845 : CH 4860	4.11	15	16.5	1.2	297.00	43.19	253.81	
325	CH 4860 : CH 4875	3.73	15	16.5	1.2	297.00	39.11	257.89	

Sl. No	Chainage	W (m)	L (m)	Proposed canal width (m)	Assumed cutting depth (m)	Total Required Quantity (m3)	De-Silting Quantity (m3)	Net Cutting Quantity to be required (m3)	Remarks
326	CH 4875 : CH 4890	3.92	15	16.5	1.2	297.00	41.18	255.82	
327	CH 4890 : CH 4905	4.77	15	16.5	1.2	297.00	50.08	246.92	
328	CH 4905 : CH 4920	4.91	15	16.5	1.2	297.00	51.59	245.41	
329	CH 4920 : CH 4935	4.51	15	16.5	1.2	297.00	47.34	249.66	
330	CH 4935 : CH 4950	4.43	15	16.5	1.2	297.00	46.53	250.47	
331	CH 4950 : CH 4965	4.46	15	16.5	1.2	297.00	46.78	250.22	
332	CH 4965 : CH 4980	4.37	15	16.5	1.2	297.00	45.83	251.17	
333	CH 4980 : CH 4995	4.28	15	16.5	1.2	297.00	44.89	252.11	
334	CH 4995 : CH 5010	4.19	15	16.5	1.2	297.00	43.95	253.05	
335	CH 5010 : CH 5025	4.10	15	16.5	1.2	297.00	43.01	253.99	
336	CH 5025 : CH 5040	4.62	15	16.5	1.2	297.00	48.51	248.49	
337	CH 5040 : CH 5055	5.17	15	16.5	1.2	297.00	54.32	242.68	
338	CH 5055 : CH 5070	5.04	15	16.5	1.2	297.00	52.87	244.13	
339	CH 5070 : CH 5085	5.05	15	16.5	1.2	297.00	52.98	244.02	
340	CH 5085 : CH 5100	5.11	15	16.5	1.2	297.00	53.64	243.36	
341	CH 5100 : CH 5115	4.77	15	16.5	1.2	297.00	50.05	246.95	
342	CH 5115 : CH 5130	4.53	15	16.5	1.2	297.00	47.59	249.41	
343	CH 5130 : CH 5145	4.83	15	16.5	1.2	297.00	50.74	246.26	
344	CH 5145 : CH 5160	4.84	15	16.5	1.2	297.00	50.81	246.19	
345	CH 5160 : CH 5175	4.81	15	16.5	1.2	297.00	50.46	246.54	
346	CH 5175 : CH 5190	5.15	15	16.5	1.2	297.00	54.09	242.91	
347	CH 5190 : CH 5205	5.31	15	16.5	1.2	297.00	55.72	241.28	

Sl. No	Chainage	W (m)	L (m)	Proposed canal width (m)	Assumed cutting depth (m)	Total Required Quantity (m3)	De-Silting Quantity (m3)	Net Cutting Quantity to be required (m3)	Remarks
348	CH 5205 : CH 5220	5.33	15	16.5	1.2	297.00	56.00	241.00	
349	CH 5220 : CH 5235	5.58	15	16.5	1.2	297.00	58.64	238.36	
350	CH 5235 : CH 5250	5.90	15	16.5	1.2	297.00	62.00	235.00	
351	CH 5250 : CH 5265	6.40	15	16.5	1.2	297.00	67.21	229.79	
352	CH 5265 : CH 5280	5.82	15	16.5	1.2	297.00	61.13	235.87	
353	CH 5280 : CH 5295	4.71	15	16.5	1.2	297.00	49.47	247.53	
354	CH 5295 : CH 5310	4.87	15	16.5	1.2	297.00	51.09	245.91	
355	CH 5310 : CH 5325	5.02	15	16.5	1.2	297.00	52.66	244.34	
356	CH 5325 : CH 5340	5.37	15	16.5	1.2	297.00	56.35	240.65	
357	CH 5340 : CH 5355	6.16	15	16.5	1.2	297.00	64.64	232.36	
358	CH 5355 : CH 5370	6.89	15	16.5	1.2	297.00	72.38	224.62	
359	CH 5370 : CH 5385	6.65	15	16.5	1.2	297.00	69.77	227.23	
360	CH 5385 : CH 5400	5.71	15	16.5	1.2	297.00	59.95	237.05	
361	CH 5400 : CH 5415	5.99	15	16.5	1.2	297.00	62.90	234.10	
362	CH 5415 : CH 5430	6.23	15	16.5	1.2	297.00	65.43	231.57	
363	CH 5430 : CH 5445	5.06	15	16.5	1.2	297.00	53.13	243.87	
364	CH 5445 : CH 5460	3.86	15	16.5	1.2	297.00	40.54	256.46	
365	CH 5460 : CH 5475	4.80	15	16.5	1.2	297.00	50.42	246.58	
366	CH 5475 : CH 5490	6.06	15	16.5	1.2	297.00	63.67	233.33	
367	CH 5490 : CH 5505	6.03	15	16.5	1.2	297.00	63.27	233.73	
368	CH 5505 : CH 5520	5.75	15	16.5	1.2	297.00	60.35	236.65	
369	CH 5520 : CH 5535	5.34	15	16.5	1.2	297.00	56.05	240.95	

Sl. No	Chainage	W (m)	L (m)	Proposed canal width (m)	Assumed cutting depth (m)	Total Required Quantity (m3)	De-Silting Quantity (m3)	Net Cutting Quantity to be required (m3)	Remarks
370	CH 5535 : CH 5550	5.30	15	16.5	1.2	297.00	55.63	241.37	
371	CH 5550 : CH 5565	5.57	15	16.5	1.2	297.00	58.48	238.52	
372	CH 5565 : CH 5580	5.93	15	16.5	1.2	297.00	62.30	234.70	
373	CH 5580 : CH 5595	5.93	15	16.5	1.2	297.00	62.30	234.70	
374	CH 5595 : CH 5610	6.02	15	16.5	1.2	297.00	63.22	233.78	
375	CH 5610 : CH 5625	6.51	15	16.5	1.2	297.00	68.38	228.62	
376	CH 5625 : CH 5640	6.72	15	16.5	1.2	297.00	70.60	226.40	
377	CH 5640 : CH 5655	6.82	15	16.5	1.2	297.00	71.62	225.38	
378	CH 5655 : CH 5670	6.60	15	16.5	1.2	297.00	69.32	227.68	
379	CH 5670 : CH 5685	6.37	15	16.5	1.2	297.00	66.87	230.13	
380	CH 5685 : CH 5700	5.72	15	16.5	1.2	297.00	60.07	236.93	
381	CH 5700 : CH 5715	5.23	15	16.5	1.2	297.00	54.90	242.10	
382	CH 5715 : CH 5730	5.96	15	16.5	1.2	297.00	62.54	234.46	
383	CH 5730 : CH 5745	6.72	15	16.5	1.2	297.00	70.58	226.42	
384	CH 5745 : CH 5760	6.33	15	16.5	1.2	297.00	66.48	230.52	
385	CH 5760 : CH 5775	5.68	15	16.5	1.2	297.00	59.69	237.31	
386	CH 5775 : CH 5790	5.64	15	16.5	1.2	297.00	59.21	237.79	
387	CH 5790 : CH 5805	5.58	15	16.5	1.2	297.00	58.54	238.46	
388	CH 5805 : CH 5820	5.33	15	16.5	1.2	297.00	55.93	241.07	
389	CH 5820 : CH 5835	5.35	15	16.5	1.2	297.00	56.16	240.84	
390	CH 5835 : CH 5850	5.76	15	16.5	1.2	297.00	60.45	236.55	
391	CH 5850 : CH 5865	6.10	15	16.5	1.2	297.00	64.06	232.94	

Sl. No	Chainage	W (m)	L (m)	Proposed canal width (m)	Assumed cutting depth (m)	Total Required Quantity (m3)	De-Silting Quantity (m3)	Net Cutting Quantity to be required (m3)	Remarks
392	CH 5865 : CH 5880	7.29	15	16.5	1.2	297.00	76.55	220.45	
393	CH 5880 : CH 5895	7.98	15	16.5	1.2	297.00	83.80	213.20	
394	CH 5895 : CH 5910	7.35	15	16.5	1.2	297.00	77.18	219.82	
395	CH 5910 : CH 5925	7.23	15	16.5	1.2	297.00	75.89	221.11	
396	CH 5925 : CH 5940	7.58	15	16.5	1.2	297.00	79.54	217.46	
397	CH 5940 : CH 5955	8.04	15	16.5	1.2	297.00	84.42	212.58	
398	CH 5955 : CH 5970	8.36	15	16.5	1.2	297.00	87.82	209.18	
399	CH 5970 : CH 5985	8.42	15	16.5	1.2	297.00	88.44	208.56	
400	CH 5985 : CH 6000	7.52	15	16.5	1.2	297.00	78.93	218.07	
401	CH 6000 : CH 6015	6.15	15	16.5	1.2	297.00	64.56	232.44	
402	CH 6015 : CH 6030	6.36	15	16.5	1.2	297.00	66.73	230.27	
403	CH 6030 : CH 6045	7.24	15	16.5	1.2	297.00	76.04	220.96	
404	CH 6045 : CH 6060	7.99	15	16.5	1.2	297.00	83.87	213.13	
405	CH 6060 : CH 6075	8.48	15	16.5	1.2	297.00	89.08	207.92	
406	CH 6075 : CH 6090	8.75	15	16.5	1.2	297.00	91.85	205.15	
407	CH 6090 : CH 6105	9.16	15	16.5	1.2	297.00	96.22	200.78	
408	CH 6105 : CH 6120	9.53	15	16.5	1.2	297.00	100.05	196.95	
409	CH 6120 : CH 6135	9.93	15	16.5	1.2	297.00	104.31	192.69	
410	CH 6135 : CH 6150	12.20	15	16.5	1.2	297.00	128.11	168.89	
411	CH 6150 : CH 6165	13.79	15	16.5	1.2	297.00	144.78	152.22	
412	CH 6165 : CH 6180	11.95	15	16.5	1.2	297.00	125.48	171.53	
413	CH 6180 : CH 6195	10.43	15	16.5	1.2	297.00	109.55	187.45	

Sl. No	Chainage	W (m)	L (m)	Proposed canal width (m)	Assumed cutting depth (m)	Total Required Quantity (m3)	De-Silting Quantity (m3)	Net Cutting Quantity to be required (m3)	Remarks
414	CH 6195 : CH 6210	10.27	15	16.5	1.2	297.00	107.84	189.17	
415	CH 6210 : CH 6225	10.35	15	16.5	1.2	297.00	108.64	188.36	
416	CH 6225 : CH 6240	10.55	15	16.5	1.2	297.00	110.81	186.19	
417	CH 6240 : CH 6255	10.76	15	16.5	1.2	297.00	112.99	184.01	
418	CH 6255 : CH 6270	10.97	15	16.5	1.2	297.00	115.16	181.84	
419	CH 6270 : CH 6285	10.85	15	16.5	1.2	297.00	113.90	183.10	
420	CH 6285 : CH 6300	11.33	15	16.5	1.2	297.00	118.93	178.07	
421	CH 6300 : CH 6315	12.09	15	16.5	1.2	297.00	126.99	170.01	
422	CH 6315 : CH 6330	12.04	15	16.5	1.2	297.00	126.45	170.55	
423	CH 6330 : CH 6345	10.92	15	16.5	1.2	297.00	114.70	182.30	
424	CH 6345 : CH 6360	9.14	15	16.5	1.2	297.00	96.01	200.99	
425	CH 6360 : CH 6375	8.26	15	16.5	1.2	297.00	86.68	210.32	
426	CH 6375 : CH 6390	8.07	15	16.5	1.2	297.00	84.73	212.27	
427	CH 6390 : CH 6405	7.84	15	16.5	1.2	297.00	82.33	214.67	
428	CH 6405 : CH 6420	7.42	15	16.5	1.2	297.00	77.93	219.07	
429	CH 6420 : CH 6435	7.00	15	16.5	1.2	297.00	73.51	223.49	
430	CH 6435 : CH 6450	7.22	15	16.5	1.2	297.00	75.85	221.15	
431	CH 6450 : CH 6465	7.69	15	16.5	1.2	297.00	80.76	216.24	
432	CH 6465 : CH 6480	8.26	15	16.5	1.2	297.00	86.69	210.31	
433	CH 6480 : CH 6495	8.04	15	16.5	1.2	297.00	84.46	212.54	
434	CH 6495 : CH 6510	7.31	15	16.5	1.2	297.00	76.71	220.29	
435	CH 6510 : CH 6525	7.55	15	16.5	1.2	297.00	79.28	217.72	

Sl. No	Chainage	W (m)	L (m)	Proposed canal width (m)	Assumed cutting depth (m)	Total Required Quantity (m3)	De-Silting Quantity (m3)	Net Cutting Quantity to be required (m3)	Remarks
436	CH 6525 : CH 6540	8.19	15	16.5	1.2	297.00	85.95	211.05	
437	CH 6540 : CH 6555	8.80	15	16.5	1.2	297.00	92.38	204.62	
438	CH 6555 : CH 6570	10.63	15	16.5	1.2	297.00	111.59	185.41	
439	CH 6570 : CH 6585	14.04	15	16.5	1.2	297.00	147.46	149.54	
440	CH 6585 : CH 6600	15.32	15	16.5	1.2	297.00	160.83	136.17	
441	CH 6600 : CH 6615	14.60	15	16.5	1.2	297.00	153.31	143.69	
442	CH 6615 : CH 6630	14.37	15	16.5	1.2	297.00	150.89	146.12	
443	CH 6630 : CH 6645	14.02	15	16.5	1.2	297.00	147.21	149.79	
444	CH 6645 : CH 6660	13.43	15	16.5	1.2	297.00	140.96	156.04	
445	CH 6660 : CH 6675	13.06	15	16.5	1.2	297.00	137.14	159.86	
446	CH 6675 : CH 6690	12.26	15	16.5	1.2	297.00	128.69	168.31	
447	CH 6690 : CH 6705	11.39	15	16.5	1.2	297.00	119.55	177.45	
448	CH 6705 : CH 6720	12.05	15	16.5	1.2	297.00	126.54	170.46	
449	CH 6720 : CH 6735	13.01	15	16.5	1.2	297.00	136.60	160.40	
450	CH 6735 : CH 6750	13.27	15	16.5	1.2	297.00	139.38	157.62	
451	CH 6750 : CH 6765	13.71	15	16.5	1.2	297.00	143.91	153.09	
452	CH 6765 : CH 6780	14.56	15	16.5	1.2	297.00	152.87	144.13	
453	CH 6780 : CH 6795	15.35	15	16.5	1.2	297.00	161.22	135.78	
454	CH 6795 : CH 6810	15.29	15	16.5	1.2	297.00	160.58	136.42	
455	CH 6810 : CH 6825	14.35	15	16.5	1.2	297.00	150.65	146.35	
456	CH 6825 : CH 6840	13.71	15	16.5	1.2	297.00	144.00	153.00	
457	CH 6840 : CH 6855	13.25	15	16.5	1.2	297.00	139.14	157.86	

Sl. No	Chainage	W (m)	L (m)	Proposed canal width (m)	Assumed cutting depth (m)	Total Required Quantity (m3)	De-Silting Quantity (m3)	Net Cutting Quantity to be required (m3)	Remarks
458	CH 6855 : CH 6870	12.96	15	16.5	1.2	297.00	136.06	160.94	
459	CH 6870 : CH 6885	13.44	15	16.5	1.2	297.00	141.09	155.91	
460	CH 6885 : CH 6900	14.33	15	16.5	1.2	297.00	150.41	146.59	
461	CH 6900 : CH 6915	14.54	15	16.5	1.2	297.00	152.64	144.36	
462	CH 6915 : CH 6930	14.41	15	16.5	1.2	297.00	151.26	145.74	
463	CH 6930 : CH 6945	14.75	15	16.5	1.2	297.00	154.89	142.11	
464	CH 6945 : CH 6960	14.74	15	16.5	1.2	297.00	154.79	142.21	
465	CH 6960 : CH 6975	14.15	15	16.5	1.2	297.00	148.52	148.48	
466	CH 6975 : CH 6990	14.71	15	16.5	1.2	297.00	154.48	142.52	
467	CH 6990 : CH 7005	17.66	15	16.5	1.2	0.00	185.46	0.00	
468	CH 7005 : CH 7020	17.44	15	16.5	1.2	0.00	183.16	0.00	
469	CH 7020 : CH 7035	15.87	15	16.5	1.2	297.00	166.59	130.41	
470	CH 7035 : CH 7050	16.37	15	16.5	1.2	297.00	171.84	125.16	
471	CH 7050 : CH 7065	15.60	15	16.5	1.2	297.00	163.85	133.15	
472	CH 7065 : CH 7080	14.94	15	16.5	1.2	297.00	156.82	140.18	
473	CH 7080 : CH 7095	14.79	15	16.5	1.2	297.00	155.30	141.71	
474	CH 7095 : CH 7110	15.29	15	16.5	1.2	297.00	160.58	136.42	
475	CH 7110 : CH 7125	15.47	15	16.5	1.2	297.00	162.40	134.60	
476	CH 7125 : CH 7140	15.45	15	16.5	1.2	297.00	162.24	134.76	
477	CH 7140 : CH 7155	14.89	15	16.5	1.2	297.00	156.38	140.62	
478	CH 7155 : CH 7170	13.73	15	16.5	1.2	297.00	144.21	152.79	
479	CH 7170 : CH 7185	12.85	15	16.5	1.2	297.00	134.97	162.03	

Sl. No	Chainage	W (m)	L (m)	Proposed canal width (m)	Assumed cutting depth (m)	Total Required Quantity (m3)	De-Silting Quantity (m3)	Net Cutting Quantity to be required (m3)	Remarks
480	CH 7185 : CH 7200	12.79	15	16.5	1.2	297.00	134.29	162.71	
481	CH 7200 : CH 7215	15.01	15	16.5	1.2	297.00	157.60	139.40	
482	CH 7215 : CH 7230	16.75	15	16.5	1.2	0.00	175.90	0.00	"
483	CH 7230 : CH 7245	22.85	15	16.5	1.2	0.00	239.94	0.00	"
484	CH 7245 : CH 7260	28.11	15	16.5	1.2	0.00	295.13	0.00	"
485	CH 7260 : CH 7275	17.48	15	16.5	1.2	0.00	183.49	0.00	
486	CH 7275 : CH 7290	12.84	15	16.5	1.2	297.00	134.78	162.22	
487	CH 7290 : CH 7305	9.40	15	16.5	1.2	297.00	98.68	198.32	
488	CH 7305 : CH 7320	9.09	15	16.5	1.2	297.00	95.40	201.60	
489	CH 7320 : CH 7335	10.59	15	16.5	1.2	297.00	111.20	185.80	
490	CH 7335 : CH 7350	11.93	15	16.5	1.2	297.00	125.31	171.69	
491	CH 7350 : CH 7365	14.62	15	16.5	1.2	297.00	153.48	143.52	
492	CH 7365 : CH 7380	18.72	15	16.5	1.2	0.00	196.59	0.00	
493	CH 7380 : CH 7395	18.20	15	16.5	1.2	0.00	191.14	0.00	
494	CH 7395 : CH 7410	14.11	15	16.5	1.2	297.00	148.11	148.89	
495	CH 7410 : CH 7425	13.98	15	16.5	1.2	297.00	146.80	150.20	
496	CH 7425 : CH 7440	15.54	15	16.5	1.2	297.00	163.20	133.80	
497	CH 7440 : CH 7455	15.19	15	16.5	1.2	297.00	159.49	137.51	
498	CH 7455 : CH 7470	15.40	15	16.5	1.2	297.00	161.71	135.29	
499	CH 7470 : CH 7485	14.59	15	16.5	1.2	297.00	153.22	143.78	
500	CH 7485 : CH 7500	13.05	15	16.5	1.2	297.00	136.99	160.01	
501	CH 7500 : CH 7515	14.34	15	16.5	1.2	297.00	150.53	146.47	

Sl. No	Chainage	W (m)	L (m)	Proposed canal width (m)	Assumed cutting depth (m)	Total Required Quantity (m3)	De-Silting Quantity (m3)	Net Cutting Quantity to be required (m3)	Remarks
502	CH 7515 : CH 7530	15.30	15	16.5	1.2	297.00	160.69	136.31	
503	CH 7530 : CH 7545	15.58	15	16.5	1.2	297.00	163.55	133.45	
504	CH 7545 : CH 7560	16.14	15	16.5	1.2	297.00	169.50	127.50	
505	CH 7560 : CH 7575	16.07	15	16.5	1.2	297.00	168.71	128.29	
506	CH 7575 : CH 7590	16.02	15	16.5	1.2	297.00	168.24	128.76	
507	CH 7590 : CH 7605	16.49	15	16.5	1.2	297.00	173.11	123.89	
508	CH 7605 : CH 7620	16.33	15	16.5	1.2	297.00	171.44	125.56	
509	CH 7620 : CH 7635	16.41	15	16.5	1.2	297.00	172.35	124.65	
510	CH 7635 : CH 7650	16.60	15	16.5	1.2	0.00	174.30	0.00	
511	CH 7650 : CH 7665	14.60	15	16.5	1.2	297.00	153.32	143.68	
512	CH 7665 : CH 7680	11.01	15	16.5	1.2	297.00	115.63	181.37	
513	CH 7680 : CH 7695	10.26	15	16.5	1.2	297.00	107.71	189.29	
514	CH 7695 : CH 7710	12.10	15	16.5	1.2	297.00	127.08	169.92	
515	CH 7710 : CH 7725	13.07	15	16.5	1.2	297.00	137.24	159.76	
516	CH 7725 : CH 7740	13.22	15	16.5	1.2	297.00	138.76	158.24	
517	CH 7740 : CH 7755	12.99	15	16.5	1.2	297.00	136.38	160.62	
518	CH 7755 : CH 7770	12.64	15	16.5	1.2	297.00	132.67	164.33	
519	CH 7770 : CH 7785	12.28	15	16.5	1.2	297.00	128.92	168.08	
520	CH 7785 : CH 7800	12.32	15	16.5	1.2	297.00	129.33	167.67	
521	CH 7800 : CH 7815	12.44	15	16.5	1.2	297.00	130.66	166.34	
522	CH 7815 : CH 7830	12.30	15	16.5	1.2	297.00	129.16	167.84	
523	CH 7830 : CH 7845	12.39	15	16.5	1.2	297.00	130.13	166.87	

Sl. No	Chainage	W (m)	L (m)	Proposed canal width (m)	Assumed cutting depth (m)	Total Required Quantity (m3)	De-Silting Quantity (m3)	Net Cutting Quantity to be required (m3)	Remarks
524	CH 7845 : CH 7860	12.66	15	16.5	1.2	297.00	132.95	164.05	
525	CH 7860 : CH 7875	12.79	15	16.5	1.2	297.00	134.30	162.70	
526	CH 7875 : CH 7890	12.76	15	16.5	1.2	297.00	133.93	163.07	
527	CH 7890 : CH 7905	12.60	15	16.5	1.2	297.00	132.28	164.72	
528	CH 7905 : CH 7920	12.52	15	16.5	1.2	297.00	131.50	165.50	
529	CH 7920 : CH 7935	12.51	15	16.5	1.2	297.00	131.31	165.69	
530	CH 7935 : CH 7950	12.47	15	16.5	1.2	297.00	130.98	166.02	
531	CH 7950 : CH 7965	12.49	15	16.5	1.2	297.00	131.10	165.90	
532	CH 7965 : CH 7980	12.51	15	16.5	1.2	297.00	131.37	165.63	
533	CH 7980 : CH 7995	12.54	15	16.5	1.2	297.00	131.70	165.30	
534	CH 7995 : CH 8010	12.37	15	16.5	1.2	297.00	129.83	167.17	
535	CH 8010 : CH 8025	11.18	15	16.5	1.2	297.00	117.34	179.66	
536	CH 8025 : CH 8040	10.33	15	16.5	1.2	297.00	108.42	188.58	
537	CH 8040 : CH 8055	10.27	15	16.5	1.2	297.00	107.86	189.14	
538	CH 8055 : CH 8070	9.91	15	16.5	1.2	297.00	104.08	192.92	
539	CH 8070 : CH 8085	9.64	15	16.5	1.2	297.00	101.18	195.82	
540	CH 8085 : CH 8100	9.48	15	16.5	1.2	297.00	99.54	197.46	
541	CH 8100 : CH 8115	10.19	15	16.5	1.2	297.00	106.98	190.02	
542	CH 8115 : CH 8130	18.38	15	16.5	1.2	0.00	192.94	0.00	
543	CH 8130 : CH 8145	18.52	15	16.5	1.2	0.00	194.49	0.00	
544	CH 8145 : CH 8160	9.59	15	16.5	1.2	297.00	100.70	196.31	
545	CH 8160 : CH 8175	7.94	15	16.5	1.2	297.00	83.32	213.68	

Sl. No	Chainage	W (m)	L (m)	Proposed canal width (m)	Assumed cutting depth (m)	Total Required Quantity (m3)	De-Silting Quantity (m3)	Net Cutting Quantity to be required (m3)	Remarks
546	CH 8175 : CH 8190	7.95	15	16.5	1.2	297.00	83.49	213.51	
547	CH 8190 : CH 8205	8.08	15	16.5	1.2	297.00	84.85	212.15	
548	CH 8205 : CH 8220	8.37	15	16.5	1.2	297.00	87.84	209.16	
549	CH 8220 : CH 8235	8.51	15	16.5	1.2	297.00	89.40	207.60	
550	CH 8235 : CH 8250	8.25	15	16.5	1.2	297.00	86.61	210.39	
551	CH 8250 : CH 8265	8.27	15	16.5	1.2	297.00	86.82	210.18	
552	CH 8265 : CH 8280	8.13	15	16.5	1.2	297.00	85.37	211.63	
553	CH 8280 : CH 8295	7.87	15	16.5	1.2	297.00	82.61	214.39	
554	CH 8295 : CH 8310	9.35	15	16.5	1.2	297.00	98.20	198.80	
555	CH 8310 : CH 8325	11.07	15	16.5	1.2	297.00	116.20	180.80	
556	CH 8325 : CH 8340	11.46	15	16.5	1.2	297.00	120.34	176.66	
557	CH 8340 : CH 8355	11.41	15	16.5	1.2	297.00	119.77	177.23	
558	CH 8355 : CH 8370	11.30	15	16.5	1.2	297.00	118.63	178.37	
559	CH 8370 : CH 8385	11.16	15	16.5	1.2	297.00	117.16	179.84	
560	CH 8385 : CH 8400	10.36	15	16.5	1.2	297.00	108.74	188.26	
561	CH 8400 : CH 8415	9.47	15	16.5	1.2	297.00	99.47	197.53	
562	CH 8415 : CH 8430	9.06	15	16.5	1.2	297.00	95.15	201.85	
563	CH 8430 : CH 8445	8.42	15	16.5	1.2	297.00	88.36	208.64	
564	CH 8445 : CH 8460	8.58	15	16.5	1.2	297.00	90.09	206.91	
565	CH 8460 : CH 8475	9.37	15	16.5	1.2	297.00	98.43	198.57	
566	CH 8475 : CH 8490	9.36	15	16.5	1.2	297.00	98.24	198.76	
567	CH 8490 : CH 8505	9.33	15	16.5	1.2	297.00	97.94	199.06	

Sl. No	Chainage	W (m)	L (m)	Proposed canal width (m)	Assumed cutting depth (m)	Total Required Quantity (m3)	De-Silting Quantity (m3)	Net Cutting Quantity to be required (m3)	Remarks
568	CH 8505 : CH 8520	9.79	15	16.5	1.2	297.00	102.81	194.19	
569	CH 8520 : CH 8535	10.30	15	16.5	1.2	297.00	108.14	188.86	
570	CH 8535 : CH 8550	8.86	15	16.5	1.2	297.00	93.04	203.96	
571	CH 8550 : CH 8565	7.83	15	16.5	1.2	297.00	82.17	214.83	
572	CH 8565 : CH 8580	8.72	15	16.5	1.2	297.00	91.58	205.42	
573	CH 8580 : CH 8595	9.07	15	16.5	1.2	297.00	95.19	201.81	
574	CH 8595 : CH 8610	9.34	15	16.5	1.2	297.00	98.03	198.97	
575	CH 8610 : CH 8625	9.84	15	16.5	1.2	297.00	103.36	193.64	
576	CH 8625 : CH 8640	10.15	15	16.5	1.2	297.00	106.61	190.39	
577	CH 8640 : CH 8655	10.03	15	16.5	1.2	297.00	105.26	191.74	
578	CH 8655 : CH 8670	9.98	15	16.5	1.2	297.00	104.75	192.25	
579	CH 8670 : CH 8685	10.15	15	16.5	1.2	297.00	106.54	190.46	
580	CH 8685 : CH 8700	10.50	15	16.5	1.2	297.00	110.27	186.73	
581	CH 8700 : CH 8715	11.05	15	16.5	1.2	297.00	116.01	180.99	
582	CH 8715 : CH 8730	11.77	15	16.5	1.2	297.00	123.53	173.47	
583	CH 8730 : CH 8745	12.44	15	16.5	1.2	297.00	130.67	166.33	
584	CH 8745 : CH 8760	12.73	15	16.5	1.2	297.00	133.70	163.30	
585	CH 8760 : CH 8775	12.74	15	16.5	1.2	297.00	133.75	163.25	
586	CH 8775 : CH 8790	8.61	15	16.5	1.2	297.00	90.40	206.60	
587	CH 8790 : CH 8805	6.53	15	16.5	1.2	297.00	68.53	228.47	
588	CH 8805 : CH 8820	8.62	15	16.5	1.2	297.00	90.54	206.46	
589	CH 8820 : CH 8835	8.93	15	16.5	1.2	297.00	93.75	203.25	

Sl. No	Chainage	W (m)	L (m)	Proposed canal width (m)	Assumed cutting depth (m)	Total Required Quantity (m3)	De-Silting Quantity (m3)	Net Cutting Quantity to be required (m3)	Remarks
590	CH 8835 : CH 8850	9.67	15	16.5	1.2	297.00	101.52	195.48	
591	CH 8850 : CH 8865	7.65	15	16.5	1.2	297.00	80.33	216.68	
592	CH 8865 : CH 8880	8.75	15	16.5	1.2	297.00	91.86	205.14	
593	CH 8880 : CH 8895	28.73	15	16.5	1.2	0.00	301.70	0.00	
594	CH 8895 : CH 8910	45.14	15	16.5	1.2	0.00	473.95	0.00	"
595	CH 8910 : CH 8925	45.35	15	16.5	1.2	0.00	476.21	0.00	"
596	CH 8925 : CH 8940	53.12	15	16.5	1.2	0.00	557.76	0.00	"
597	CH 8940 : CH 8955	69.01	15	16.5	1.2	0.00	724.59	0.00	"
598	CH 8955 : CH 8970	74.80	15	16.5	1.2	0.00	785.43	0.00	"
599	CH 8970 : CH 8985	71.82	15	16.5	1.2	0.00	754.11	0.00	"
600	CH 8985 : CH 9000	71.44	15	16.5	1.2	0.00	750.10	0.00	"
601	CH 9000 : CH 9015	71.63	15	16.5	1.2	0.00	752.09	0.00	"
602	CH 9015 : CH 9030	71.91	15	16.5	1.2	0.00	755.04	0.00	"
603	CH 9030 : CH 9045	73.15	15	16.5	1.2	0.00	768.08	0.00	"
604	CH 9045 : CH 9060	72.67	15	16.5	1.2	0.00	763.08	0.00	"
605	CH 9060 : CH 9075	69.39	15	16.5	1.2	0.00	728.61	0.00	"
606	CH 9075 : CH 9090	66.64	15	16.5	1.2	0.00	699.71	0.00	"
607	CH 9090 : CH 9105	65.20	15	16.5	1.2	0.00	684.62	0.00	"
608	CH 9105 : CH 9120	65.51	15	16.5	1.2	0.00	687.88	0.00	"
609	CH 9120 : CH 9135	66.33	15	16.5	1.2	0.00	696.44	0.00	"
610	CH 9135 : CH 9150	67.38	15	16.5	1.2	0.00	707.45	0.00	"
611	CH 9150 : CH 9165	68.89	15	16.5	1.2	0.00	723.37	0.00	"

Sl. No	Chainage	W (m)	L (m)	Proposed canal width (m)	Assumed cutting depth (m)	Total Required Quantity (m3)	De-Silting Quantity (m3)	Net Cutting Quantity to be required (m3)	Remarks
612	CH 9165 : CH 9180	72.09	15	16.5	1.2	0.00	756.99	0.00	"
613	CH 9180 : CH 9195	76.78	15	16.5	1.2	0.00	806.18	0.00	"
614	CH 9195 : CH 9210	80.56	15	16.5	1.2	0.00	845.87	0.00	"
615	CH 9210 : CH 9225	84.22	15	16.5	1.2	0.00	884.30	0.00	"
616	CH 9225 : CH 9240	87.33	15	16.5	1.2	0.00	916.95	0.00	"
617	CH 9240 : CH 9255	88.77	15	16.5	1.2	0.00	932.06	0.00	"
618	CH 9255 : CH 9270	90.25	15	16.5	1.2	0.00	947.60	0.00	"
619	CH 9270 : CH 9285	93.18	15	16.5	1.2	0.00	978.42	0.00	"
620	CH 9285 : CH 9300	95.57	15	16.5	1.2	0.00	1003.43	0.00	"
621	CH 9300 : CH 9315	95.92	15	16.5	1.2	0.00	1007.12	0.00	"
622	CH 9315 : CH 9330	95.65	15	16.5	1.2	0.00	1004.28	0.00	"
623	CH 9330 : CH 9345	95.95	15	16.5	1.2	0.00	1007.50	0.00	"
624	CH 9345 : CH 9360	93.67	15	16.5	1.2	0.00	983.49	0.00	"
625	CH 9360 : CH 9375	86.92	15	16.5	1.2	0.00	912.69	0.00	"
626	CH 9375 : CH 9390	91.45	15	16.5	1.2	0.00	960.26	0.00	"
627	CH 9390 : CH 9405	99.38	15	16.5	1.2	0.00	1043.52	0.00	"
628	CH 9405 : CH 9420	96.29	15	16.5	1.2	0.00	1011.02	0.00	"
629	CH 9420 : CH 9435	90.94	15	16.5	1.2	0.00	954.89	0.00	"
630	CH 9435 : CH 9450	88.15	15	16.5	1.2	0.00	925.60	0.00	"
631	CH 9450 : CH 9465	88.64	15	16.5	1.2	0.00	930.75	0.00	"
632	CH 9465 : CH 9480	87.56	15	16.5	1.2	0.00	919.37	0.00	"
633	CH 9480 : CH 9495	83.71	15	16.5	1.2	0.00	878.98	0.00	"

Sl. No	Chainage	W (m)	L (m)	Proposed canal width (m)	Assumed cutting depth (m)	Total Required Quantity (m3)	De-Silting Quantity (m3)	Net Cutting Quantity to be required (m3)	Remarks
634	CH 9495 : CH 9510	77.89	15	16.5	1.2	0.00	817.87	0.00	"
635	CH 9510 : CH 9525	72.00	15	16.5	1.2	0.00	755.97	0.00	"
636	CH 9525 : CH 9540	66.20	15	16.5	1.2	0.00	695.05	0.00	"
637	CH 9540 : CH 9555	60.62	15	16.5	1.2	0.00	636.56	0.00	"
638	CH 9555 : CH 9570	54.40	15	16.5	1.2	0.00	571.24	0.00	"
639	CH 9570 : CH 9585	47.16	15	16.5	1.2	0.00	495.17	0.00	"
640	CH 9585 : CH 9600	41.04	15	16.5	1.2	0.00	430.91	0.00	"
641	CH 9600 : CH 9615	44.41	15	16.5	1.2	0.00	466.25	0.00	"
642	CH 9615 : CH 9630	60.63	15	16.5	1.2	0.00	636.60	0.00	"
643	CH 9630 : CH 9645	79.97	15	16.5	1.2	0.00	839.70	0.00	"
644	CH 9645 : CH 9660	90.19	15	16.5	1.2	0.00	946.97	0.00	"
645	CH 9660 : CH 9675	93.14	15	16.5	1.2	0.00	977.93	0.00	"
646	CH 9675 : CH 9690	97.81	15	16.5	1.2	0.00	1026.96	0.00	"
647	CH 9690 : CH 9705	103.96	15	16.5	1.2	0.00	1091.61	0.00	"
648	CH 9705 : CH 9720	111.06	15	16.5	1.2	0.00	1166.16	0.00	"
649	CH 9720 : CH 9735	118.45	15	16.5	1.2	0.00	1243.71	0.00	"
650	CH 9735 : CH 9750	123.13	15	16.5	1.2	0.00	1292.82	0.00	"
651	CH 9750 : CH 9765	123.42	15	16.5	1.2	0.00	1295.86	0.00	"
652	CH 9765 : CH 9780	122.01	15	16.5	1.2	0.00	1281.05	0.00	"
653	CH 9780 : CH 9795	121.36	15	16.5	1.2	0.00	1274.29	0.00	"
654	CH 9795 : CH 9810	121.07	15	16.5	1.2	0.00	1271.27	0.00	"
655	CH 9810 : CH 9825	123.94	15	16.5	1.2	0.00	1301.37	0.00	"

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656	CH 9825 : CH 9840	129.23	15	16.5	1.2	0.00	1356.95	0.00	"
657	CH 9840 : CH 9855	133.05	15	16.5	1.2	0.00	1396.98	0.00	"
658	CH 9855 : CH 9870	135.95	15	16.5	1.2	0.00	1427.51	0.00	"
659	CH 9870 : CH 9885	138.70	15	16.5	1.2	0.00	1456.30	0.00	"
660	CH 9885 : CH 9900	142.48	15	16.5	1.2	0.00	1496.02	0.00	"
661	CH 9900 : CH 9915	147.10	15	16.5	1.2	0.00	1544.59	0.00	"
662	CH 9915 : CH 9930	154.03	15	16.5	1.2	0.00	1617.33	0.00	"
663	CH 9930 : CH 9945	163.78	15	16.5	1.2	0.00	1719.67	0.00	"
664	CH 9945 : CH 9960	198.86	15	16.5	1.2	0.00	2088.06	0.00	"
665	CH 9960 : CH 9975	230.46	15	16.5	1.2	0.00	2419.84	0.00	"
666	CH 9975 : CH 9990	234.72	15	16.5	1.2	0.00	2464.57	0.00	"
667	CH 9990 : CH 10005	238.51	15	16.5	1.2	0.00	2504.30	0.00	"
668	CH 10005 : CH 10020	241.81	15	16.5	1.2	0.00	2539.04	0.00	"
669	CH 10020 : CH 10035	246.76	15	16.5	1.2	0.00	2590.93	0.00	"
670	CH 10035 : CH 10050	243.21	15	16.5	1.2	0.00	2553.67	0.00	"
671	CH 10050 : CH 10065	238.80	15	16.5	1.2	0.00	2507.37	0.00	"
672	CH 10065 : CH 10080	244.57	15	16.5	1.2	0.00	2568.00	0.00	"
673	CH 10080 : CH 10095	252.73	15	16.5	1.2	0.00	2653.64	0.00	"
674	CH 10095 : CH 10110	259.00	15	16.5	1.2	0.00	2719.48	0.00	"
675	CH 10110 : CH 10125	252.45	15	16.5	1.2	0.00	2650.68	0.00	"
676	CH 10125 : CH 10140	228.10	15	16.5	1.2	0.00	2395.03	0.00	"
677	CH 10140 : CH 10155	195.06	15	16.5	1.2	0.00	2048.16	0.00	"

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678	CH 10155 : CH 10170	172.57	15	16.5	1.2	0.00	1811.94	0.00	"
679	CH 10170 : CH 10185	169.73	15	16.5	1.2	0.00	1782.15	0.00	"
680	CH 10185 : CH 10200	177.30	15	16.5	1.2	0.00	1861.63	0.00	"
681	CH 10200 : CH 10215	183.86	15	16.5	1.2	0.00	1930.58	0.00	"
682	CH 10215 : CH 10230	187.13	15	16.5	1.2	0.00	1964.85	0.00	"
683	CH 10230 : CH 10245	190.89	15	16.5	1.2	0.00	2004.39	0.00	"
684	CH 10245 : CH 10260	193.99	15	16.5	1.2	0.00	2036.92	0.00	"
685	CH 10260 : CH 10275	197.61	15	16.5	1.2	0.00	2074.89	0.00	"
686	CH 10275 : CH 10290	203.15	15	16.5	1.2	0.00	2133.09	0.00	"
687	CH 10290 : CH 10305	208.94	15	16.5	1.2	0.00	2193.83	0.00	"
688	CH 10305 : CH 10320	214.11	15	16.5	1.2	0.00	2248.18	0.00	"
689	CH 10320 : CH 10335	219.04	15	16.5	1.2	0.00	2299.87	0.00	"
690	CH 10335 : CH 10350	223.37	15	16.5	1.2	0.00	2345.42	0.00	"
691	CH 10350 : CH 10365	226.63	15	16.5	1.2	0.00	2379.66	0.00	"
692	CH 10365 : CH 10380	229.60	15	16.5	1.2	0.00	2410.84	0.00	"
693	CH 10380 : CH 10395	232.94	15	16.5	1.2	0.00	2445.82	0.00	"
694	CH 10395 : CH 10410	236.24	15	16.5	1.2	0.00	2480.56	0.00	"
695	CH 10410 : CH 10425	236.76	15	16.5	1.2	0.00	2486.00	0.00	"
696	CH 10425 : CH 10440	235.76	15	16.5	1.2	0.00	2475.47	0.00	"
697	CH 10440 : CH 10455	236.06	15	16.5	1.2	0.00	2478.58	0.00	"
698	CH 10455 : CH 10470	237.04	15	16.5	1.2	0.00	2488.93	0.00	"
699	CH 10470 : CH 10485	237.68	15	16.5	1.2	0.00	2495.65	0.00	"

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700	CH 10485 : CH 10500	236.91	15	16.5	1.2	0.00	2487.52	0.00	"
701	CH 10500 : CH 10515	235.75	15	16.5	1.2	0.00	2475.40	0.00	"
702	CH 10515 : CH 10530	232.99	15	16.5	1.2	0.00	2446.40	0.00	"
703	CH 10530 : CH 10545	229.15	15	16.5	1.2	0.00	2406.05	0.00	"
704	CH 10545 : CH 10560	225.20	15	16.5	1.2	0.00	2364.59	0.00	"
705	CH 10560 : CH 10575	219.98	15	16.5	1.2	0.00	2309.74	0.00	"
706	CH 10575 : CH 10590	219.61	15	16.5	1.2	0.00	2305.86	0.00	"
707	CH 10590 : CH 10605	222.04	15	16.5	1.2	0.00	2331.46	0.00	"
708	CH 10605 : CH 10620	223.67	15	16.5	1.2	0.00	2348.51	0.00	"
709	CH 10620 : CH 10635	227.85	15	16.5	1.2	0.00	2392.44	0.00	"
710	CH 10635 : CH 10650	232.74	15	16.5	1.2	0.00	2443.80	0.00	"
711	CH 10650 : CH 10665	238.00	15	16.5	1.2	0.00	2498.98	0.00	"
712	CH 10665 : CH 10680	241.35	15	16.5	1.2	0.00	2534.14	0.00	"
713	CH 10680 : CH 10695	240.98	15	16.5	1.2	0.00	2530.26	0.00	"
714	CH 10695 : CH 10710	239.69	15	16.5	1.2	0.00	2516.73	0.00	"
715	CH 10710 : CH 10725	239.54	15	16.5	1.2	0.00	2515.14	0.00	"
716	CH 10725 : CH 10740	240.78	15	16.5	1.2	0.00	2528.20	0.00	"
717	CH 10740 : CH 10755	242.50	15	16.5	1.2	0.00	2546.24	0.00	"
718	CH 10755 : CH 10770	244.55	15	16.5	1.2	0.00	2567.75	0.00	"
719	CH 10770 : CH 10785	246.84	15	16.5	1.2	0.00	2591.82	0.00	"
720	CH 10785 : CH 10800	246.99	15	16.5	1.2	0.00	2593.43	0.00	"
721	CH 10800 : CH 10815	248.20	15	16.5	1.2	0.00	2606.13	0.00	"

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722	CH 10815 : CH 10830	254.53	15	16.5	1.2	0.00	2672.58	0.00	"
723	CH 10830 : CH 10845	260.70	15	16.5	1.2	0.00	2737.37	0.00	"
724	CH 10845 : CH 10860	265.08	15	16.5	1.2	0.00	2783.36	0.00	"
725	CH 10860 : CH 10875	269.72	15	16.5	1.2	0.00	2832.09	0.00	"
726	CH 10875 : CH 10890	274.46	15	16.5	1.2	0.00	2881.78	0.00	"
727	CH 10890 : CH 10905	279.27	15	16.5	1.2	0.00	2932.31	0.00	"
728	CH 10905 : CH 10920	284.08	15	16.5	1.2	0.00	2982.88	0.00	"
729	CH 10920 : CH 10935	288.46	15	16.5	1.2	0.00	3028.78	0.00	"
730	CH 10935 : CH 10950	292.25	15	16.5	1.2	0.00	3068.58	0.00	"
731	CH 10950 : CH 10965	295.09	15	16.5	1.2	0.00	3098.46	0.00	"
732	CH 10965 : CH 10980	295.35	15	16.5	1.2	0.00	3101.12	0.00	"
733	CH 10980 : CH 10995	297.21	15	16.5	1.2	0.00	3120.74	0.00	"
734	CH 10995 : CH 11010	302.48	15	16.5	1.2	0.00	3176.08	0.00	"
735	CH 11010 : CH 11025	306.20	15	16.5	1.2	0.00	3215.15	0.00	"
736	CH 11025 : CH 11040	306.73	15	16.5	1.2	0.00	3220.62	0.00	"
737	CH 11040 : CH 11055	305.64	15	16.5	1.2	0.00	3209.20	0.00	"
738	CH 11055 : CH 11070	302.00	15	16.5	1.2	0.00	3171.01	0.00	"
739	CH 11070 : CH 11085	294.68	15	16.5	1.2	0.00	3094.11	0.00	"
740	CH 11085 : CH 11100	288.17	15	16.5	1.2	0.00	3025.76	0.00	"
741	CH 11100 : CH 11115	285.42	15	16.5	1.2	0.00	2996.95	0.00	"
742	CH 11115 : CH 11130	284.35	15	16.5	1.2	0.00	2985.64	0.00	"
743	CH 11130 : CH 11145	159.74	15	16.5	1.2	0.00	1677.27	0.00	"

Sl. No	Chainage	W (m)	L (m)	Proposed canal width (m)	Assumed cutting depth (m)	Total Required Quantity (m3)	De-Silting Quantity (m3)	Net Cutting Quantity to be required (m3)	Remarks
744	CH 11145 : CH 11150	33.88	5	16.5	1.2	0.00	118.56	0.00	"
	Total Quantity							**1,09,554.11**	

1.3 Thevara_Perandoor canal

Table 4: Widening Details of Thevara_Perandoor Canal

Sl. No	Chainage	W (m)	L (m)	Proposed canal width (m)	Assumed cutting depth (m)	Total Required Quantity (m3)	De-Silting Quantity (m3)	Net Cutting Quantity to be required (m3)	Remarks
1	CH 000 : CH 15	25.30	15	16.5	1.2	0.00	257.25	0.00	w>16.50
2	CH 15 : CH 30	49.30	15	16.5	1.2	0.00	257.25	0.00	"
3	CH 30 : CH 45	67.07	15	16.5	1.2	0.00	257.25	0.00	"
4	CH 45 : CH 60	64.31	15	16.5	1.2	0.00	257.25	0.00	"
5	CH 60 : CH 75	58.34	15	16.5	1.2	0.00	257.25	0.00	"
6	CH 75 : CH 90	53.13	15	16.5	1.2	0.00	257.25	0.00	"
7	CH 90 : CH 105	50.09	15	16.5	1.2	0.00	257.25	0.00	"
8	CH 105 : CH 120	48.44	15	16.5	1.2	0.00	257.25	0.00	"
9	CH 120 : CH 135	47.32	15	16.5	1.2	0.00	257.25	0.00	"
10	CH 135 : CH 150	43.11	15	16.5	1.2	0.00	257.25	0.00	"
11	CH 150 : CH 165	38.61	15	16.5	1.2	0.00	257.25	0.00	"

Sl. No	Chainage	W (m)	L (m)	Proposed canal width (m)	Assumed cutting depth (m)	Total Required Quantity (m3)	De-Silting Quantity (m3)	Net Cutting Quantity to be required (m3)	Remarks
12	CH 165 : CH 180	37.13	15	16.5	1.2	0.00	257.25	0.00	"
13	CH 180 : CH 195	35.38	15	16.5	1.2	0.00	257.25	0.00	"
14	CH 195 : CH 210	33.55	15	16.5	1.2	0.00	257.25	0.00	"
15	CH 210 : CH 225	35.58	15	16.5	1.2	0.00	257.25	0.00	"
16	CH 225 : CH 240	45.02	15	16.5	1.2	0.00	257.25	0.00	"
17	CH 240 : CH 255	54.70	15	16.5	1.2	0.00	257.25	0.00	"
18	CH 255 : CH 270	61.94	15	16.5	1.2	0.00	257.25	0.00	"
19	CH 270 : CH 285	72.24	15	16.5	1.2	0.00	257.25	0.00	"
20	CH 285 : CH 300	84.74	15	16.5	1.2	0.00	257.25	0.00	"
21	CH 300 : CH 315	97.48	15	16.5	1.2	0.00	257.25	0.00	"
22	CH 315 : CH 330	109.16	15	16.5	1.2	0.00	257.25	0.00	"
23	CH 330 : CH 345	113.84	15	16.5	1.2	0.00	257.25	0.00	"
24	CH 345 : CH 360	110.19	15	16.5	1.2	0.00	257.25	0.00	"
25	CH 360 : CH 375	106.99	15	16.5	1.2	0.00	257.25	0.00	"
26	CH 375 : CH 390	107.36	15	16.5	1.2	0.00	257.25	0.00	"
27	CH 390 : CH 405	105.45	15	16.5	1.2	0.00	257.25	0.00	"
28	CH 405 : CH 420	99.31	15	16.5	1.2	0.00	257.25	0.00	"
29	CH 420 : CH 435	91.69	15	16.5	1.2	0.00	257.25	0.00	"
30	CH 435 : CH 450	82.75	15	16.5	1.2	0.00	257.25	0.00	"
31	CH 450 : CH 465	73.05	15	16.5	1.2	0.00	257.25	0.00	"
32	CH 465 : CH 480	66.41	15	16.5	1.2	0.00	257.25	0.00	"
33	CH 480 : CH 495	64.29	15	16.5	1.2	0.00	257.25	0.00	"
34	CH 495 : CH 510	63.95	15	16.5	1.2	0.00	257.25	0.00	"

Sl. No	Chainage	W (m)	L (m)	Proposed canal width (m)	Assumed cutting depth (m)	Total Required Quantity (m3)	De-Silting Quantity (m3)	Net Cutting Quantity to be required (m3)	Remarks
35	CH 510 : CH 525	66.68	15	16.5	1.2	0.00	257.25	0.00	"
36	CH 525 : CH 540	72.52	15	16.5	1.2	0.00	257.25	0.00	"
37	CH 540 : CH 555	77.48	15	16.5	1.2	0.00	257.25	0.00	"
38	CH 555 : CH 570	79.59	15	16.5	1.2	0.00	257.25	0.00	"
39	CH 570 : CH 585	79.07	15	16.5	1.2	0.00	257.25	0.00	"
40	CH 585 : CH 600	78.42	15	16.5	1.2	0.00	257.25	0.00	"
41	CH 600 : CH 615	78.58	15	16.5	1.2	0.00	257.25	0.00	"
42	CH 615 : CH 630	77.31	15	16.5	1.2	0.00	257.25	0.00	"
43	CH 630 : CH 645	74.03	15	16.5	1.2	0.00	257.25	0.00	"
44	CH 645 : CH 660	70.41	15	16.5	1.2	0.00	257.25	0.00	"
45	CH 660 : CH 675	66.81	15	16.5	1.2	0.00	257.25	0.00	"
46	CH 675 : CH 690	63.26	15	16.5	1.2	0.00	257.25	0.00	"
47	CH 690 : CH 705	60.14	15	16.5	1.2	0.00	257.25	0.00	"
48	CH 705 : CH 720	57.73	15	16.5	1.2	0.00	257.25	0.00	"
49	CH 720 : CH 735	55.71	15	16.5	1.2	0.00	257.25	0.00	"
50	CH 735 : CH 750	54.23	15	16.5	1.2	0.00	257.25	0.00	"
51	CH 750 : CH 765	53.20	15	16.5	1.2	0.00	257.25	0.00	"
52	CH 765 : CH 780	52.46	15	16.5	1.2	0.00	257.25	0.00	"
53	CH 780 : CH 795	51.64	15	16.5	1.2	0.00	257.25	0.00	"
54	CH 795 : CH 810	50.61	15	16.5	1.2	0.00	257.25	0.00	"
55	CH 810 : CH 825	50.87	15	16.5	1.2	0.00	257.25	0.00	"
56	CH 825 : CH 840	51.96	15	16.5	1.2	0.00	257.25	0.00	"
57	CH 840 : CH 855	52.91	15	16.5	1.2	0.00	257.25	0.00	"

Sl. No	Chainage	W (m)	L (m)	Proposed canal width (m)	Assumed cutting depth (m)	Total Required Quantity (m3)	De-Silting Quantity (m3)	Net Cutting Quantity to be required (m3)	Remarks
58	CH 855 : CH 870	54.95	15	16.5	1.2	0.00	257.25	0.00	"
59	CH 870 : CH 885	56.77	15	16.5	1.2	0.00	257.25	0.00	"
60	CH 885 : CH 900	54.49	15	16.5	1.2	0.00	257.25	0.00	"
61	CH 900 : CH 915	49.51	15	16.5	1.2	0.00	257.25	0.00	"
62	CH 915 : CH 930	46.68	15	16.5	1.2	0.00	257.25	0.00	"
63	CH 930 : CH 945	46.08	15	16.5	1.2	0.00	257.25	0.00	"
64	CH 945 : CH 960	46.45	15	16.5	1.2	0.00	257.25	0.00	"
65	CH 960 : CH 975	48.36	15	16.5	1.2	0.00	257.25	0.00	"
66	CH 975 : CH 990	50.81	15	16.5	1.2	0.00	257.25	0.00	"
67	CH 990 : CH 1005	52.51	15	16.5	1.2	0.00	257.25	0.00	"
68	CH 1005 : CH 1020	50.70	15	16.5	1.2	0.00	257.25	0.00	"
69	CH 1020 : CH 1035	45.11	15	16.5	1.2	0.00	257.25	0.00	"
70	CH 1035 : CH 1050	39.05	15	16.5	1.2	0.00	257.25	0.00	"
71	CH 1050 : CH 1065	33.40	15	16.5	1.2	0.00	257.25	0.00	"
72	CH 1065 : CH 1080	30.51	15	16.5	1.2	0.00	257.25	0.00	"
73	CH 1080 : CH 1095	30.80	15	16.5	1.2	0.00	257.25	0.00	"
74	CH 1095 : CH 1110	32.56	15	16.5	1.2	0.00	257.25	0.00	"
75	CH 1110 : CH 1125	32.79	15	16.5	1.2	0.00	257.25	0.00	"
76	CH 1125 : CH 1140	31.07	15	16.5	1.2	0.00	257.25	0.00	"
77	CH 1140 : CH 1155	31.90	15	16.5	1.2	0.00	257.25	0.00	"
78	CH 1155 : CH 1170	39.23	15	16.5	1.2	0.00	257.25	0.00	"
79	CH 1170 : CH 1185	52.13	15	16.5	1.2	0.00	257.25	0.00	"
80	CH 1185 : CH 1200	52.32	15	16.5	1.2	0.00	257.25	0.00	"

Sl. No	Chainage	W (m)	L (m)	Proposed canal width (m)	Assumed cutting depth (m)	Total Required Quantity (m3)	De-Silting Quantity (m3)	Net Cutting Quantity to be required (m3)	Remarks
81	CH 1200 : CH 1215	49.13	15	16.5	1.2	0.00	257.25	0.00	"
82	CH 1215 : CH 1230	47.09	15	16.5	1.2	0.00	257.25	0.00	"
83	CH 1230 : CH 1245	48.96	15	16.5	1.2	0.00	257.25	0.00	"
84	CH 1245 : CH 1260	54.42	15	16.5	1.2	0.00	257.25	0.00	"
85	CH 1260 : CH 1275	54.95	15	16.5	1.2	0.00	257.25	0.00	"
86	CH 1275 : CH 1290	50.32	15	16.5	1.2	0.00	257.25	0.00	"
87	CH 1290 : CH 1305	48.22	15	16.5	1.2	0.00	257.25	0.00	"
88	CH 1305 : CH 1320	47.20	15	16.5	1.2	0.00	257.25	0.00	"
89	CH 1320 : CH 1335	43.99	15	16.5	1.2	0.00	257.25	0.00	"
90	CH 1335 : CH 1350	39.31	15	16.5	1.2	0.00	257.25	0.00	"
91	CH 1350 : CH 1365	35.56	15	16.5	1.2	0.00	257.25	0.00	"
92	CH 1365 : CH 1380	34.40	15	16.5	1.2	0.00	257.25	0.00	"
93	CH 1380 : CH 1395	35.29	15	16.5	1.2	0.00	257.25	0.00	"
94	CH 1395 : CH 1410	37.35	15	16.5	1.2	0.00	257.25	0.00	"
95	CH 1410 : CH 1425	40.04	15	16.5	1.2	0.00	257.25	0.00	"
96	CH 1425 : CH 1440	43.77	15	16.5	1.2	0.00	257.25	0.00	"
97	CH 1440 : CH 1455	47.00	15	16.5	1.2	0.00	257.25	0.00	"
98	CH 1455 : CH 1470	47.51	15	16.5	1.2	0.00	257.25	0.00	"
99	CH 1470 : CH 1485	46.26	15	16.5	1.2	0.00	257.25	0.00	"
100	CH 1485 : CH 1500	46.62	15	16.5	1.2	0.00	257.25	0.00	"
101	CH 1500 : CH 1515	45.56	15	16.5	1.2	0.00	257.25	0.00	"
102	CH 1515 : CH 1530	42.11	15	16.5	1.2	0.00	257.25	0.00	"
103	CH 1530 : CH 1545	38.74	15	16.5	1.2	0.00	257.25	0.00	"

Sl. No	Chainage	W (m)	L (m)	Proposed canal width (m)	Assumed cutting depth (m)	Total Required Quantity (m3)	De-Silting Quantity (m3)	Net Cutting Quantity to be required (m3)	Remarks
104	CH 1545 : CH 1560	36.90	15	16.5	1.2	0.00	257.25	0.00	"
105	CH 1560 : CH 1575	36.53	15	16.5	1.2	0.00	257.25	0.00	"
106	CH 1575 : CH 1590	37.47	15	16.5	1.2	0.00	257.25	0.00	"
107	CH 1590 : CH 1605	42.37	15	16.5	1.2	0.00	257.25	0.00	"
108	CH 1605 : CH 1620	48.95	15	16.5	1.2	0.00	257.25	0.00	"
109	CH 1620 : CH 1635	54.54	15	16.5	1.2	0.00	257.25	0.00	"
110	CH 1635 : CH 1650	58.02	15	16.5	1.2	0.00	257.25	0.00	"
111	CH 1650 : CH 1665	60.78	15	16.5	1.2	0.00	257.25	0.00	"
112	CH 1665 : CH 1680	63.63	15	16.5	1.2	0.00	257.25	0.00	"
113	CH 1680 : CH 1695	67.95	15	16.5	1.2	0.00	257.25	0.00	"
114	CH 1695 : CH 1710	60.83	15	16.5	1.2	0.00	257.25	0.00	"
115	CH 1710 : CH 1725	45.46	15	16.5	1.2	0.00	257.25	0.00	"
116	CH 1725 : CH 1740	36.95	15	16.5	1.2	0.00	257.25	0.00	"
117	CH 1740 : CH 1755	36.28	15	16.5	1.2	0.00	257.25	0.00	"
118	CH 1755 : CH 1770	40.92	15	16.5	1.2	0.00	257.25	0.00	"
119	CH 1770 : CH 1785	40.78	15	16.5	1.2	0.00	257.25	0.00	"
120	CH 1785 : CH 1800	37.79	15	16.5	1.2	0.00	257.25	0.00	"
121	CH 1800 : CH 1815	36.01	15	16.5	1.2	0.00	257.25	0.00	"
122	CH 1815 : CH 1830	34.74	15	16.5	1.2	0.00	257.25	0.00	"
123	CH 1830 : CH 1845	33.26	15	16.5	1.2	0.00	257.25	0.00	"
124	CH 1845 : CH 1860	31.66	15	16.5	1.2	0.00	257.25	0.00	"
125	CH 1860 : CH 1875	31.74	15	16.5	1.2	0.00	257.25	0.00	"
126	CH 1875 : CH 1890	33.71	15	16.5	1.2	0.00	257.25	0.00	"

Sl. No	Chainage	W (m)	L (m)	Proposed canal width (m)	Assumed cutting depth (m)	Total Required Quantity (m3)	De-Silting Quantity (m3)	Net Cutting Quantity to be required (m3)	Remarks
127	CH 1890 : CH 1905	35.89	15	16.5	1.2	0.00	257.25	0.00	"
128	CH 1905 : CH 1920	33.32	15	16.5	1.2	0.00	257.25	0.00	"
129	CH 1920 : CH 1935	30.38	15	16.5	1.2	0.00	257.25	0.00	"
130	CH 1935 : CH 1950	31.36	15	16.5	1.2	0.00	257.25	0.00	"
131	CH 1950 : CH 1965	30.72	15	16.5	1.2	0.00	257.25	0.00	"
132	CH 1965 : CH 1980	28.36	15	16.5	1.2	0.00	257.25	0.00	"
133	CH 1980 : CH 1995	26.91	15	16.5	1.2	0.00	257.25	0.00	"
134	CH 1995 : CH 2010	27.12	15	16.5	1.2	0.00	257.25	0.00	"
135	CH 2010 : CH 2025	28.12	15	16.5	1.2	0.00	257.25	0.00	"
136	CH 2025 : CH 2040	30.64	15	16.5	1.2	0.00	257.25	0.00	"
137	CH 2040 : CH 2055	32.85	15	16.5	1.2	0.00	257.25	0.00	"
138	CH 2055 : CH 2070	34.69	15	16.5	1.2	0.00	257.25	0.00	"
139	CH 2070 : CH 2085	27.28	15	16.5	1.2	0.00	257.25	0.00	"
140	CH 2085 : CH 2100	17.71	15	16.5	1.2	0.00	185.95	0.00	
141	CH 2100 : CH 2115	16.21	15	16.5	1.2	297.00	170.16	126.84	
142	CH 2115 : CH 2130	14.08	15	16.5	1.2	297.00	147.86	149.14	
143	CH 2130 : CH 2145	14.33	15	16.5	1.2	297.00	150.49	146.51	
144	CH 2145 : CH 2160	16.72	15	16.5	1.2	0.00	175.51	0.00	w>16.50
145	CH 2160 : CH 2175	18.04	15	16.5	1.2	0.00	189.43	0.00	"
146	CH 2175 : CH 2190	17.73	15	16.5	1.2	0.00	186.21	0.00	"
147	CH 2190 : CH 2205	18.18	15	16.5	1.2	0.00	190.88	0.00	"
148	CH 2205 : CH 2220	20.37	15	16.5	1.2	0.00	213.88	0.00	"
149	CH 2220 : CH 2235	22.16	15	16.5	1.2	0.00	232.72	0.00	"

Sl. No	Chainage	W (m)	L (m)	Proposed canal width (m)	Assumed cutting depth (m)	Total Required Quantity (m3)	De-Silting Quantity (m3)	Net Cutting Quantity to be required (m3)	Remarks
150	CH 2235 : CH 2250	21.40	15	16.5	1.2	0.00	224.73	0.00	"
151	CH 2250 : CH 2265	19.76	15	16.5	1.2	0.00	207.44	0.00	"
152	CH 2265 : CH 2280	19.52	15	16.5	1.2	0.00	204.91	0.00	"
153	CH 2280 : CH 2295	19.57	15	16.5	1.2	0.00	205.53	0.00	"
154	CH 2295 : CH 2310	20.06	15	16.5	1.2	0.00	210.65	0.00	"
155	CH 2310 : CH 2325	20.84	15	16.5	1.2	0.00	218.80	0.00	"
156	CH 2325 : CH 2340	20.73	15	16.5	1.2	0.00	217.67	0.00	"
157	CH 2340 : CH 2355	19.88	15	16.5	1.2	0.00	208.76	0.00	"
158	CH 2355 : CH 2370	19.58	15	16.5	1.2	0.00	205.62	0.00	"
159	CH 2370 : CH 2385	19.32	15	16.5	1.2	0.00	202.86	0.00	"
160	CH 2385 : CH 2400	19.27	15	16.5	1.2	0.00	202.36	0.00	"
161	CH 2400 : CH 2415	20.64	15	16.5	1.2	0.00	216.70	0.00	"
162	CH 2415 : CH 2430	21.16	15	16.5	1.2	0.00	222.23	0.00	"
163	CH 2430 : CH 2445	21.62	15	16.5	1.2	0.00	226.97	0.00	"
164	CH 2445 : CH 2460	24.05	15	16.5	1.2	0.00	252.51	0.00	"
165	CH 2460 : CH 2475	24.44	15	16.5	1.2	0.00	256.66	0.00	"
166	CH 2475 : CH 2490	24.67	15	16.5	1.2	0.00	257.25	0.00	"
167	CH 2490 : CH 2505	25.07	15	16.5	1.2	0.00	257.25	0.00	"
168	CH 2505 : CH 2520	27.40	15	16.5	1.2	0.00	257.25	0.00	"
169	CH 2520 : CH 2535	23.59	15	16.5	1.2	0.00	247.71	0.00	"
170	CH 2535 : CH 2550	20.26	15	16.5	1.2	0.00	212.76	0.00	"
171	CH 2550 : CH 2565	33.32	15	16.5	1.2	0.00	257.25	0.00	"
172	CH 2565 : CH 2580	37.03	15	16.5	1.2	0.00	257.25	0.00	"

Sl. No	Chainage	W (m)	L (m)	Proposed canal width (m)	Assumed cutting depth (m)	Total Required Quantity (m3)	De-Silting Quantity (m3)	Net Cutting Quantity to be required (m3)	Remarks
173	CH 2580 : CH 2595	25.38	15	16.5	1.2	0.00	257.25	0.00	"
174	CH 2595 : CH 2610	20.51	15	16.5	1.2	0.00	215.31	0.00	
175	CH 2610 : CH 2625	17.70	15	16.5	1.2	0.00	185.83	0.00	
176	CH 2625 : CH 2640	14.28	15	16.5	1.2	297.00	149.89	147.11	
177	CH 2640 : CH 2655	14.45	15	16.5	1.2	297.00	151.73	145.27	
178	CH 2655 : CH 2670	14.11	15	16.5	1.2	297.00	148.12	148.88	
179	CH 2670 : CH 2685	12.57	15	16.5	1.2	297.00	131.97	165.03	
180	CH 2685 : CH 2700	13.48	15	16.5	1.2	297.00	141.56	155.44	
181	CH 2700 : CH 2715	16.65	15	16.5	1.2	0.00	174.80	0.00	w>16.50
182	CH 2715 : CH 2730	18.48	15	16.5	1.2	0.00	194.02	0.00	
183	CH 2730 : CH 2745	18.93	15	16.5	1.2	0.00	198.78	-198.78	
184	CH 2745 : CH 2760	13.93	15	16.5	1.2	297.00	146.29	150.71	
185	CH 2760 : CH 2775	11.35	15	16.5	1.2	297.00	119.18	177.83	
186	CH 2775 : CH 2790	10.78	15	16.5	1.2	297.00	113.14	183.86	
187	CH 2790 : CH 2805	10.53	15	16.5	1.2	297.00	110.54	186.46	
188	CH 2805 : CH 2820	10.65	15	16.5	1.2	297.00	111.85	185.15	
189	CH 2820 : CH 2835	14.76	15	16.5	1.2	297.00	155.02	141.98	
190	CH 2835 : CH 2850	14.04	15	16.5	1.2	297.00	147.39	149.61	
191	CH 2850 : CH 2865	17.50	15	16.5	1.2	0.00	183.78	0.00	
192	CH 2865 : CH 2880	18.65	15	16.5	1.2	0.00	195.85	-195.85	
193	CH 2880 : CH 2895	14.25	15	16.5	1.2	297.00	149.64	147.36	
194	CH 2895 : CH 2910	12.74	15	16.5	1.2	297.00	133.76	163.24	
195	CH 2910 : CH 2925	12.40	15	16.5	1.2	297.00	130.18	166.82	

Sl. No	Chainage	W (m)	L (m)	Proposed canal width (m)	Assumed cutting depth (m)	Total Required Quantity (m3)	De-Silting Quantity (m3)	Net Cutting Quantity to be required (m3)	Remarks
196	CH 2925 : CH 2940	11.22	15	16.5	1.2	297.00	117.78	179.22	
197	CH 2940 : CH 2955	10.75	15	16.5	1.2	297.00	112.92	184.08	
198	CH 2955 : CH 2970	9.02	15	16.5	1.2	297.00	94.70	202.30	
199	CH 2970 : CH 2985	8.01	15	16.5	1.2	297.00	84.14	212.86	
200	CH 2985 : CH 3000	10.35	15	16.5	1.2	297.00	108.65	188.35	
201	CH 3000 : CH 3015	11.84	15	16.5	1.2	297.00	124.34	172.66	
202	CH 3015 : CH 3030	11.67	15	16.5	1.2	297.00	122.52	174.48	
203	CH 3030 : CH 3045	12.09	15	16.5	1.2	297.00	126.97	170.03	
204	CH 3045 : CH 3060	12.91	15	16.5	1.2	297.00	135.56	161.44	
205	CH 3060 : CH 3075	14.78	15	16.5	1.2	297.00	155.22	141.78	
206	CH 3075 : CH 3090	15.54	15	16.5	1.2	297.00	163.20	133.80	
207	CH 3090 : CH 3105	16.50	15	16.5	1.2	297.00	173.30	123.70	
208	CH 3105 : CH 3120	16.63	15	16.5	1.2	0.00	174.58	0.00	
209	CH 3120 : CH 3135	12.09	15	16.5	1.2	297.00	126.99	170.01	
210	CH 3135 : CH 3150	9.09	15	16.5	1.2	297.00	95.43	201.57	
211	CH 3150 : CH 3165	8.41	15	16.5	1.2	297.00	88.33	208.67	
212	CH 3165 : CH 3180	9.40	15	16.5	1.2	297.00	98.66	198.34	
213	CH 3180 : CH 3195	10.06	15	16.5	1.2	297.00	105.63	191.37	
214	CH 3195 : CH 3210	8.90	15	16.5	1.2	297.00	93.44	203.56	
215	CH 3210 : CH 3225	8.98	15	16.5	1.2	297.00	94.33	202.67	
216	CH 3225 : CH 3240	8.64	15	16.5	1.2	297.00	90.70	206.30	
217	CH 3240 : CH 3255	7.87	15	16.5	1.2	297.00	82.67	214.33	
218	CH 3255 : CH 3270	7.81	15	16.5	1.2	297.00	81.95	215.05	

Sl. No	Chainage	W (m)	L (m)	Proposed canal width (m)	Assumed cutting depth (m)	Total Required Quantity (m3)	De-Silting Quantity (m3)	Net Cutting Quantity to be required (m3)	Remarks
219	CH 3270 : CH 3285	8.01	15	16.5	1.2	297.00	84.12	212.88	
220	CH 3285 : CH 3300	7.84	15	16.5	1.2	297.00	82.30	214.70	
221	CH 3300 : CH 3315	7.03	15	16.5	1.2	297.00	73.76	223.24	
222	CH 3315 : CH 3330	8.10	15	16.5	1.2	297.00	85.00	212.00	
223	CH 3330 : CH 3345	8.34	15	16.5	1.2	297.00	87.56	209.44	
224	CH 3345 : CH 3360	6.83	15	16.5	1.2	297.00	71.76	225.24	
225	CH 3360 : CH 3375	6.75	15	16.5	1.2	297.00	70.87	226.13	
226	CH 3375 : CH 3390	6.64	15	16.5	1.2	297.00	69.67	227.33	
227	CH 3390 : CH 3405	6.33	15	16.5	1.2	297.00	66.50	230.50	
228	CH 3405 : CH 3420	5.61	15	16.5	1.2	297.00	58.87	238.13	
229	CH 3420 : CH 3435	5.12	15	16.5	1.2	297.00	53.73	243.27	
230	CH 3435 : CH 3450	5.37	15	16.5	1.2	297.00	56.35	240.65	
231	CH 3450 : CH 3465	6.42	15	16.5	1.2	297.00	67.43	229.57	
232	CH 3465 : CH 3480	8.10	15	16.5	1.2	297.00	85.01	211.99	
233	CH 3480 : CH 3495	7.58	15	16.5	1.2	297.00	79.61	217.39	
234	CH 3495 : CH 3510	6.35	15	16.5	1.2	297.00	66.63	230.37	
235	CH 3510 : CH 3525	6.81	15	16.5	1.2	297.00	71.49	225.51	
236	CH 3525 : CH 3540	7.53	15	16.5	1.2	297.00	79.04	217.96	
237	CH 3540 : CH 3555	8.74	15	16.5	1.2	297.00	91.81	205.19	
238	CH 3555 : CH 3570	9.85	15	16.5	1.2	297.00	103.38	193.62	
239	CH 3570 : CH 3585	9.93	15	16.5	1.2	297.00	104.31	192.69	
240	CH 3585 : CH 3600	9.54	15	16.5	1.2	297.00	100.13	196.87	
241	CH 3600 : CH 3615	9.25	15	16.5	1.2	297.00	97.16	199.84	

Sl. No	Chainage	W (m)	L (m)	Proposed canal width (m)	Assumed cutting depth (m)	Total Required Quantity (m3)	De-Silting Quantity (m3)	Net Cutting Quantity to be required (m3)	Remarks
242	CH 3615 : CH 3630	8.82	15	16.5	1.2	297.00	92.57	204.43	
243	CH 3630 : CH 3645	8.05	15	16.5	1.2	297.00	84.54	212.46	
244	CH 3645 : CH 3660	7.15	15	16.5	1.2	297.00	75.11	221.89	
245	CH 3660 : CH 3675	6.84	15	16.5	1.2	297.00	71.82	225.18	
246	CH 3675 : CH 3690	7.42	15	16.5	1.2	297.00	77.94	219.06	
247	CH 3690 : CH 3705	8.08	15	16.5	1.2	297.00	84.89	212.11	
248	CH 3705 : CH 3720	7.25	15	16.5	1.2	297.00	76.17	220.83	
249	CH 3720 : CH 3735	6.23	15	16.5	1.2	297.00	65.45	231.55	
250	CH 3735 : CH 3750	6.56	15	16.5	1.2	297.00	68.86	228.14	
251	CH 3750 : CH 3765	7.00	15	16.5	1.2	297.00	73.49	223.51	
252	CH 3765 : CH 3780	7.69	15	16.5	1.2	297.00	80.72	216.28	
253	CH 3780 : CH 3795	8.25	15	16.5	1.2	297.00	86.58	210.42	
254	CH 3795 : CH 3810	8.27	15	16.5	1.2	297.00	86.78	210.22	
255	CH 3810 : CH 3825	7.31	15	16.5	1.2	297.00	76.80	220.20	
256	CH 3825 : CH 3840	6.18	15	16.5	1.2	297.00	64.91	232.09	
257	CH 3840 : CH 3855	6.11	15	16.5	1.2	297.00	64.19	232.81	
258	CH 3855 : CH 3870	6.26	15	16.5	1.2	297.00	65.72	231.28	
259	CH 3870 : CH 3885	6.45	15	16.5	1.2	297.00	67.68	229.32	
260	CH 3885 : CH 3900	6.82	15	16.5	1.2	297.00	71.60	225.40	
261	CH 3900 : CH 3915	6.56	15	16.5	1.2	297.00	68.91	228.09	
262	CH 3915 : CH 3930	5.92	15	16.5	1.2	297.00	62.13	234.87	
263	CH 3930 : CH 3945	5.32	15	16.5	1.2	297.00	55.86	241.14	
264	CH 3945 : CH 3960	4.98	15	16.5	1.2	297.00	52.28	244.72	

Sl. No	Chainage	W (m)	L (m)	Proposed canal width (m)	Assumed cutting depth (m)	Total Required Quantity (m3)	De-Silting Quantity (m3)	Net Cutting Quantity to be required (m3)	Remarks
265	CH 3960 : CH 3975	4.83	15	16.5	1.2	297.00	50.68	246.32	
266	CH 3975 : CH 3990	4.71	15	16.5	1.2	297.00	49.45	247.55	
267	CH 3990 : CH 4005	4.93	15	16.5	1.2	297.00	51.77	245.24	
268	CH 4005 : CH 4020	5.45	15	16.5	1.2	297.00	57.18	239.82	
269	CH 4020 : CH 4035	6.32	15	16.5	1.2	297.00	66.41	230.59	
270	CH 4035 : CH 4050	6.45	15	16.5	1.2	297.00	67.71	229.29	
271	CH 4050 : CH 4065	5.89	15	16.5	1.2	297.00	61.82	235.18	
272	CH 4065 : CH 4080	5.64	15	16.5	1.2	297.00	59.24	237.76	
273	CH 4080 : CH 4095	5.47	15	16.5	1.2	297.00	57.39	239.61	
274	CH 4095 : CH 4110	5.93	15	16.5	1.2	297.00	62.24	234.76	
275	CH 4110 : CH 4125	6.63	15	16.5	1.2	297.00	69.61	227.39	
276	CH 4125 : CH 4140	6.74	15	16.5	1.2	297.00	70.82	226.18	
277	CH 4140 : CH 4155	6.23	15	16.5	1.2	297.00	65.37	231.63	
278	CH 4155 : CH 4170	5.77	15	16.5	1.2	297.00	60.57	236.43	
279	CH 4170 : CH 4185	6.39	15	16.5	1.2	297.00	67.14	229.86	
280	CH 4185 : CH 4200	7.00	15	16.5	1.2	297.00	73.55	223.45	
281	CH 4200 : CH 4215	6.87	15	16.5	1.2	297.00	72.15	224.85	
282	CH 4215 : CH 4230	6.83	15	16.5	1.2	297.00	71.68	225.32	
283	CH 4230 : CH 4245	6.68	15	16.5	1.2	297.00	70.13	226.87	
284	CH 4245 : CH 4260	6.43	15	16.5	1.2	297.00	67.51	229.49	
285	CH 4260 : CH 4275	6.76	15	16.5	1.2	297.00	71.01	225.99	
286	CH 4275 : CH 4290	6.42	15	16.5	1.2	297.00	67.43	229.57	
287	CH 4290 : CH 4305	5.95	15	16.5	1.2	297.00	62.44	234.56	

Sl. No	Chainage	W (m)	L (m)	Proposed canal width (m)	Assumed cutting depth (m)	Total Required Quantity (m3)	De-Silting Quantity (m3)	Net Cutting Quantity to be required (m3)	Remarks
288	CH 4305 : CH 4320	6.98	15	16.5	1.2	297.00	73.31	223.69	
289	CH 4320 : CH 4335	7.69	15	16.5	1.2	297.00	80.73	216.27	
290	CH 4335 : CH 4350	6.98	15	16.5	1.2	297.00	73.33	223.67	
291	CH 4350 : CH 4365	6.14	15	16.5	1.2	297.00	64.49	232.51	
292	CH 4365 : CH 4380	6.07	15	16.5	1.2	297.00	63.74	233.27	
293	CH 4380 : CH 4395	6.95	15	16.5	1.2	297.00	72.92	224.08	
294	CH 4395 : CH 4410	8.02	15	16.5	1.2	297.00	84.24	212.76	
295	CH 4410 : CH 4425	8.78	15	16.5	1.2	297.00	92.15	204.85	
296	CH 4425 : CH 4440	9.32	15	16.5	1.2	297.00	97.81	199.19	
297	CH 4440 : CH 4455	9.26	15	16.5	1.2	297.00	97.28	199.72	
298	CH 4455 : CH 4470	8.84	15	16.5	1.2	297.00	92.80	204.20	
299	CH 4470 : CH 4485	8.61	15	16.5	1.2	297.00	90.45	206.55	
300	CH 4485 : CH 4500	8.78	15	16.5	1.2	297.00	92.24	204.76	
301	CH 4500 : CH 4515	8.92	15	16.5	1.2	297.00	93.69	203.31	
302	CH 4515 : CH 4530	8.75	15	16.5	1.2	297.00	91.89	205.11	
303	CH 4530 : CH 4545	8.83	15	16.5	1.2	297.00	92.76	204.24	
304	CH 4545 : CH 4560	8.90	15	16.5	1.2	297.00	93.43	203.57	
305	CH 4560 : CH 4575	8.68	15	16.5	1.2	297.00	91.13	205.87	
306	CH 4575 : CH 4590	8.36	15	16.5	1.2	297.00	87.76	209.24	
307	CH 4590 : CH 4605	8.04	15	16.5	1.2	297.00	84.41	212.59	
308	CH 4605 : CH 4620	7.92	15	16.5	1.2	297.00	83.12	213.88	
309	CH 4620 : CH 4635	8.07	15	16.5	1.2	297.00	84.77	212.23	
310	CH 4635 : CH 4650	7.72	15	16.5	1.2	297.00	81.02	215.98	

Sl. No	Chainage	W (m)	L (m)	Proposed canal width (m)	Assumed cutting depth (m)	Total Required Quantity (m3)	De-Silting Quantity (m3)	Net Cutting Quantity to be required (m3)	Remarks
311	CH 4650 : CH 4665	6.81	15	16.5	1.2	297.00	71.46	225.54	
312	CH 4665 : CH 4680	7.05	15	16.5	1.2	297.00	73.97	223.03	
313	CH 4680 : CH 4695	7.61	15	16.5	1.2	297.00	79.89	217.11	
314	CH 4695 : CH 4710	7.41	15	16.5	1.2	297.00	77.77	219.23	
315	CH 4710 : CH 4725	7.13	15	16.5	1.2	297.00	74.88	222.12	
316	CH 4725 : CH 4740	7.14	15	16.5	1.2	297.00	74.95	222.05	
317	CH 4740 : CH 4755	7.57	15	16.5	1.2	297.00	79.53	217.47	
318	CH 4755 : CH 4770	7.65	15	16.5	1.2	297.00	80.34	216.66	
319	CH 4770 : CH 4785	7.29	15	16.5	1.2	297.00	76.58	220.42	
320	CH 4785 : CH 4800	7.02	15	16.5	1.2	297.00	73.70	223.30	
321	CH 4800 : CH 4815	6.54	15	16.5	1.2	297.00	68.66	228.34	
322	CH 4815 : CH 4830	6.31	15	16.5	1.2	297.00	66.21	230.79	
323	CH 4830 : CH 4845	6.78	15	16.5	1.2	297.00	71.16	225.84	
324	CH 4845 : CH 4860	6.68	15	16.5	1.2	297.00	70.19	226.81	
325	CH 4860 : CH 4875	6.36	15	16.5	1.2	297.00	66.81	230.19	
326	CH 4875 : CH 4890	6.76	15	16.5	1.2	297.00	70.97	226.03	
327	CH 4890 : CH 4905	7.13	15	16.5	1.2	297.00	74.88	222.12	
328	CH 4905 : CH 4920	7.32	15	16.5	1.2	297.00	76.87	220.13	
329	CH 4920 : CH 4935	7.18	15	16.5	1.2	297.00	75.36	221.64	
330	CH 4935 : CH 4950	6.69	15	16.5	1.2	297.00	70.25	226.76	
331	CH 4950 : CH 4965	6.54	15	16.5	1.2	297.00	68.66	228.34	
332	CH 4965 : CH 4980	7.39	15	16.5	1.2	297.00	77.57	219.43	
333	CH 4980 : CH 4995	8.02	15	16.5	1.2	297.00	84.26	212.74	

Sl. No	Chainage	W (m)	L (m)	Proposed canal width (m)	Assumed cutting depth (m)	Total Required Quantity (m3)	De-Silting Quantity (m3)	Net Cutting Quantity to be required (m3)	Remarks
334	CH 4995 : CH 5010	8.08	15	16.5	1.2	297.00	84.85	212.15	
335	CH 5010 : CH 5025	8.36	15	16.5	1.2	297.00	87.74	209.26	
336	CH 5025 : CH 5040	8.62	15	16.5	1.2	297.00	90.53	206.47	
337	CH 5040 : CH 5055	8.79	15	16.5	1.2	297.00	92.26	204.74	
338	CH 5055 : CH 5070	8.92	15	16.5	1.2	297.00	93.62	203.38	
339	CH 5070 : CH 5085	9.09	15	16.5	1.2	297.00	95.42	201.58	
340	CH 5085 : CH 5100	9.22	15	16.5	1.2	297.00	96.83	200.17	
341	CH 5100 : CH 5115	9.37	15	16.5	1.2	297.00	98.37	198.63	
342	CH 5115 : CH 5130	9.41	15	16.5	1.2	297.00	98.79	198.21	
343	CH 5130 : CH 5145	9.32	15	16.5	1.2	297.00	97.90	199.10	
344	CH 5145 : CH 5160	9.22	15	16.5	1.2	297.00	96.76	200.24	
345	CH 5160 : CH 5175	9.19	15	16.5	1.2	297.00	96.45	200.55	
346	CH 5175 : CH 5190	9.32	15	16.5	1.2	297.00	97.81	199.19	
347	CH 5190 : CH 5205	9.49	15	16.5	1.2	297.00	99.69	197.31	
348	CH 5205 : CH 5220	9.60	15	16.5	1.2	297.00	100.83	196.17	
349	CH 5220 : CH 5235	8.10	15	16.5	1.2	297.00	85.03	211.97	
350	CH 5235 : CH 5250	6.71	15	16.5	1.2	297.00	70.45	226.55	
351	CH 5250 : CH 5265	7.14	15	16.5	1.2	297.00	74.99	222.01	
352	CH 5265 : CH 5280	7.18	15	16.5	1.2	297.00	75.40	221.60	
353	CH 5280 : CH 5295	6.97	15	16.5	1.2	297.00	73.15	223.85	
354	CH 5295 : CH 5310	7.30	15	16.5	1.2	297.00	76.64	220.36	
355	CH 5310 : CH 5325	7.88	15	16.5	1.2	297.00	82.71	214.29	
356	CH 5325 : CH 5340	2.32	15	16.5	1.2	297.00	24.36	272.64	

Sl. No	Chainage	W (m)	L (m)	Proposed canal width (m)	Assumed cutting depth (m)	Total Required Quantity (m3)	De-Silting Quantity (m3)	Net Cutting Quantity to be required (m3)	Remarks
357	CH 5340 : CH 5355	0.00	15	16.5	1.2	297.00	0.00	297.00	
358	CH 5355 : CH 5370	0.00	15	16.5	1.2	297.00	0.00	297.00	
359	CH 5370 : CH 5385	0.95	15	16.5	1.2	297.00	9.95	287.05	
360	CH 5385 : CH 5400	4.54	15	16.5	1.2	297.00	47.63	249.37	
361	CH 5400 : CH 5415	7.70	15	16.5	1.2	297.00	80.88	216.12	
362	CH 5415 : CH 5430	8.25	15	16.5	1.2	297.00	86.57	210.43	
363	CH 5430 : CH 5445	8.35	15	16.5	1.2	297.00	87.63	209.37	
364	CH 5445 : CH 5460	8.18	15	16.5	1.2	297.00	85.90	211.10	
365	CH 5460 : CH 5475	7.34	15	16.5	1.2	297.00	77.02	219.98	
366	CH 5475 : CH 5490	5.82	15	16.5	1.2	297.00	61.06	235.94	
367	CH 5490 : CH 5505	5.48	15	16.5	1.2	297.00	57.50	239.50	
368	CH 5505 : CH 5520	6.62	15	16.5	1.2	297.00	69.51	227.49	
369	CH 5520 : CH 5535	7.28	15	16.5	1.2	297.00	76.42	220.58	
370	CH 5535 : CH 5550	7.38	15	16.5	1.2	297.00	77.53	219.47	
371	CH 5550 : CH 5565	7.31	15	16.5	1.2	297.00	76.74	220.26	
372	CH 5565 : CH 5580	8.20	15	16.5	1.2	297.00	86.15	210.85	
373	CH 5580 : CH 5595	10.06	15	16.5	1.2	297.00	105.61	191.39	
374	CH 5595 : CH 5610	7.62	15	16.5	1.2	297.00	80.00	217.00	
375	CH 5610 : CH 5625	5.97	15	16.5	1.2	297.00	62.65	234.35	
376	CH 5625 : CH 5640	6.14	15	16.5	1.2	297.00	64.48	232.52	
377	CH 5640 : CH 5655	6.30	15	16.5	1.2	297.00	66.18	230.82	
378	CH 5655 : CH 5670	6.28	15	16.5	1.2	297.00	65.97	231.03	
379	CH 5670 : CH 5685	6.11	15	16.5	1.2	297.00	64.19	232.81	

Sl. No	Chainage	W (m)	L (m)	Proposed canal width (m)	Assumed cutting depth (m)	Total Required Quantity (m3)	De-Silting Quantity (m3)	Net Cutting Quantity to be required (m3)	Remarks
380	CH 5685 : CH 5700	6.12	15	16.5	1.2	297.00	64.23	232.77	
381	CH 5700 : CH 5715	6.34	15	16.5	1.2	297.00	66.53	230.47	
382	CH 5715 : CH 5730	6.63	15	16.5	1.2	297.00	69.59	227.41	
383	CH 5730 : CH 5745	6.44	15	16.5	1.2	297.00	67.58	229.42	
384	CH 5745 : CH 5760	5.24	15	16.5	1.2	297.00	54.99	242.01	
385	CH 5760 : CH 5775	7.81	15	16.5	1.2	297.00	82.01	214.99	
386	CH 5775 : CH 5790	11.50	15	16.5	1.2	297.00	120.73	176.27	
387	CH 5790 : CH 5805	13.57	15	16.5	1.2	297.00	142.43	154.57	
388	CH 5805 : CH 5820	12.29	15	16.5	1.2	297.00	129.03	167.97	
389	CH 5820 : CH 5835	8.53	15	16.5	1.2	297.00	89.59	207.41	
390	CH 5835 : CH 5850	8.22	15	16.5	1.2	297.00	86.30	210.70	
391	CH 5850 : CH 5865	8.20	15	16.5	1.2	297.00	86.06	210.94	
392	CH 5865 : CH 5880	9.04	15	16.5	1.2	297.00	94.91	202.09	
393	CH 5880 : CH 5895	9.71	15	16.5	1.2	297.00	101.91	195.09	
394	CH 5895 : CH 5910	9.57	15	16.5	1.2	297.00	100.53	196.47	
395	CH 5910 : CH 5925	9.72	15	16.5	1.2	297.00	102.11	194.89	
396	CH 5925 : CH 5940	10.35	15	16.5	1.2	297.00	108.69	188.31	
397	CH 5940 : CH 5955	11.47	15	16.5	1.2	297.00	120.40	176.60	
398	CH 5955 : CH 5970	13.47	15	16.5	1.2	297.00	141.46	155.54	
399	CH 5970 : CH 5985	15.60	15	16.5	1.2	297.00	163.79	133.21	
400	CH 5985 : CH 6000	15.20	15	16.5	1.2	297.00	159.64	137.36	
401	CH 6000 : CH 6015	14.13	15	16.5	1.2	297.00	148.41	148.59	
402	CH 6015 : CH 6030	14.17	15	16.5	1.2	297.00	148.81	148.19	

Sl. No	Chainage	W (m)	L (m)	Proposed canal width (m)	Assumed cutting depth (m)	Total Required Quantity (m3)	De-Silting Quantity (m3)	Net Cutting Quantity to be required (m3)	Remarks
403	CH 6030 : CH 6045	14.01	15	16.5	1.2	297.00	147.15	149.85	
404	CH 6045 : CH 6060	13.66	15	16.5	1.2	297.00	143.44	153.56	
405	CH 6060 : CH 6075	13.25	15	16.5	1.2	297.00	139.12	157.88	
406	CH 6075 : CH 6090	13.57	15	16.5	1.2	297.00	142.50	154.50	
407	CH 6090 : CH 6105	13.88	15	16.5	1.2	297.00	145.71	151.29	
408	CH 6105 : CH 6120	12.96	15	16.5	1.2	297.00	136.11	160.89	
409	CH 6120 : CH 6135	12.17	15	16.5	1.2	297.00	127.79	169.22	
410	CH 6135 : CH 6150	13.63	15	16.5	1.2	297.00	143.13	153.87	
411	CH 6150 : CH 6165	14.95	15	16.5	1.2	297.00	157.01	139.99	
412	CH 6165 : CH 6180	14.19	15	16.5	1.2	297.00	148.97	148.03	
413	CH 6180 : CH 6195	12.51	15	16.5	1.2	297.00	131.32	165.68	
414	CH 6195 : CH 6210	11.53	15	16.5	1.2	297.00	121.02	175.98	
415	CH 6210 : CH 6225	12.16	15	16.5	1.2	297.00	127.70	169.30	
416	CH 6225 : CH 6240	13.12	15	16.5	1.2	297.00	137.79	159.21	
417	CH 6240 : CH 6255	12.42	15	16.5	1.2	297.00	130.40	166.60	
418	CH 6255 : CH 6270	11.27	15	16.5	1.2	297.00	118.34	178.66	
419	CH 6270 : CH 6285	11.67	15	16.5	1.2	297.00	122.55	174.45	
420	CH 6285 : CH 6300	12.68	15	16.5	1.2	297.00	133.19	163.81	
421	CH 6300 : CH 6315	14.28	15	16.5	1.2	297.00	149.90	147.10	
422	CH 6315 : CH 6330	15.78	15	16.5	1.2	297.00	165.66	131.34	w>16.50
423	CH 6330 : CH 6345	16.77	15	16.5	1.2	0.00	176.04	0.00	"
424	CH 6345 : CH 6360	17.47	15	16.5	1.2	0.00	183.41	0.00	"
425	CH 6360 : CH 6375	17.47	15	16.5	1.2	0.00	183.45	0.00	"

Sl. No	Chainage	W (m)	L (m)	Proposed canal width (m)	Assumed cutting depth (m)	Total Required Quantity (m3)	De-Silting Quantity (m3)	Net Cutting Quantity to be required (m3)	Remarks
426	CH 6375 : CH 6390	17.02	15	16.5	1.2	0.00	178.66	0.00	
427	CH 6390 : CH 6405	16.52	15	16.5	1.2	0.00	173.42	0.00	
428	CH 6405 : CH 6420	16.02	15	16.5	1.2	297.00	168.18	128.82	
429	CH 6420 : CH 6435	15.52	15	16.5	1.2	297.00	162.95	134.05	
430	CH 6435 : CH 6450	15.02	15	16.5	1.2	297.00	157.71	139.29	
431	CH 6450 : CH 6465	14.52	15	16.5	1.2	297.00	152.47	144.53	
432	CH 6465 : CH 6480	14.02	15	16.5	1.2	297.00	147.24	149.76	
433	CH 6480 : CH 6495	13.42	15	16.5	1.2	297.00	140.90	156.10	
434	CH 6495 : CH 6510	12.66	15	16.5	1.2	297.00	132.88	164.12	
435	CH 6510 : CH 6525	10.60	15	16.5	1.2	297.00	111.28	185.72	
436	CH 6525 : CH 6540	8.11	15	16.5	1.2	297.00	85.20	211.80	
437	CH 6540 : CH 6555	9.15	15	16.5	1.2	297.00	96.08	200.93	
438	CH 6555 : CH 6570	12.23	15	16.5	1.2	297.00	128.46	168.54	
439	CH 6570 : CH 6585	13.65	15	16.5	1.2	297.00	143.28	153.72	
440	CH 6585 : CH 6600	12.07	15	16.5	1.2	297.00	126.72	170.28	
441	CH 6600 : CH 6615	9.66	15	16.5	1.2	297.00	101.44	195.56	
442	CH 6615 : CH 6630	10.45	15	16.5	1.2	297.00	109.77	187.23	
443	CH 6630 : CH 6645	12.03	15	16.5	1.2	297.00	126.27	170.73	
444	CH 6645 : CH 6660	12.55	15	16.5	1.2	297.00	131.82	165.18	
445	CH 6660 : CH 6675	11.94	15	16.5	1.2	297.00	125.32	171.68	
446	CH 6675 : CH 6690	11.22	15	16.5	1.2	297.00	117.76	179.24	
447	CH 6690 : CH 6705	11.59	15	16.5	1.2	297.00	121.68	175.32	
448	CH 6705 : CH 6720	12.79	15	16.5	1.2	297.00	134.26	162.74	

Sl. No	Chainage	W (m)	L (m)	Proposed canal width (m)	Assumed cutting depth (m)	Total Required Quantity (m3)	De-Silting Quantity (m3)	Net Cutting Quantity to be required (m3)	Remarks
449	CH 6720 : CH 6735	14.62	15	16.5	1.2	297.00	153.52	143.48	
450	CH 6735 : CH 6750	16.25	15	16.5	1.2	297.00	170.59	126.41	
451	CH 6750 : CH 6765	16.50	15	16.5	1.2	297.00	173.23	123.77	
452	CH 6765 : CH 6780	16.17	15	16.5	1.2	297.00	169.81	127.19	
453	CH 6780 : CH 6795	16.44	15	16.5	1.2	297.00	172.65	124.35	
454	CH 6795 : CH 6810	16.26	15	16.5	1.2	297.00	170.69	126.31	
455	CH 6810 : CH 6825	15.94	15	16.5	1.2	297.00	167.40	129.60	
456	CH 6825 : CH 6840	15.12	15	16.5	1.2	297.00	158.74	138.26	
457	CH 6840 : CH 6855	13.27	15	16.5	1.2	297.00	139.34	157.67	
458	CH 6855 : CH 6870	12.05	15	16.5	1.2	297.00	126.51	170.49	
459	CH 6870 : CH 6885	12.69	15	16.5	1.2	297.00	133.21	163.79	
460	CH 6885 : CH 6900	14.78	15	16.5	1.2	297.00	155.14	141.86	
461	CH 6900 : CH 6915	16.45	15	16.5	1.2	297.00	172.77	124.23	w>16.50
462	CH 6915 : CH 6930	17.34	15	16.5	1.2	0.00	182.04	0.00	"
463	CH 6930 : CH 6945	17.34	15	16.5	1.2	0.00	182.09	0.00	
464	CH 6945 : CH 6960	16.51	15	16.5	1.2	0.00	173.36	0.00	
465	CH 6960 : CH 6975	16.19	15	16.5	1.2	297.00	170.03	126.97	
466	CH 6975 : CH 6990	15.71	15	16.5	1.2	297.00	164.94	132.06	
467	CH 6990 : CH 7005	15.27	15	16.5	1.2	297.00	160.29	136.71	
468	CH 7005 : CH 7020	15.55	15	16.5	1.2	297.00	163.25	133.75	
469	CH 7020 : CH 7035	15.88	15	16.5	1.2	297.00	166.75	130.25	
470	CH 7035 : CH 7050	15.46	15	16.5	1.2	297.00	162.30	134.70	
471	CH 7050 : CH 7065	14.85	15	16.5	1.2	297.00	155.94	141.06	

Sl. No	Chainage	W (m)	L (m)	Proposed canal width (m)	Assumed cutting depth (m)	Total Required Quantity (m3)	De-Silting Quantity (m3)	Net Cutting Quantity to be required (m3)	Remarks
472	CH 7065 : CH 7080	14.42	15	16.5	1.2	297.00	151.42	145.58	
473	CH 7080 : CH 7095	13.98	15	16.5	1.2	297.00	146.74	150.26	
474	CH 7095 : CH 7110	13.53	15	16.5	1.2	297.00	142.09	154.91	
475	CH 7110 : CH 7125	13.19	15	16.5	1.2	297.00	138.51	158.49	
476	CH 7125 : CH 7140	13.57	15	16.5	1.2	297.00	142.52	154.48	
477	CH 7140 : CH 7155	14.41	15	16.5	1.2	297.00	151.26	145.74	
478	CH 7155 : CH 7170	13.49	15	16.5	1.2	297.00	141.68	155.32	
479	CH 7170 : CH 7185	12.33	15	16.5	1.2	297.00	129.46	167.54	
480	CH 7185 : CH 7200	13.29	15	16.5	1.2	297.00	139.52	157.48	
481	CH 7200 : CH 7215	13.72	15	16.5	1.2	297.00	144.01	152.99	
482	CH 7215 : CH 7230	12.95	15	16.5	1.2	297.00	135.99	161.01	
483	CH 7230 : CH 7245	12.27	15	16.5	1.2	297.00	128.82	168.18	
484	CH 7245 : CH 7260	13.08	15	16.5	1.2	297.00	137.32	159.68	
485	CH 7260 : CH 7275	14.51	15	16.5	1.2	297.00	152.37	144.63	
486	CH 7275 : CH 7290	14.67	15	16.5	1.2	297.00	154.02	142.98	
487	CH 7290 : CH 7305	14.26	15	16.5	1.2	297.00	149.74	147.26	
488	CH 7305 : CH 7320	14.12	15	16.5	1.2	297.00	148.21	148.79	
489	CH 7320 : CH 7335	14.71	15	16.5	1.2	297.00	154.49	142.51	
490	CH 7335 : CH 7350	14.97	15	16.5	1.2	297.00	157.20	139.80	
491	CH 7350 : CH 7365	14.37	15	16.5	1.2	297.00	150.93	146.07	
492	CH 7365 : CH 7380	13.36	15	16.5	1.2	297.00	140.25	156.75	
493	CH 7380 : CH 7395	12.52	15	16.5	1.2	297.00	131.49	165.51	
494	CH 7395 : CH 7410	12.69	15	16.5	1.2	297.00	133.21	163.79	

Sl. No	Chainage	W (m)	L (m)	Proposed canal width (m)	Assumed cutting depth (m)	Total Required Quantity (m3)	De-Silting Quantity (m3)	Net Cutting Quantity to be required (m3)	Remarks
495	CH 7410 : CH 7425	13.70	15	16.5	1.2	297.00	143.81	153.19	
496	CH 7425 : CH 7440	14.91	15	16.5	1.2	297.00	156.52	140.48	
497	CH 7440 : CH 7455	16.15	15	16.5	1.2	297.00	169.56	127.44	w>16.50
498	CH 7455 : CH 7470	16.80	15	16.5	1.2	0.00	176.40	0.00	"
499	CH 7470 : CH 7485	16.65	15	16.5	1.2	0.00	174.84	0.00	
500	CH 7485 : CH 7500	16.31	15	16.5	1.2	297.00	171.24	125.76	
501	CH 7500 : CH 7515	15.96	15	16.5	1.2	297.00	167.57	129.43	
502	CH 7515 : CH 7530	15.61	15	16.5	1.2	297.00	163.86	133.14	
503	CH 7530 : CH 7545	14.73	15	16.5	1.2	297.00	154.66	142.34	
504	CH 7545 : CH 7560	13.38	15	16.5	1.2	297.00	140.47	156.53	
505	CH 7560 : CH 7575	12.11	15	16.5	1.2	297.00	127.12	169.88	
506	CH 7575 : CH 7590	11.49	15	16.5	1.2	297.00	120.68	176.32	
507	CH 7590 : CH 7605	12.20	15	16.5	1.2	297.00	128.11	168.89	
508	CH 7605 : CH 7620	12.94	15	16.5	1.2	297.00	135.82	161.18	
509	CH 7620 : CH 7635	12.98	15	16.5	1.2	297.00	136.31	160.69	
510	CH 7635 : CH 7650	13.01	15	16.5	1.2	297.00	136.56	160.44	
511	CH 7650 : CH 7665	12.91	15	16.5	1.2	297.00	135.52	161.48	
512	CH 7665 : CH 7680	12.81	15	16.5	1.2	297.00	134.54	162.46	
513	CH 7680 : CH 7695	13.15	15	16.5	1.2	297.00	138.06	158.94	
514	CH 7695 : CH 7710	14.53	15	16.5	1.2	297.00	152.60	144.40	
515	CH 7710 : CH 7725	15.87	15	16.5	1.2	297.00	166.64	130.36	
516	CH 7725 : CH 7740	15.26	15	16.5	1.2	297.00	160.21	136.79	
517	CH 7740 : CH 7755	15.53	15	16.5	1.2	297.00	163.11	133.89	w>16.50

Sl. No	Chainage	W (m)	L (m)	Proposed canal width (m)	Assumed cutting depth (m)	Total Required Quantity (m3)	De-Silting Quantity (m3)	Net Cutting Quantity to be required (m3)	Remarks
518	CH 7755 : CH 7770	16.74	15	16.5	1.2	0.00	175.81	0.00	"
519	CH 7770 : CH 7785	16.81	15	16.5	1.2	0.00	176.48	0.00	"
520	CH 7785 : CH 7800	16.86	15	16.5	1.2	0.00	177.07	0.00	"
521	CH 7800 : CH 7815	16.99	15	16.5	1.2	0.00	178.39	0.00	"
522	CH 7815 : CH 7830	17.05	15	16.5	1.2	0.00	179.05	0.00	
523	CH 7830 : CH 7845	16.07	15	16.5	1.2	297.00	168.70	128.30	
524	CH 7845 : CH 7860	15.76	15	16.5	1.2	297.00	165.45	131.55	w>16.50
525	CH 7860 : CH 7875	16.49	15	16.5	1.2	297.00	173.11	123.89	
526	CH 7875 : CH 7890	16.45	15	16.5	1.2	297.00	172.71	124.29	
527	CH 7890 : CH 7905	16.03	15	16.5	1.2	297.00	168.29	128.71	
528	CH 7905 : CH 7920	15.50	15	16.5	1.2	297.00	162.71	134.29	
529	CH 7920 : CH 7935	15.07	15	16.5	1.2	297.00	158.21	138.79	
530	CH 7935 : CH 7950	14.83	15	16.5	1.2	297.00	155.75	141.25	
531	CH 7950 : CH 7965	14.66	15	16.5	1.2	297.00	153.96	143.04	
532	CH 7965 : CH 7980	14.53	15	16.5	1.2	297.00	152.58	144.42	
533	CH 7980 : CH 7995	14.44	15	16.5	1.2	297.00	151.59	145.41	
534	CH 7995 : CH 8010	14.34	15	16.5	1.2	297.00	150.56	146.44	
535	CH 8010 : CH 8025	14.34	15	16.5	1.2	297.00	150.55	146.45	
536	CH 8025 : CH 8040	13.63	15	16.5	1.2	297.00	143.14	153.86	
537	CH 8040 : CH 8055	13.29	15	16.5	1.2	297.00	139.50	157.50	
538	CH 8055 : CH 8070	13.62	15	16.5	1.2	297.00	143.02	153.98	
539	CH 8070 : CH 8085	14.04	15	16.5	1.2	297.00	147.41	149.59	
540	CH 8085 : CH 8100	14.36	15	16.5	1.2	297.00	150.80	146.20	

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541	CH 8100 : CH 8115	13.96	15	16.5	1.2	297.00	146.58	150.42	
542	CH 8115 : CH 8130	15.05	15	16.5	1.2	297.00	157.99	139.01	
543	CH 8130 : CH 8145	15.96	15	16.5	1.2	297.00	167.55	129.45	
544	CH 8145 : CH 8160	15.62	15	16.5	1.2	297.00	163.96	133.04	
545	CH 8160 : CH 8175	16.04	15	16.5	1.2	297.00	168.39	128.61	w>16.50
546	CH 8175 : CH 8190	16.83	15	16.5	1.2	0.00	176.66	0.00	"
547	CH 8190 : CH 8205	17.19	15	16.5	1.2	0.00	180.48	0.00	"
548	CH 8205 : CH 8220	17.10	15	16.5	1.2	0.00	179.53	0.00	"
549	CH 8220 : CH 8235	17.24	15	16.5	1.2	0.00	181.01	0.00	"
550	CH 8235 : CH 8250	17.38	15	16.5	1.2	0.00	182.44	0.00	"
551	CH 8250 : CH 8265	17.67	15	16.5	1.2	0.00	185.57	0.00	"
552	CH 8265 : CH 8280	17.57	15	16.5	1.2	0.00	184.49	0.00	
553	CH 8280 : CH 8295	16.63	15	16.5	1.2	0.00	174.63	0.00	
554	CH 8295 : CH 8310	15.83	15	16.5	1.2	297.00	166.23	130.77	
555	CH 8310 : CH 8325	15.59	15	16.5	1.2	297.00	163.67	133.33	
556	CH 8325 : CH 8340	15.39	15	16.5	1.2	297.00	161.55	135.45	
557	CH 8340 : CH 8355	15.15	15	16.5	1.2	297.00	159.09	137.91	
558	CH 8355 : CH 8370	13.64	15	16.5	1.2	297.00	143.21	153.79	
559	CH 8370 : CH 8385	12.85	15	16.5	1.2	297.00	134.95	162.05	
560	CH 8385 : CH 8400	14.11	15	16.5	1.2	297.00	148.14	148.86	
561	CH 8400 : CH 8415	14.41	15	16.5	1.2	297.00	151.29	145.71	
562	CH 8415 : CH 8430	14.29	15	16.5	1.2	297.00	150.00	147.00	
563	CH 8430 : CH 8445	14.77	15	16.5	1.2	297.00	155.09	141.91	

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564	CH 8445 : CH 8460	14.85	15	16.5	1.2	297.00	155.97	141.03	
565	CH 8460 : CH 8475	14.40	15	16.5	1.2	297.00	151.16	145.84	
566	CH 8475 : CH 8490	13.94	15	16.5	1.2	297.00	146.41	150.59	
567	CH 8490 : CH 8505	13.67	15	16.5	1.2	297.00	143.52	153.48	
568	CH 8505 : CH 8520	13.59	15	16.5	1.2	297.00	142.71	154.29	
569	CH 8520 : CH 8535	13.41	15	16.5	1.2	297.00	140.76	156.24	
570	CH 8535 : CH 8550	13.28	15	16.5	1.2	297.00	139.43	157.57	
571	CH 8550 : CH 8565	13.30	15	16.5	1.2	297.00	139.69	157.31	
572	CH 8565 : CH 8580	13.46	15	16.5	1.2	297.00	141.28	155.72	
573	CH 8580 : CH 8595	13.69	15	16.5	1.2	297.00	143.72	153.28	
574	CH 8595 : CH 8610	13.78	15	16.5	1.2	297.00	144.68	152.32	
575	CH 8610 : CH 8625	13.42	15	16.5	1.2	297.00	140.90	156.10	
576	CH 8625 : CH 8640	13.10	15	16.5	1.2	297.00	137.56	159.44	
577	CH 8640 : CH 8655	13.19	15	16.5	1.2	297.00	138.49	158.51	
578	CH 8655 : CH 8670	13.27	15	16.5	1.2	297.00	139.35	157.65	
579	CH 8670 : CH 8685	13.30	15	16.5	1.2	297.00	139.68	157.32	
580	CH 8685 : CH 8700	13.52	15	16.5	1.2	297.00	141.94	155.06	
581	CH 8700 : CH 8715	14.98	15	16.5	1.2	297.00	157.31	139.69	
582	CH 8715 : CH 8730	16.37	15	16.5	1.2	297.00	171.90	125.10	
583	CH 8730 : CH 8745	16.05	15	16.5	1.2	297.00	168.49	128.51	
584	CH 8745 : CH 8760	15.55	15	16.5	1.2	297.00	163.31	133.69	
585	CH 8760 : CH 8775	15.74	15	16.5	1.2	297.00	165.24	131.76	
586	CH 8775 : CH 8790	16.16	15	16.5	1.2	297.00	169.63	127.37	

Sl. No	Chainage	W (m)	L (m)	Proposed canal width (m)	Assumed cutting depth (m)	Total Required Quantity (m3)	De-Silting Quantity (m3)	Net Cutting Quantity to be required (m3)	Remarks
587	CH 8790 : CH 8805	15.93	15	16.5	1.2	297.00	167.28	129.72	
588	CH 8805 : CH 8820	15.51	15	16.5	1.2	297.00	162.82	134.18	
589	CH 8820 : CH 8835	15.60	15	16.5	1.2	297.00	163.82	133.18	
590	CH 8835 : CH 8850	15.55	15	16.5	1.2	297.00	163.27	133.73	
591	CH 8850 : CH 8865	16.46	15	16.5	1.2	297.00	172.88	124.12	
592	CH 8865 : CH 8880	16.95	15	16.5	1.2	297.00	178.02	118.98	
593	CH 8880 : CH 8895	15.71	15	16.5	1.2	297.00	165.00	132.00	
594	CH 8895 : CH 8910	14.94	15	16.5	1.2	297.00	156.91	140.09	
595	CH 8910 : CH 8925	15.24	15	16.5	1.2	297.00	160.05	136.95	
596	CH 8925 : CH 8940	16.05	15	16.5	1.2	297.00	168.55	128.45	w>16.50
597	CH 8940 : CH 8955	16.91	15	16.5	1.2	0.00	177.56	0.00	"
598	CH 8955 : CH 8970	17.66	15	16.5	1.2	0.00	185.42	0.00	"
599	CH 8970 : CH 8985	18.09	15	16.5	1.2	0.00	189.96	0.00	"
600	CH 8985 : CH 9000	18.18	15	16.5	1.2	0.00	190.84	0.00	"
601	CH 9000 : CH 9015	17.97	15	16.5	1.2	0.00	188.73	0.00	"
602	CH 9015 : CH 9030	17.53	15	16.5	1.2	0.00	184.07	0.00	"
603	CH 9030 : CH 9045	19.86	15	16.5	1.2	0.00	208.54	0.00	"
604	CH 9045 : CH 9060	22.06	15	16.5	1.2	0.00	231.63	0.00	"
605	CH 9060 : CH 9075	22.27	15	16.5	1.2	0.00	233.80	0.00	"
606	CH 9075 : CH 9090	22.19	15	16.5	1.2	0.00	233.04	0.00	"
607	CH 9090 : CH 9105	19.34	15	16.5	1.2	0.00	203.06	0.00	"
608	CH 9105 : CH 9120	17.23	15	16.5	1.2	0.00	180.96	0.00	"
609	CH 9120 : CH 9135	17.32	15	16.5	1.2	0.00	181.81	0.00	"

Sl. No	Chainage	W (m)	L (m)	Proposed canal width (m)	Assumed cutting depth (m)	Total Required Quantity (m3)	De-Silting Quantity (m3)	Net Cutting Quantity to be required (m3)	Remarks
610	CH 9135 : CH 9150	17.43	15	16.5	1.2	0.00	183.04	0.00	"
611	CH 9150 : CH 9165	17.81	15	16.5	1.2	0.00	187.03	0.00	"
612	CH 9165 : CH 9180	18.43	15	16.5	1.2	0.00	193.53	0.00	"
613	CH 9180 : CH 9195	18.86	15	16.5	1.2	0.00	198.07	0.00	"
614	CH 9195 : CH 9210	19.06	15	16.5	1.2	0.00	200.18	0.00	"
615	CH 9210 : CH 9225	19.11	15	16.5	1.2	0.00	200.62	0.00	"
616	CH 9225 : CH 9240	19.03	15	16.5	1.2	0.00	199.82	0.00	"
617	CH 9240 : CH 9255	18.40	15	16.5	1.2	0.00	193.16	0.00	
618	CH 9255 : CH 9270	16.98	15	16.5	1.2	0.00	178.27	0.00	
619	CH 9270 : CH 9285	15.50	15	16.5	1.2	297.00	162.79	134.21	
620	CH 9285 : CH 9300	14.67	15	16.5	1.2	297.00	154.00	143.00	
621	CH 9300 : CH 9315	14.53	15	16.5	1.2	297.00	152.52	144.48	
622	CH 9315 : CH 9330	14.68	15	16.5	1.2	297.00	154.09	142.91	
623	CH 9330 : CH 9345	14.95	15	16.5	1.2	297.00	156.94	140.06	
624	CH 9345 : CH 9360	14.91	15	16.5	1.2	297.00	156.60	140.40	
625	CH 9360 : CH 9375	14.58	15	16.5	1.2	297.00	153.14	143.86	
626	CH 9375 : CH 9390	14.32	15	16.5	1.2	297.00	150.40	146.60	
627	CH 9390 : CH 9405	14.12	15	16.5	1.2	297.00	148.28	148.72	
628	CH 9405 : CH 9420	14.17	15	16.5	1.2	297.00	148.73	148.27	
629	CH 9420 : CH 9435	14.41	15	16.5	1.2	297.00	151.33	145.67	
630	CH 9435 : CH 9450	14.63	15	16.5	1.2	297.00	153.64	143.36	
631	CH 9450 : CH 9465	14.93	15	16.5	1.2	297.00	156.72	140.28	
632	CH 9465 : CH 9480	15.43	15	16.5	1.2	297.00	161.99	135.01	

Sl. No	Chainage	W (m)	L (m)	Proposed canal width (m)	Assumed cutting depth (m)	Total Required Quantity (m3)	De-Silting Quantity (m3)	Net Cutting Quantity to be required (m3)	Remarks
633	CH 9480 : CH 9495	15.78	15	16.5	1.2	297.00	165.72	131.28	
634	CH 9495 : CH 9510	15.60	15	16.5	1.2	297.00	163.77	133.23	
635	CH 9510 : CH 9525	15.07	15	16.5	1.2	297.00	158.24	138.77	
636	CH 9525 : CH 9540	14.78	15	16.5	1.2	297.00	155.23	141.77	
637	CH 9540 : CH 9555	14.79	15	16.5	1.2	297.00	155.26	141.74	
638	CH 9555 : CH 9570	15.64	15	16.5	1.2	297.00	164.21	132.79	w>16.50
639	CH 9570 : CH 9585	17.45	15	16.5	1.2	0.00	183.25	0.00	"
640	CH 9585 : CH 9600	18.87	15	16.5	1.2	0.00	198.10	0.00	"
641	CH 9600 : CH 9615	18.69	15	16.5	1.2	0.00	196.23	0.00	"
642	CH 9615 : CH 9630	18.03	15	16.5	1.2	0.00	189.32	0.00	"
643	CH 9630 : CH 9645	18.03	15	16.5	1.2	0.00	189.30	0.00	"
644	CH 9645 : CH 9660	18.18	15	16.5	1.2	0.00	190.92	0.00	"
645	CH 9660 : CH 9675	18.18	15	16.5	1.2	0.00	190.89	0.00	"
646	CH 9675 : CH 9690	17.97	15	16.5	1.2	0.00	188.69	0.00	"
647	CH 9690 : CH 9705	17.74	15	16.5	1.2	0.00	186.28	0.00	"
648	CH 9705 : CH 9720	17.36	15	16.5	1.2	0.00	182.30	0.00	"
649	CH 9720 : CH 9735	17.01	15	16.5	1.2	0.00	178.62	0.00	"
650	CH 9735 : CH 9750	16.94	15	16.5	1.2	0.00	177.83	0.00	"
651	CH 9750 : CH 9765	17.13	15	16.5	1.2	0.00	179.88	0.00	"
652	CH 9765 : CH 9780	17.40	15	16.5	1.2	0.00	182.66	0.00	"
653	CH 9780 : CH 9795	17.84	15	16.5	1.2	0.00	187.35	0.00	"
654	CH 9795 : CH 9810	18.35	15	16.5	1.2	0.00	192.63	0.00	"
655	CH 9810 : CH 9825	18.52	15	16.5	1.2	0.00	194.50	0.00	"

Sl. No	Chainage	W (m)	L (m)	Proposed canal width (m)	Assumed cutting depth (m)	Total Required Quantity (m3)	De-Silting Quantity (m3)	Net Cutting Quantity to be required (m3)	Remarks
656	CH 9825 : CH 9840	17.69	15	16.5	1.2	0.00	185.77	0.00	"
657	CH 9840 : CH 9855	17.08	15	16.5	1.2	0.00	179.29	0.00	"
658	CH 9855 : CH 9870	16.90	15	16.5	1.2	0.00	177.50	0.00	"
	CH 9870 : CH 9884.64	30.88	14.6	16.5	1.2	0.00	251.01	0.00	
	Total Quantity							**74,872.30**	

1.4 Thevara canal

Table 5: Widening Details of Thevara Canal

Sl. No	Chainage	W (m)	L (m)	Proposed canal width (m)	Assumed cutting depth (m)	Total Required Quantity (m3)	De-Silting Quantity (m3)	Balance Cutting Quantity to be required (m3)	Remarks
1	CH 000 : CH 15	21.88	15	16.5	1.2	0.00	229.69	0.00	w>16.50
2	CH 15 : CH 30	20.45	15	16.5	1.2	0.00	214.67	0.00	"
3	CH 30 : CH 45	19.53	15	16.5	1.2	0.00	205.07	0.00	"
4	CH 45 : CH 60	18.94	15	16.5	1.2	0.00	198.87	0.00	"
5	CH 60 : CH 75	18.82	15	16.5	1.2	0.00	197.56	0.00	"
6	CH 75 : CH 90	17.64	15	16.5	1.2	0.00	185.17	0.00	
7	CH 90 : CH 105	16.26	15	16.5	1.2	297.00	170.68	126.32	

Sl. No	Chainage	W (m)	L (m)	Proposed canal width (m)	Assumed cutting depth (m)	Total Required Quantity (m3)	De-Silting Quantity (m3)	Balance Cutting Quantity to be required (m3)	Remarks
8	CH 105 : CH 120	15.42	15	16.5	1.2	297.00	161.86	135.14	
9	CH 120 : CH 135	14.60	15	16.5	1.2	297.00	153.30	143.70	
10	CH 135 : CH 150	15.92	15	16.5	1.2	297.00	167.11	129.89	
11	CH 150 : CH 165	18.39	15	16.5	1.2	0.00	193.10	0.00	"
12	CH 165 : CH 180	19.32	15	16.5	1.2	0.00	202.86	0.00	"
13	CH 180 : CH 195	19.24	15	16.5	1.2	0.00	201.97	0.00	"
14	CH 195 : CH 210	19.28	15	16.5	1.2	0.00	202.44	0.00	"
15	CH 210 : CH 225	19.18	15	16.5	1.2	0.00	201.39	0.00	"
16	CH 225 : CH 240	19.16	15	16.5	1.2	0.00	201.18	0.00	"
17	CH 240 : CH 255	19.39	15	16.5	1.2	0.00	203.60	0.00	"
18	CH 255 : CH 270	19.52	15	16.5	1.2	0.00	204.91	0.00	"
19	CH 270 : CH 285	19.50	15	16.5	1.2	0.00	204.75	0.00	"
20	CH 285 : CH 300	19.31	15	16.5	1.2	0.00	202.70	0.00	"
21	CH 300 : CH 315	18.93	15	16.5	1.2	0.00	198.77	0.00	"
22	CH 315 : CH 330	18.93	15	16.5	1.2	0.00	198.71	0.00	"
23	CH 330 : CH 345	19.59	15	16.5	1.2	0.00	205.70	0.00	"
24	CH 345 : CH 360	20.02	15	16.5	1.2	0.00	210.16	0.00	"
25	CH 360 : CH 375	19.61	15	16.5	1.2	0.00	205.85	0.00	"
26	CH 375 : CH 390	18.86	15	16.5	1.2	0.00	198.03	0.00	"
27	CH 390 : CH 405	18.40	15	16.5	1.2	0.00	193.15	0.00	"
28	CH 405 : CH 420	18.63	15	16.5	1.2	0.00	195.56	0.00	"
29	CH 420 : CH 435	18.98	15	16.5	1.2	0.00	199.29	0.00	"

Sl. No	Chainage	W (m)	L (m)	Proposed canal width (m)	Assumed cutting depth (m)	Total Required Quantity (m3)	De-Silting Quantity (m3)	Balance Cutting Quantity to be required (m3)	Remarks
30	CH 435 : CH 450	19.22	15	16.5	1.2	0.00	201.81	0.00	"
31	CH 450 : CH 465	19.31	15	16.5	1.2	0.00	202.76	0.00	"
32	CH 465 : CH 480	19.28	15	16.5	1.2	0.00	202.44	0.00	"
33	CH 480 : CH 495	18.86	15	16.5	1.2	0.00	197.98	0.00	"
34	CH 495 : CH 510	17.13	15	16.5	1.2	0.00	179.81	0.00	
35	CH 510 : CH 525	15.93	15	16.5	1.2	297.00	167.21	129.79	
36	CH 525 : CH 540	15.82	15	16.5	1.2	297.00	166.11	130.89	
37	CH 540 : CH 555	15.68	15	16.5	1.2	297.00	164.64	132.36	
38	CH 555 : CH 570	15.71	15	16.5	1.2	297.00	164.90	132.10	
39	CH 570 : CH 585	16.43	15	16.5	1.2	297.00	172.52	124.49	
40	CH 585 : CH 600	17.08	15	16.5	1.2	0.00	179.34	0.00	"
41	CH 600 : CH 615	16.95	15	16.5	1.2	0.00	177.98	0.00	"
42	CH 615 : CH 630	16.24	15	16.5	1.2	297.00	170.47	126.53	
43	CH 630 : CH 645	16.04	15	16.5	1.2	297.00	168.42	128.58	
44	CH 645 : CH 660	16.49	15	16.5	1.2	297.00	173.15	123.86	
45	CH 660 : CH 675	16.76	15	16.5	1.2	0.00	175.93	0.00	"
46	CH 675 : CH 690	17.06	15	16.5	1.2	0.00	179.08	0.00	"
47	CH 690 : CH 705	17.11	15	16.5	1.2	0.00	179.60	0.00	"
48	CH 705 : CH 720	15.96	15	16.5	1.2	297.00	167.58	129.42	
49	CH 720 : CH 735	14.35	15	16.5	1.2	297.00	150.68	146.33	
50	CH 735 : CH 750	13.67	15	16.5	1.2	297.00	143.54	153.47	
51	CH 750 : CH 765	13.25	15	16.5	1.2	297.00	139.13	157.88	

Sl. No	Chainage	W (m)	L (m)	Proposed canal width (m)	Assumed cutting depth (m)	Total Required Quantity (m3)	De-Silting Quantity (m3)	Balance Cutting Quantity to be required (m3)	Remarks
52	CH 765 : CH 780	14.73	15	16.5	1.2	297.00	154.67	142.34	
53	CH 780 : CH 795	17.77	15	16.5	1.2	0.00	186.59	0.00	
54	CH 795 : CH 810	18.48	15	16.5	1.2	0.00	194.04	0.00	"
55	CH 810 : CH 825	18.31	15	16.5	1.2	0.00	192.20	0.00	"
56	CH 825 : CH 840	20.35	15	16.5	1.2	0.00	213.62	0.00	"
57	CH 840 : CH 855	19.64	15	16.5	1.2	0.00	206.17	0.00	"
58	CH 855 : CH 870	17.96	15	16.5	1.2	0.00	188.58	0.00	"
59	CH 870 : CH 885	19.01	15	16.5	1.2	0.00	199.55	0.00	"
60	CH 885 : CH 900	19.93	15	16.5	1.2	0.00	209.21	0.00	"
61	CH 900 : CH 915	19.61	15	16.5	1.2	0.00	205.91	0.00	"
62	CH 915 : CH 930	18.57	15	16.5	1.2	0.00	194.99	0.00	"
63	CH 930 : CH 945	18.06	15	16.5	1.2	0.00	189.63	0.00	"
64	CH 945 : CH 960	17.62	15	16.5	1.2	0.00	185.01	0.00	"
65	CH 960 : CH 975	17.32	15	16.5	1.2	0.00	181.86	0.00	"
66	CH 975 : CH 990	16.69	15	16.5	1.2	0.00	175.19	0.00	"
67	CH 990 : CH 1005	16.67	15	16.5	1.2	0.00	175.04	0.00	"
68	CH 1005 : CH 1020	16.81	15	16.5	1.2	0.00	176.45	0.00	"
69	CH 1020 : CH 1035	16.16	15	16.5	1.2	297.00	169.63	127.37	
70	CH 1035 : CH 1050	15.45	15	16.5	1.2	297.00	162.23	134.78	
71	CH 1050 : CH 1065	15.63	15	16.5	1.2	297.00	164.12	132.89	
72	CH 1065 : CH 1080	16.68	15	16.5	1.2	0.00	175.09	0.00	
73	CH 1080 : CH 1095	16.88	15	16.5	1.2	0.00	177.19	0.00	"

Sl. No	Chainage	W (m)	L (m)	Proposed canal width (m)	Assumed cutting depth (m)	Total Required Quantity (m3)	De-Silting Quantity (m3)	Balance Cutting Quantity to be required (m3)	Remarks
74	CH 1095 : CH 1110	16.97	15	16.5	1.2	0.00	178.19	0.00	"
75	CH 1110 : CH 1125	17.12	15	16.5	1.2	0.00	179.71	0.00	"
76	CH 1125 : CH 1140	17.31	15	16.5	1.2	0.00	181.76	0.00	"
77	CH 1140 : CH 1155	18.14	15	16.5	1.2	0.00	190.47	0.00	"
78	CH 1155 : CH 1170	19.76	15	16.5	1.2	0.00	207.48	0.00	"
79	CH 1170 : CH 1185	22.05	15	16.5	1.2	0.00	231.53	0.00	"
80	CH 1185 : CH 1200	24.05	15	16.5	1.2	0.00	252.47	0.00	"
81	CH 1200 : CH 1215	24.94	15	16.5	1.2	0.00	261.82	0.00	"
82	CH 1215 : CH 1230	24.70	15	16.5	1.2	0.00	259.30	0.00	"
83	CH 1230 : CH 1245	23.92	15	16.5	1.2	0.00	251.11	0.00	"
84	CH 1245 : CH 1260	22.67	15	16.5	1.2	0.00	237.98	0.00	"
85	CH 1260 : CH 1275	21.68	15	16.5	1.2	0.00	227.59	0.00	"
86	CH 1275 : CH 1290	21.09	15	16.5	1.2	0.00	221.39	0.00	"
87	CH 1290 : CH 1305	20.37	15	16.5	1.2	0.00	213.89	0.00	"
88	CH 1305 : CH 1320	19.54	15	16.5	1.2	0.00	205.12	0.00	"
89	CH 1320 : CH 1335	18.80	15	16.5	1.2	0.00	197.40	0.00	"
90	CH 1335 : CH 1350	18.14	15	16.5	1.2	0.00	190.47	0.00	"
91	CH 1350 : CH 1365	17.60	15	16.5	1.2	0.00	184.75	0.00	"
92	CH 1365 : CH 1380	17.53	15	16.5	1.2	0.00	184.07	0.00	"
93	CH 1380 : CH 1395	17.66	15	16.5	1.2	0.00	185.38	0.00	"
94	CH 1395 : CH 1405	17.74	10	16.5	1.2	0.00	124.18	0.00	"

Sl. No	Chainage	W (m)	L (m)	Proposed canal width (m)	Assumed cutting depth (m)	Total Required Quantity (m3)	De-Silting Quantity (m3)	Balance Cutting Quantity to be required (m3)	Remarks
	Total Quantity							**2,688.10**	

1.5 Market canal

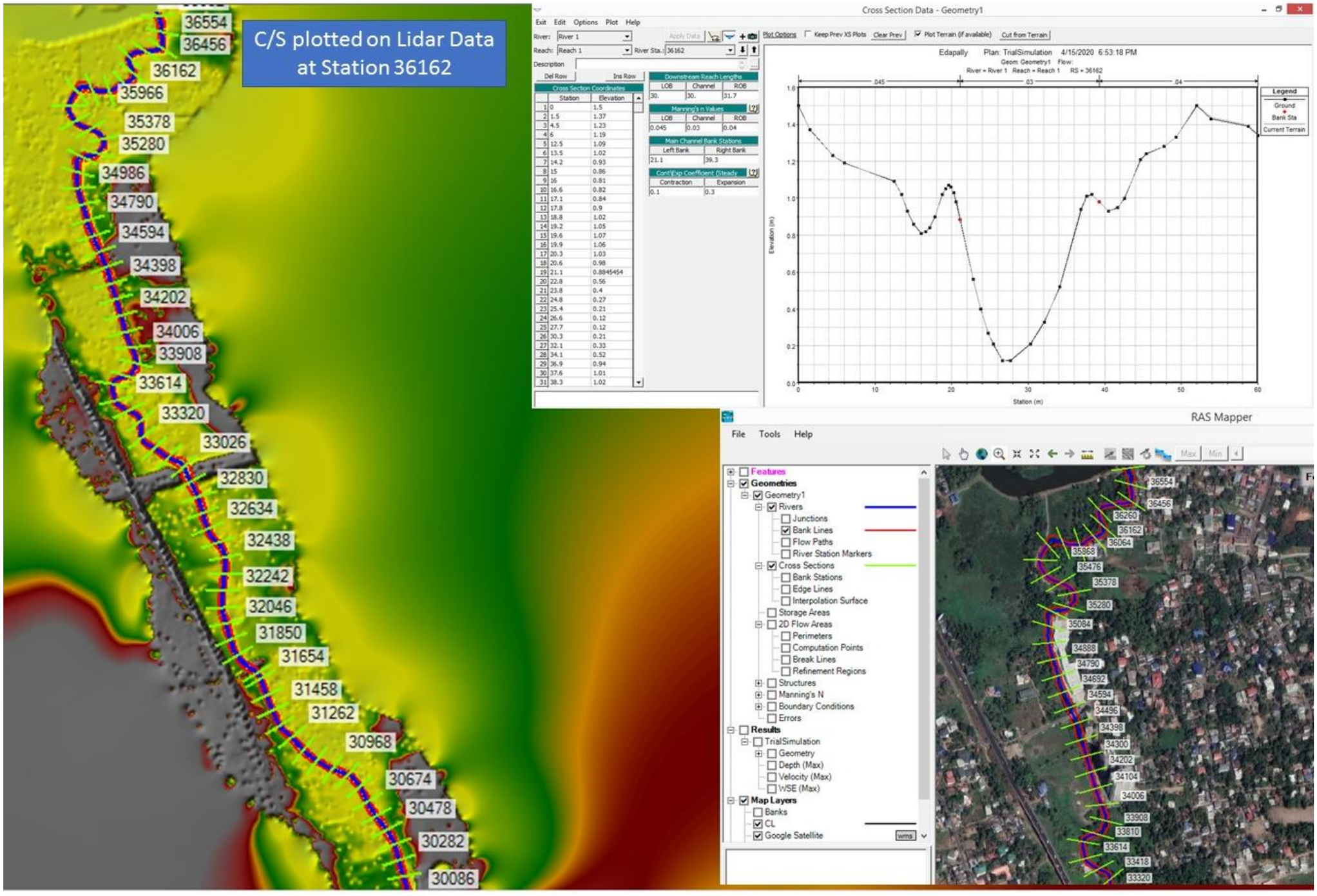
Table 6: Widening Details of Market Canal

Sl. No	Chainage	W	L (m)	Proposed canal width (m)	Assumed cutting depth (m)	Total Required Quantity (m3)	De-Silting Quantity (m3)	Balance Cutting Quantity to be required (m3)	Remarks
1	CH 0 : CH 15	15.46	15.00	16.50	1.20	297.00	162.33	134.67	
2	CH 15 : CH 30	14.00	15.00	16.50	1.20	297.00	147.00	150.00	
3	CH 30 : CH 45	13.97	15.00	16.50	1.20	297.00	146.63	150.37	
4	CH 45 : CH 60	14.07	15.00	16.50	1.20	297.00	147.74	149.27	
5	CH 60 : CH 75	14.01	15.00	16.50	1.20	297.00	147.11	149.90	
6	CH 75 : CH 90	15.03	15.00	16.50	1.20	297.00	157.82	139.19	
7	CH 90 : CH 105	15.84	15.00	16.50	1.20	297.00	166.32	130.68	
8	CH 105 : CH 120	13.75	15.00	16.50	1.20	297.00	144.38	152.63	
9	CH 120 : CH 135	12.18	15.00	16.50	1.20	297.00	127.84	169.16	

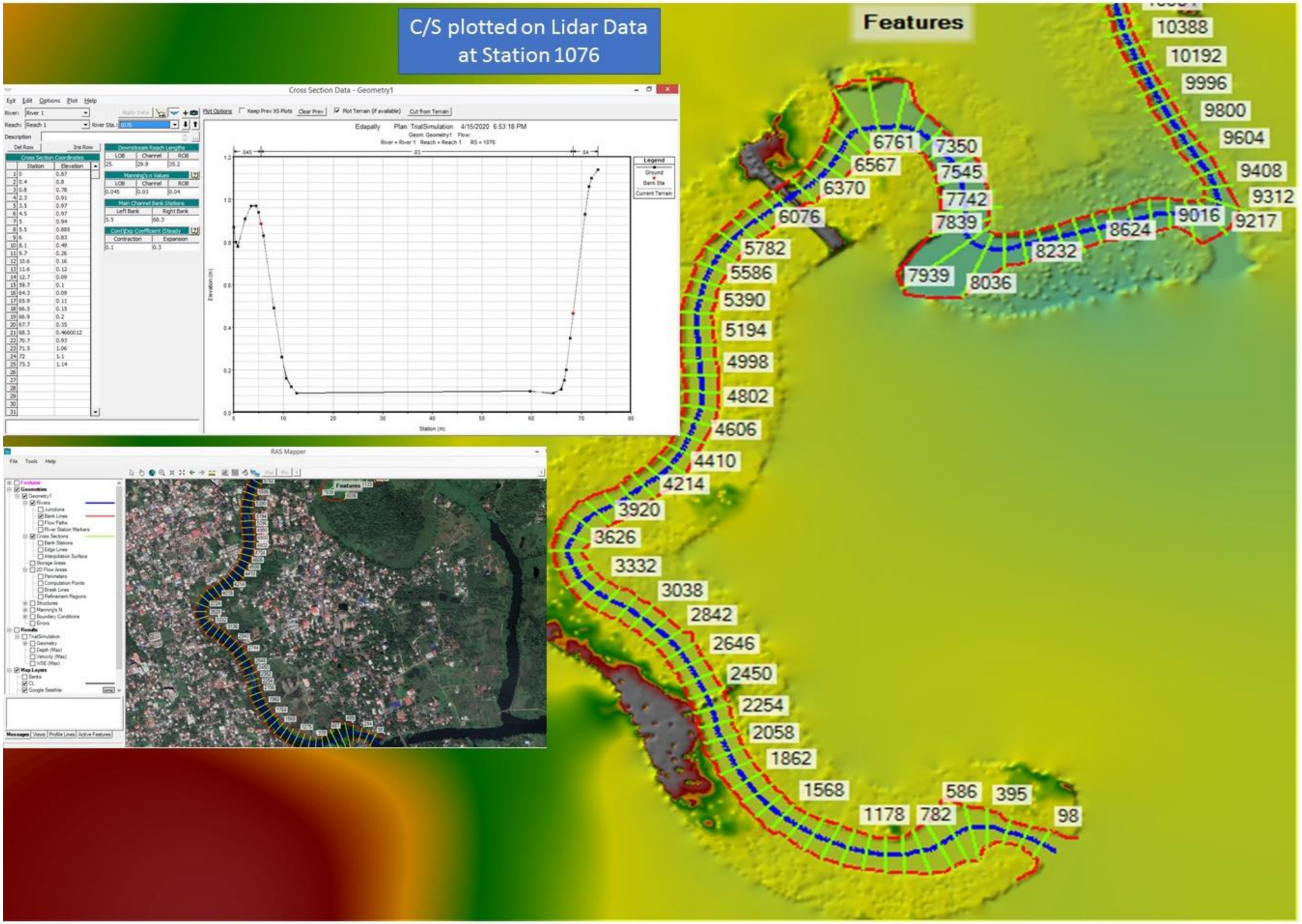
Sl. No	Chainage	W	L (m)	Proposed canal width (m)	Assumed cutting depth (m)	Total Required Quantity (m3)	De-Silting Quantity (m3)	Balance Cutting Quantity to be required (m3)	Remarks
10	CH 135 : CH 150	12.32	15.00	16.50	1.20	297.00	129.36	167.64	
11	CH 150 : CH 165	12.32	15.00	16.50	1.20	297.00	129.36	167.64	
12	CH 165 : CH 180	12.37	15.00	16.50	1.20	297.00	129.89	167.12	
13	CH 180 : CH 195	12.31	15.00	16.50	1.20	297.00	129.20	167.80	
14	CH 195 : CH 210	12.37	15.00	16.50	1.20	297.00	129.89	167.12	
15	CH 210 : CH 225	12.78	15.00	16.50	1.20	297.00	134.19	162.81	
16	CH 225 : CH 240	13.08	15.00	16.50	1.20	297.00	137.34	159.66	
17	CH 240 : CH 255	13.14	15.00	16.50	1.20	297.00	137.97	159.03	
18	CH 255 : CH 270	13.07	15.00	16.50	1.20	297.00	137.24	159.77	
19	CH 270 : CH 285	13.11	15.00	16.50	1.20	297.00	137.66	159.35	
20	CH 285 : CH 300	13.30	15.00	16.50	1.20	297.00	139.60	157.40	
21	CH 300 : CH 315	19.94	15.00	16.50	1.20	0.00	209.34	0.00	
22	CH 315 : CH 330	31.56	15.00	16.50	1.20	0.00	331.33	0.00	w>16.50
23	CH 330 : CH 345	31.88	15.00	16.50	1.20	0.00	334.74	0.00	"
24	CH 345 : CH 360	27.46	15.00	16.50	1.20	0.00	288.28	0.00	"
25	CH 360 : CH 375	15.27	15.00	16.50	1.20	297.00	160.28	136.72	
26	CH 375 : CH 390	7.65	15.00	16.50	1.20	297.00	80.27	216.73	
27	CH 390 : CH 405	7.52	15.00	16.50	1.20	297.00	78.91	218.09	
28	CH 405 : CH 420	7.39	15.00	16.50	1.20	297.00	77.54	219.46	
29	CH 420 : CH 435	7.26	15.00	16.50	1.20	297.00	76.23	220.77	
30	CH 435 : CH 450	7.19	15.00	16.50	1.20	297.00	75.50	221.51	
31	CH 450 : CH 465	7.15	15.00	16.50	1.20	297.00	75.08	221.93	
32	CH 465 : CH 480	7.12	15.00	16.50	1.20	297.00	74.71	222.29	

Sl. No	Chainage	W	L (m)	Proposed canal width (m)	Assumed cutting depth (m)	Total Required Quantity (m3)	De-Silting Quantity (m3)	Balance Cutting Quantity to be required (m3)	Remarks
33	CH 480 : CH 495	7.11	15.00	16.50	1.20	297.00	74.66	222.35	
34	CH 495 : CH 510	7.11	15.00	16.50	1.20	297.00	74.66	222.35	
35	CH 510 : CH 525	7.04	15.00	16.50	1.20	297.00	73.92	223.08	
36	CH 525 : CH 540	6.92	15.00	16.50	1.20	297.00	72.66	224.34	
37	CH 540 : CH 555	6.83	15.00	16.50	1.20	297.00	71.72	225.29	
38	CH 555 : CH 570	6.94	15.00	16.50	1.20	297.00	72.87	224.13	
39	CH 570 : CH 585	7.01	15.00	16.50	1.20	297.00	73.61	223.40	
40	CH 585 : CH 600	7.14	15.00	16.50	1.20	297.00	74.97	222.03	
41	CH 600 : CH 615	7.30	15.00	16.50	1.20	297.00	76.65	220.35	
42	CH 615 : CH 630	7.52	15.00	16.50	1.20	297.00	78.96	218.04	
43	CH 630 : CH 645	7.72	15.00	16.50	1.20	297.00	81.06	215.94	
44	CH 645 : CH 660	7.74	15.00	16.50	1.20	297.00	81.27	215.73	
45	CH 660 : CH 664	5.90	4.00	16.50	1.20	79.20	16.52	62.68	
								7,518.35	

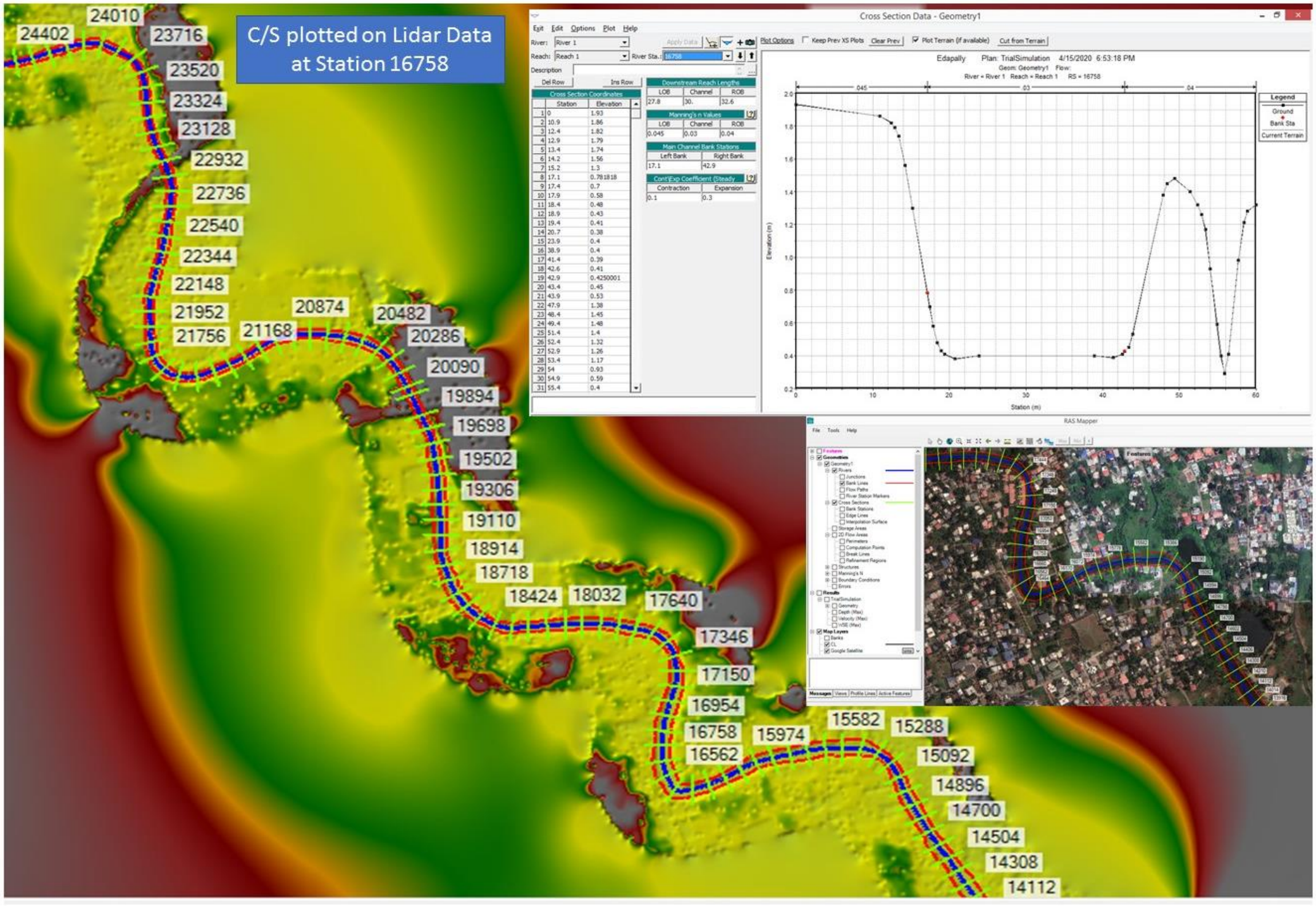
Lidar data for deriving the plan (CS 30282 to 36554m) and cross section of Edappally canal for CS-36162m



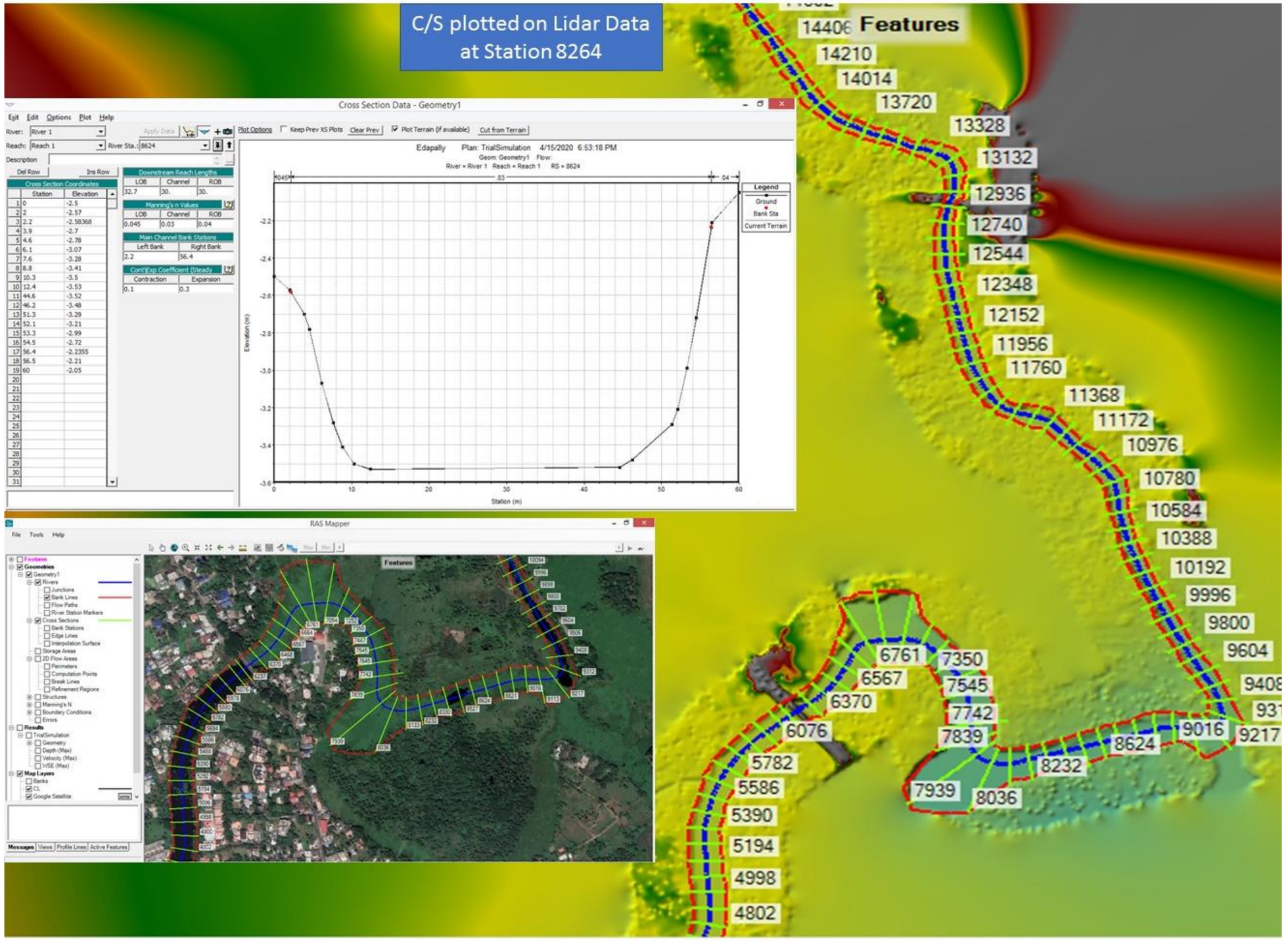
Lidar data for deriving the plan (CS 98 to 10388m) and cross section of Edappally canal for CS-1076m



Lidar data for deriving the plan (CS 14112 to 24402m) and cross section of Edappally canal for CS-16758m



Lidar data for deriving the plan (CS 4802 to 14406m) and cross section of Edappally canal for CS-8264m



3D view of Edappally canal as generated from LiDAR survey

Shore Line Protection

Shore Line Protection of Edappally canal, Chilavanoor canal and Thevara_Perandoor Canal

Sl. No	Name of the canal	Unit	Shore line protection
1	Edappally	m	4,217.87
2	Chilavanoor	m	8,386.68
3	Thevara_Perandoor	m	8,665.72
	Total length	**m**	**21,270.26**

Details of Shore Protection of Edappally Canal

Sl. No	Chainage	Shore Protection required (m)	LHS/RHS
1	CH 0 - CH 600	521.27	RHS
2	CH 0 - CH 600	524.82	LHS
3	CH 1400 - CH 2100	676.12	RHS
4	CH 1400 - CH 2100	675.67	LHS
5	CH 3600 - CH 3900	314.14	LHS
6	CH 3600 - CH 3900	371.44	RHS
7	CH 4400 - CH 4550	111.61	RHS
8	CH 4400 - CH 4550	117.60	LHS
9	CH 10400 - CH 10900	506.05	RHS
10	CH 10400 - CH 10900	399.14	LHS
		4217.86	

Details of Shore Protection of Chilavanoor Canal

Sl. No	Chainage	Shore Protection required (m)	LHS/RHS
1	CH 0-CH 400	423.4	LHS
2	CH 0-CH 400	349.15	RHS
3	CH 2050-CH 400	1198.77	LHS
4	CH 2050-CH 400	1173.5	RHS
5	CH 3610-CH 3800	161.92	LHS
6	CH 3610-CH 3800	148.85	RHS
7	CH 4290-CH 6150	1858.72	LHS
8	CH 4290-CH 6150	1877.47	RHS
9	CH 7190-CH 7300	132.21	LHS
10	CH 7190-CH 7300	179.10	RHS
11	CH 9300-CH 9600	245.5	RHS
12	CH 9300-CH 9900	638.09	LHS
		8386.68	

Details of Shore Protection of Thevara_Perandoor Canal

Sl. No	Chainage	Shore Protection required (m)	LHS/RHS
1	CH 350-CH 500	202.97	**RHS**
2	CH 850-CH 930	57.06	LHS
3	CH 850-CH 930	157.49	RHS
4	CH 1100-CH 1790	686.97	RHS
5	CH 2090-CH 2250	186.63	LHS
6	CH 2090-CH 2250	150.64	RHS
7	CH 3090-CH 3110	44.51	RHS
8	CH 3200-CH 3310	90.98	LHS
9	CH 3200-CH 3310	130.96	RHS
10	CH 3500-CH 5510	1970.93	LHS
11	CH 3500-CH 5510	1967.73	RHS
12	CH 6790-CH 7010	243.77	LHS
13	CH 6790-CH 7010	241.43	RHS
14	CH 8150-CH 9400	1017.58	LHS
15	CH 8150-CH 9400	1516.07	RHS
		8665.72	

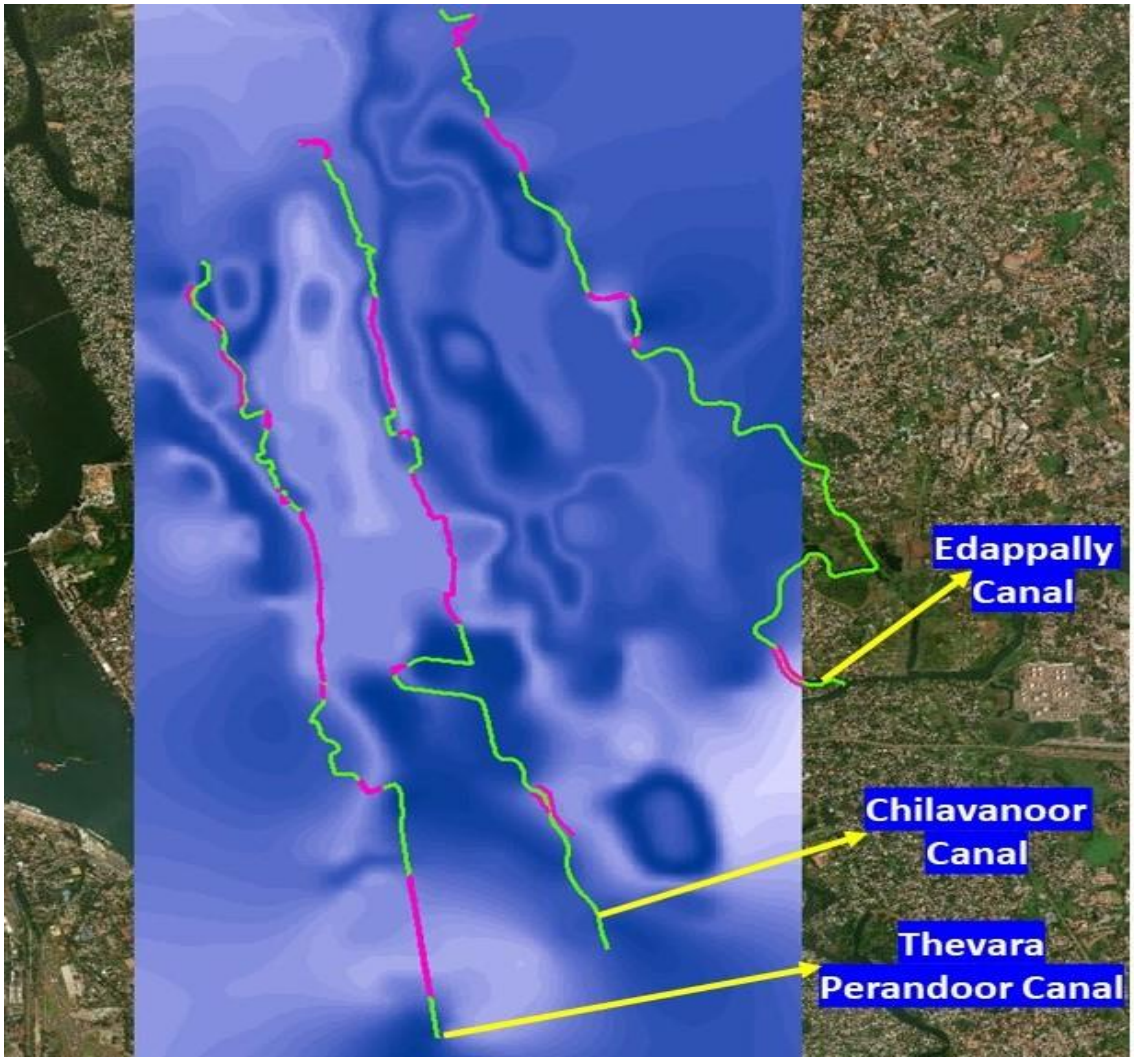


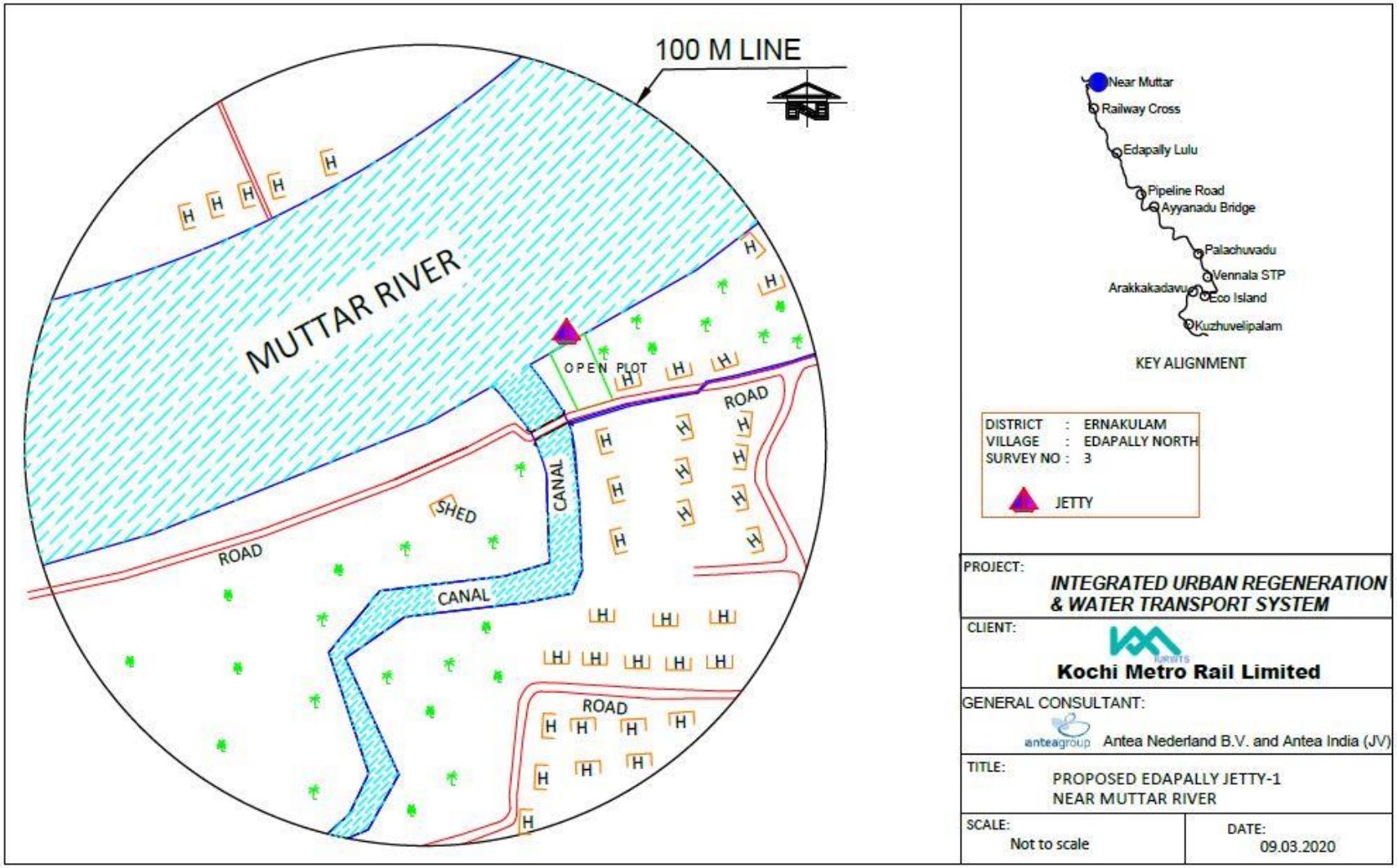
Figure 1: Shore Line Protection

Details of Jetties proposed

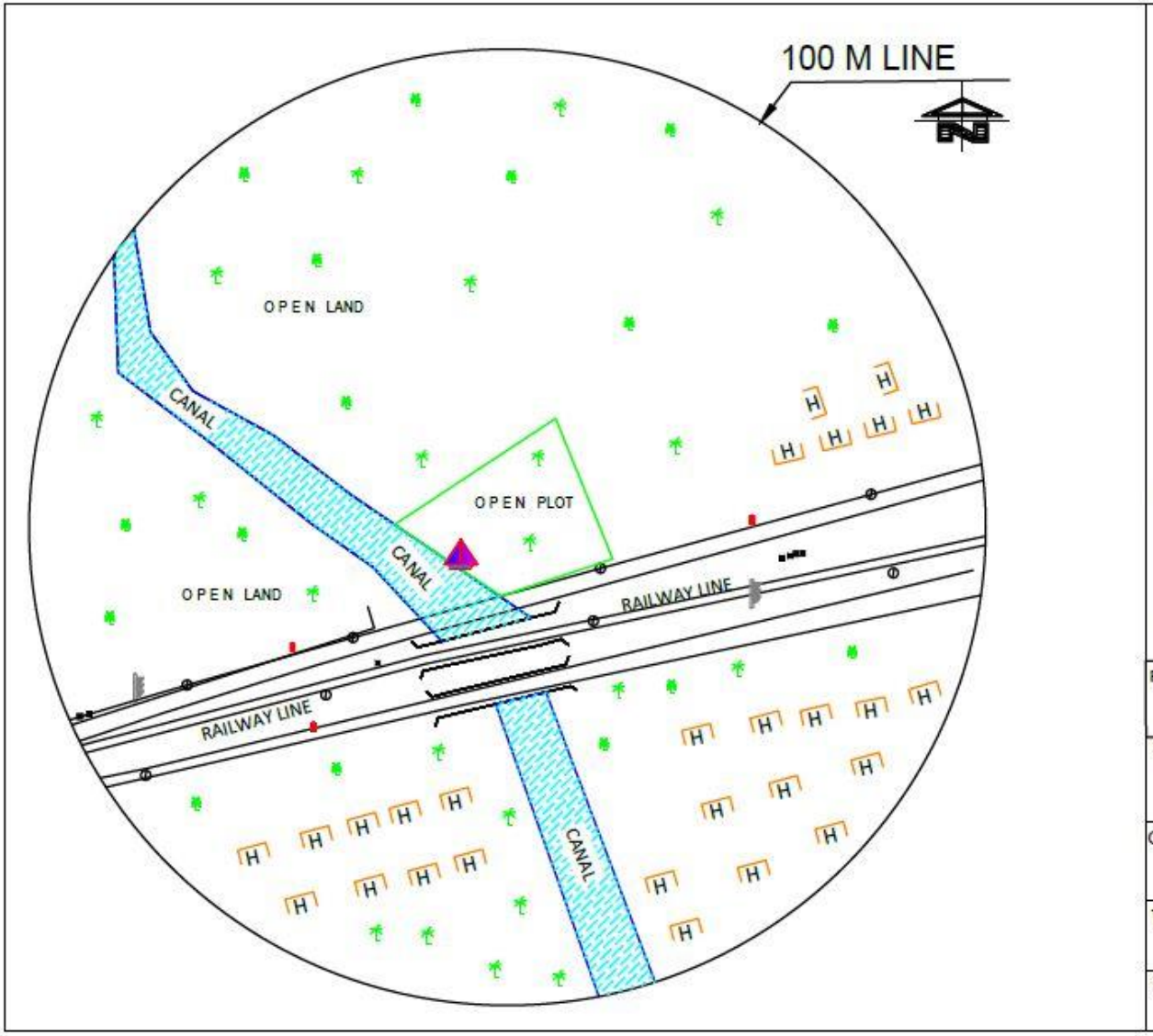
Sl.No.	Jetty No.	Jetty/Terminal Location					Location	Existing Canal width at near jetty location (m)	Land Area (sqm)	Jetty Area
		Name of the canal	Chainage	Name of the terminal	Co-Ordinates					
					Latitude	Longitude				
1	1	Edappally	0.00	Near Muttar	10° 2'36.89"N	76°18'12.56"E	LHS	52.03	1022	Built-up area = 70.00 sqm
2	2	Edappally	1.12	Near Railway cross	10° 2'10.98"N	76°18'13.68"E	LHS	17.32	611	Built-up area = 70.00 sqm
3	3	Edappally	2.60	Edappally Near LuLu	10° 1'30.83"N	76°18'34.38"E	LHS	16.34	3551	Built-up area = 80.00 sqm
4	4	Edappally	4.25	Near Pipeline Bridge	10° 0'51.47"N	76°18'57.27"E	RHS	16.18	710	Built-up area = 70.00 sqm
5	5	Edappally	4.94	Near Ayyanad Bridge, Chembumukku	10° 0'42.68"N	76°19'8.06"E	LHS	22.24	1587	Built-up area = 70.00 sqm
6	6	Edappally	7.22	Near Palachuvadu Bridge	10° 0'0.23"N	76°19'47.86"E	RHS	29.33	7394	Built-up area = 70.00 sqm
7	9	Edappally	8.75	Eco Island	9°59'21.78"N	76°19'53.53"E	LHS	62.88	5402	Built-up area = 70.00 sqm
8	7	Edappally	9.32	Near Arakkakadavu Bridge	9°59'28.03"N	76°19'40.45"E	RHS	52.91	850	Built-up area = 70.00 sqm
9	8	Edappally	10.50	Near Kuzhuvelippalam	9°58'56.67"N	76°19'39.02"E	LHS	56.90	861	Built-up area = 70.00 sqm
10	10	Chilavanoor	0.23	Near Amritha Hospital	10° 1'51.97"N	76°17'29.74"E	RHS	17.62	616	Built-up area = 70.00 sqm
11	11	Chilavanoor	2.43	Keerthi Nagar	10° 0'48.15"N	76°17'44.32"E	LHS	4.73	316	Built-up area = 70.00 sqm
12	12	Chilavanoor	3.20	Near Alpha ENT Hospital, Karukappally	10° 0'23.10"N	76°17'49.52"E	LHS	3.05	1201	Built-up area = 70.00 sqm
13	13	Chilavanoor	4.90	Near Kaloor stadium	9°59'44.63"N	76°18'4.04"E	LHS	5.74	751	Built-up area = 70.00 sqm
14	14	Chilavanoor	6.30	Near Kathrikadavu, Opp. DD Nest	9°59'2.58"N	76°18'9.53"E	LHS	12.25	597	Built-up area = 70.00 sqm
15	15	Chilavanoor	7.41	Near Railway Bridge	9°58'46.91"N	76°17'52.58"E	LHS	14.28	3988	Built-up area = 70.00 sqm
16	16	Chilavanoor	8.90	Subash Chandra Bose road	9°58'22.51"N	76°18'23.73"E	LHS	16.00	507	Built-up area = 70.00 sqm
17	17	Chilavanoor	9.55	Near Elamkulam Bridge	9°58'3.99"N	76°18'34.50"E	LHS	44.69	847	Built-up area = 80.00 sqm
18	18	Chilavanoor	11.15	Near Chilavanoor Bridge	9°57'15.72"N	76°18'54.76"E	LHS	40.00	3414	Built-up area = 70.00 sqm

Sl.No.	Jetty No.	Jetty/Terminal Location					Location	Existing Canal width at near jetty location (m)	Land Area (sqm)	Jetty Area
		Name of the canal	Chainage	Name of the terminal	Co-Ordinates					
					Latitude	Longitude				
19	19	Thevara-Perandoor	0.150	Perandoor	10° 1'8.39"N	76°16'58.50"E	LHS	43.85	54.90	Built-up area = 70.00 sqm
20	20	Thevara-Perandoor	0.420	Perandoor Railway Bridge	10° 1'1.71"N	76°16'50.91"E	RHS	101.83	1891	Built-up area = 70.00 sqm
21	21	Thevara-Perandoor	0.950	Near Chinmaya Vidyalaya	10° 0'46.73"N	76°17'2.63"E	LHS	45.76	53.3	Built-up area = 70.00 sqm
22	22	Thevara-Perandoor	1.63	Near PJ Antony Ground	10° 0'26.57"N	76°17'6.03"E	RHS	49.85	1006	Built-up area = 70.00 sqm
23	23	Thevara-Perandoor	2.23	Near Pottakkuzhy Bridge	10° 0'16.05"N	76°17'15.09"E	LHS	21.41	1074	Built-up area = 70.00 sqm
24	24	Thevara-Perandoor	3.55	Near Kaloor Market	9°59'43.97"N	76°17'22.79"E	RHS	9.12	2790	Built-up area = 70.00 sqm
25	25	Thevara-Perandoor	5.88	Near KSRTC/KSINC	9°58'33.26"N	76°17'28.64"E	LHS	9.68	640	Built-up area = 70.00 sqm
26	26	Thevara-Perandoor	6.57	P&T colony	9°58'16.35"N	76°17'35.00"E	LHS	13.89	549	Built-up area = 70.00 sqm
27	27	Thevara-Perandoor	7.64	Kadavantra Metro station	9°57'57.37"N	76°17'51.99"E	LHS	12.98	539	Built-up area = 80.00 sqm
28	28	Thevara-Perandoor	9.22	Yuvajana samajam road, Panampilly Nagar walk way	9°57'6.16"N	76°17'58.24"E	RHS	19.26	85.1	Built-up area = 70.00 sqm
29	30	Thevara	0.24	Near Market	9°56'39.52"N	76°17'39.46"E	RHS	19.36	268	Built-up area = 70.00 sqm
30	29	Thevara	1.31	Near Kallupalam	9°56'47.14"N	76°18'13.43"E	LHS	15.92	249	Built-up area = 70.00 sqm

Edappally Jetty 1



Edappally Jetty 2



KEY ALIGNMENT

DISTRICT : ERNAKULAM
VILLAGE : CHERANALLUR
SURVEY NO : 6A

JETTY

PROJECT: *INTEGRATED URBAN REGENERATION & WATER TRANSPORT SYSTEM*

CLIENT: **Kochi Metro Rail Limited**

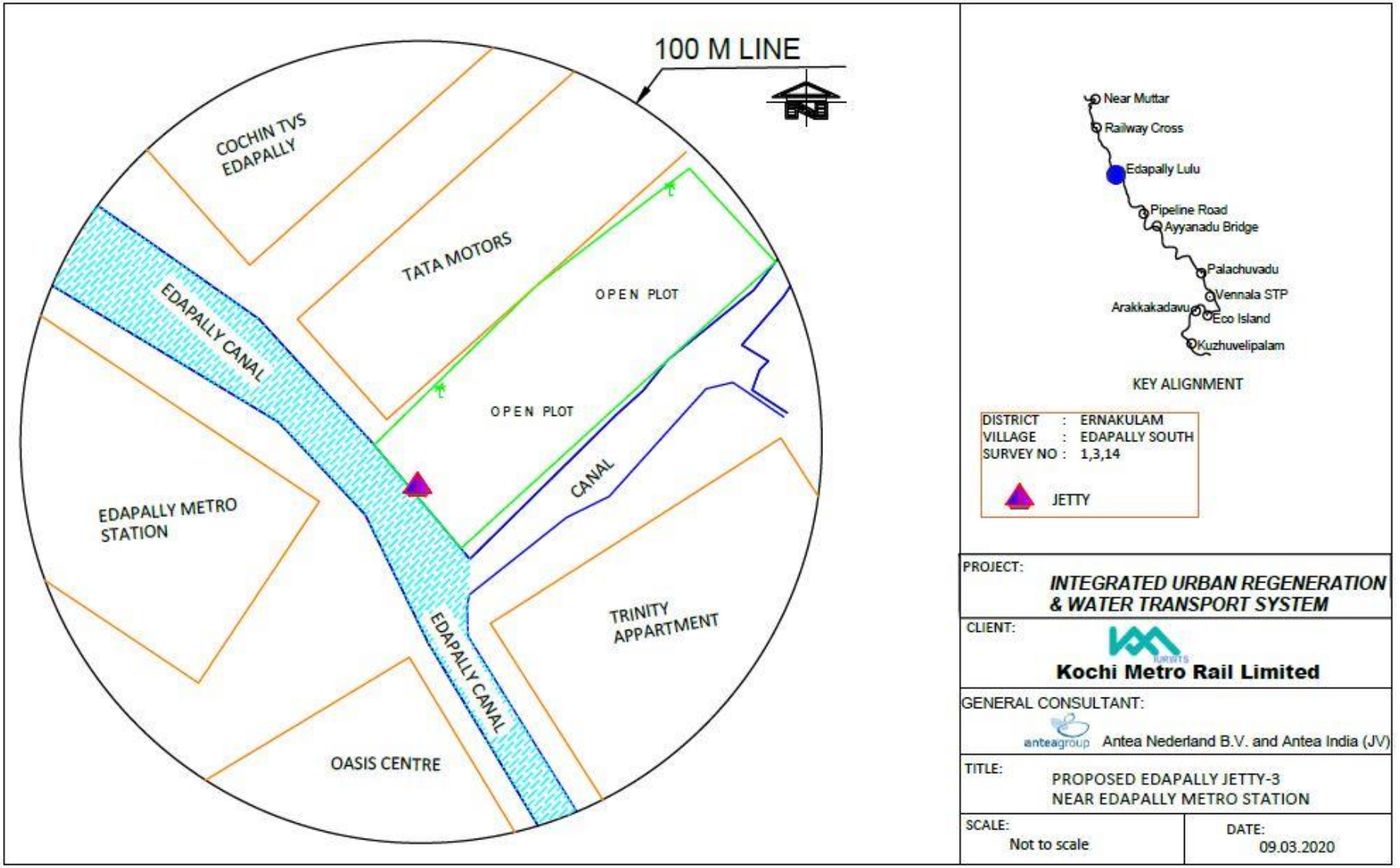
GENERAL CONSULTANT: anteagroup Antea Nederland B.V. and Antea India (JV)

TITLE: PROPOSED EDAPALLY JETTY-2 NEAR RAILWAY CROSS

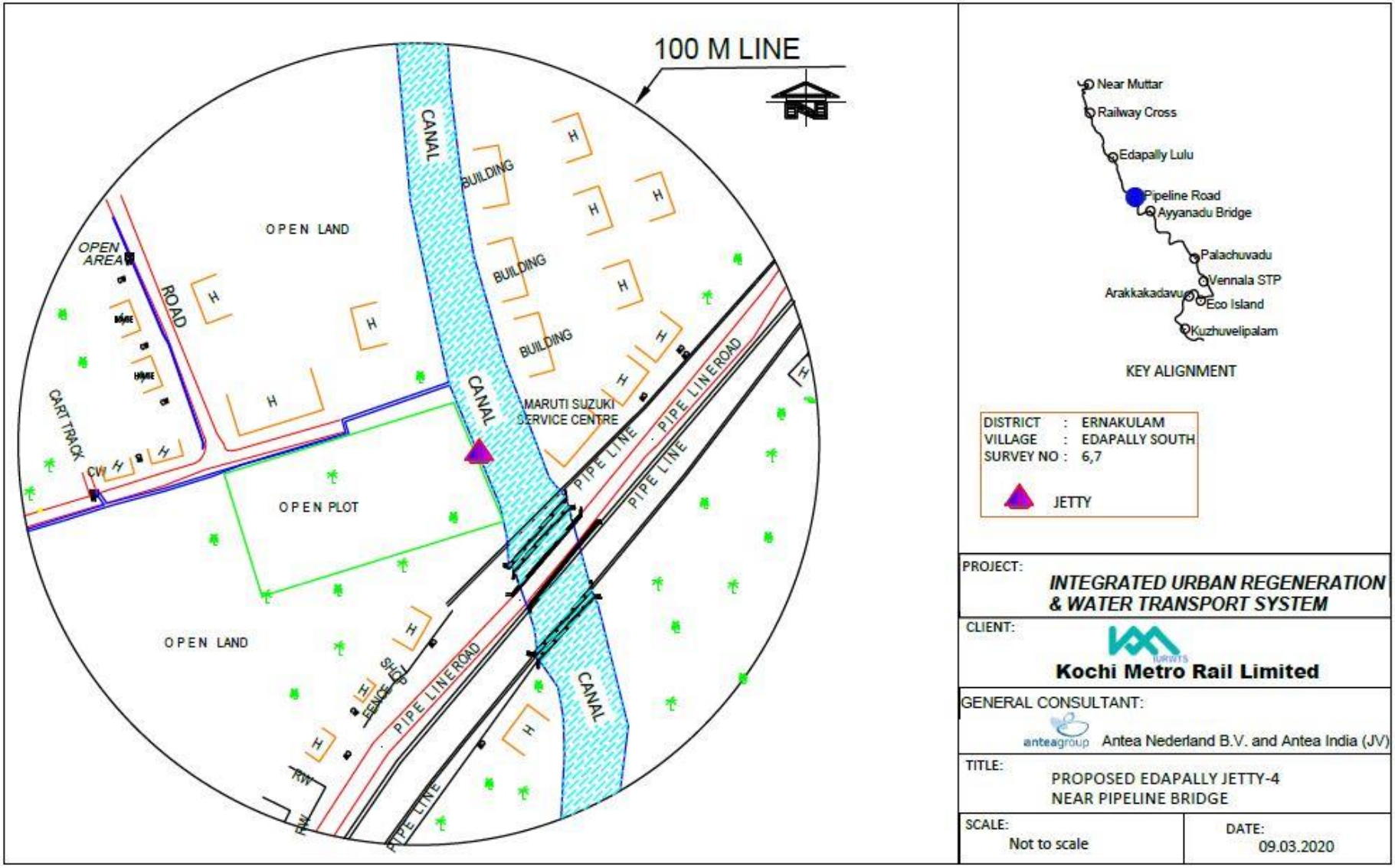
SCALE: Not to scale

DATE: 09.03.2020

Edappally Jetty 3



Edappally Jetty 4



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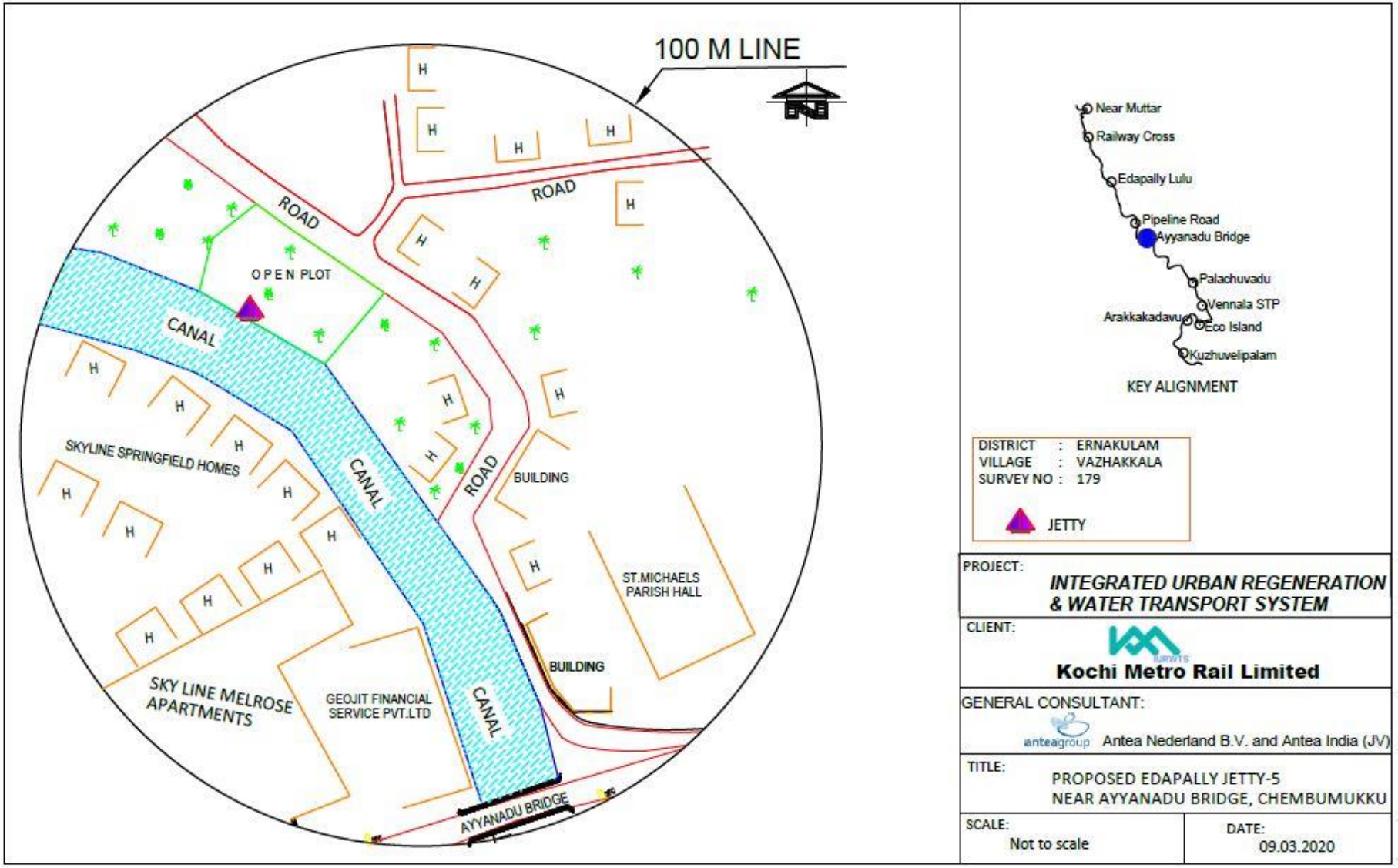

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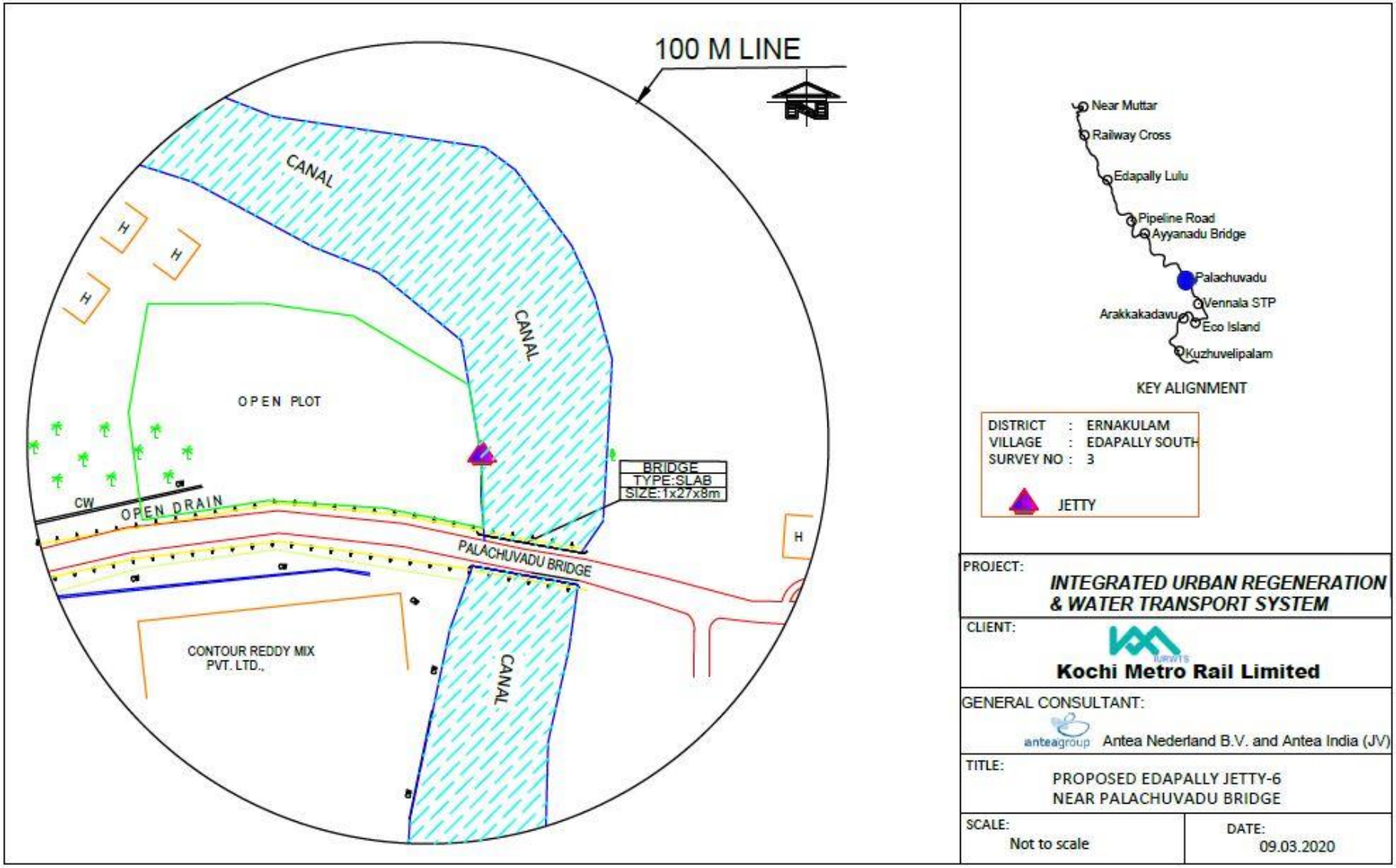

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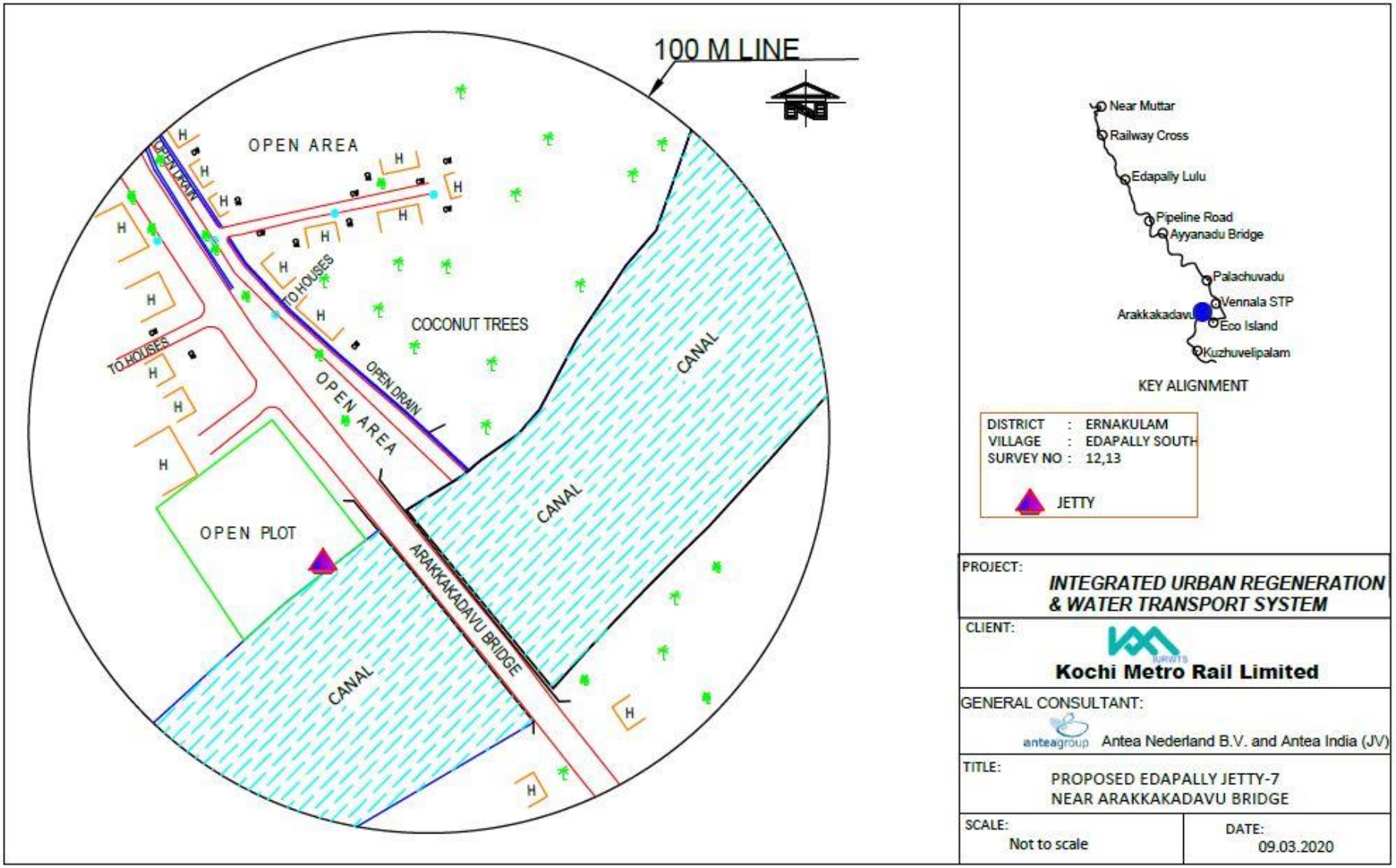

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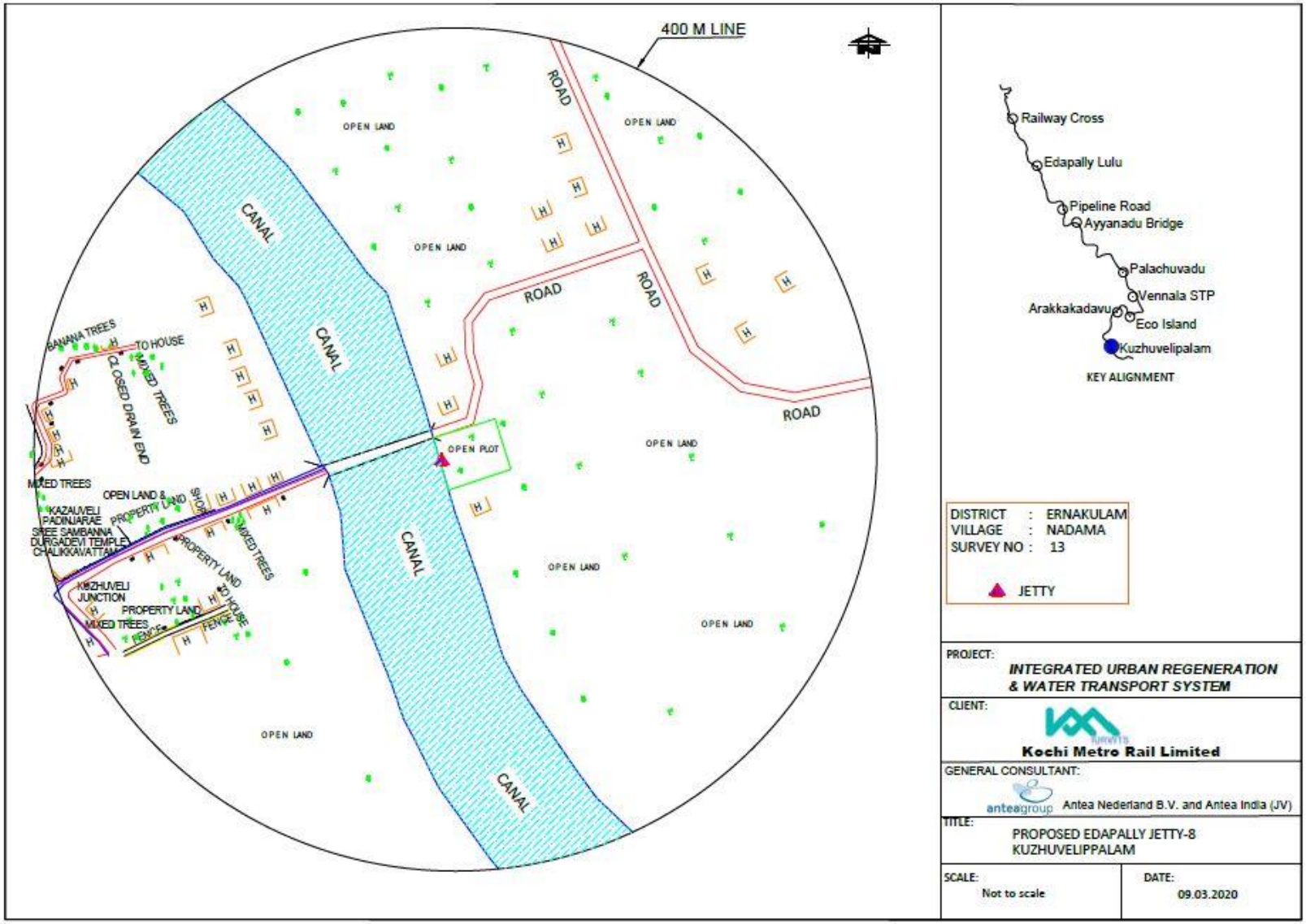

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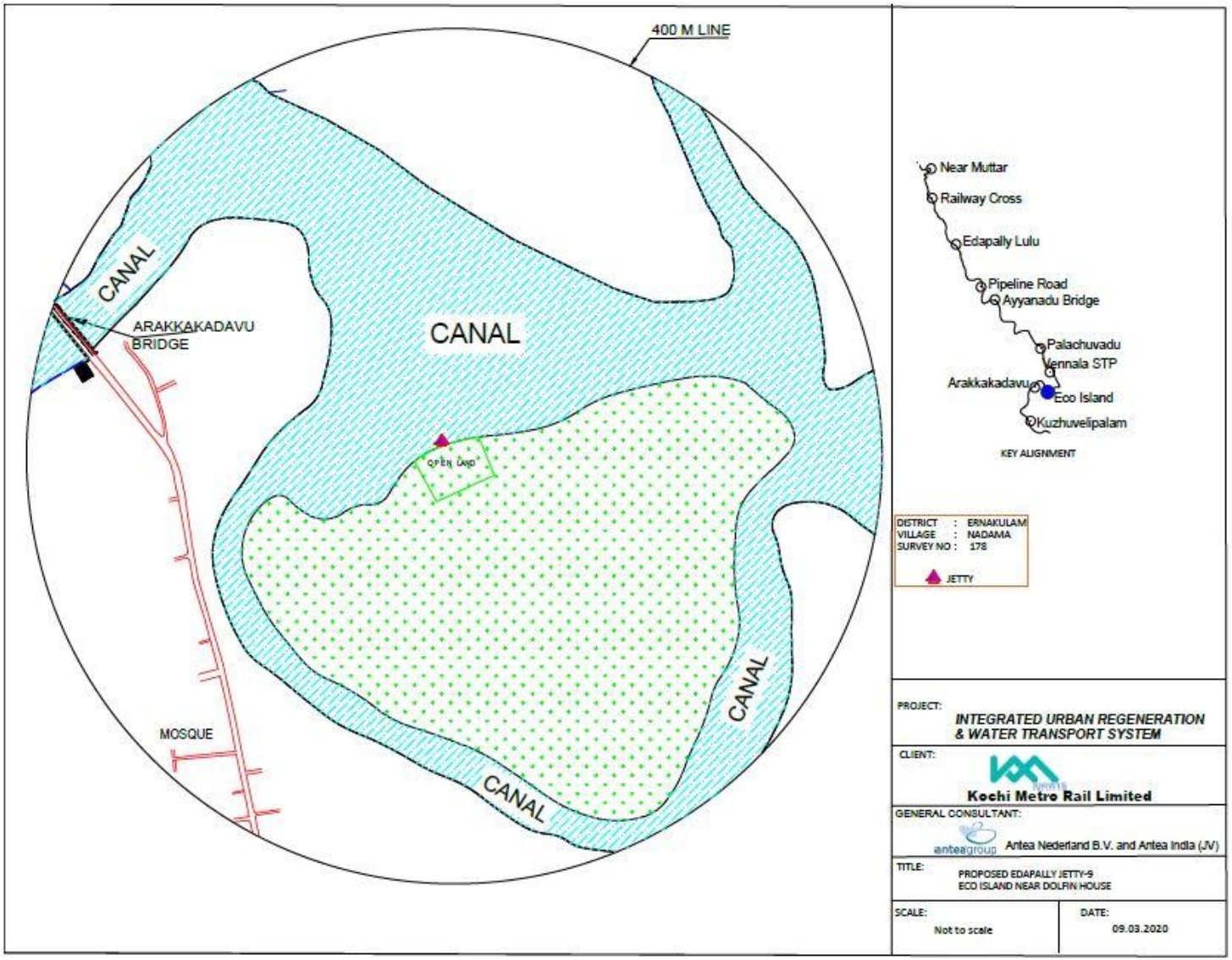
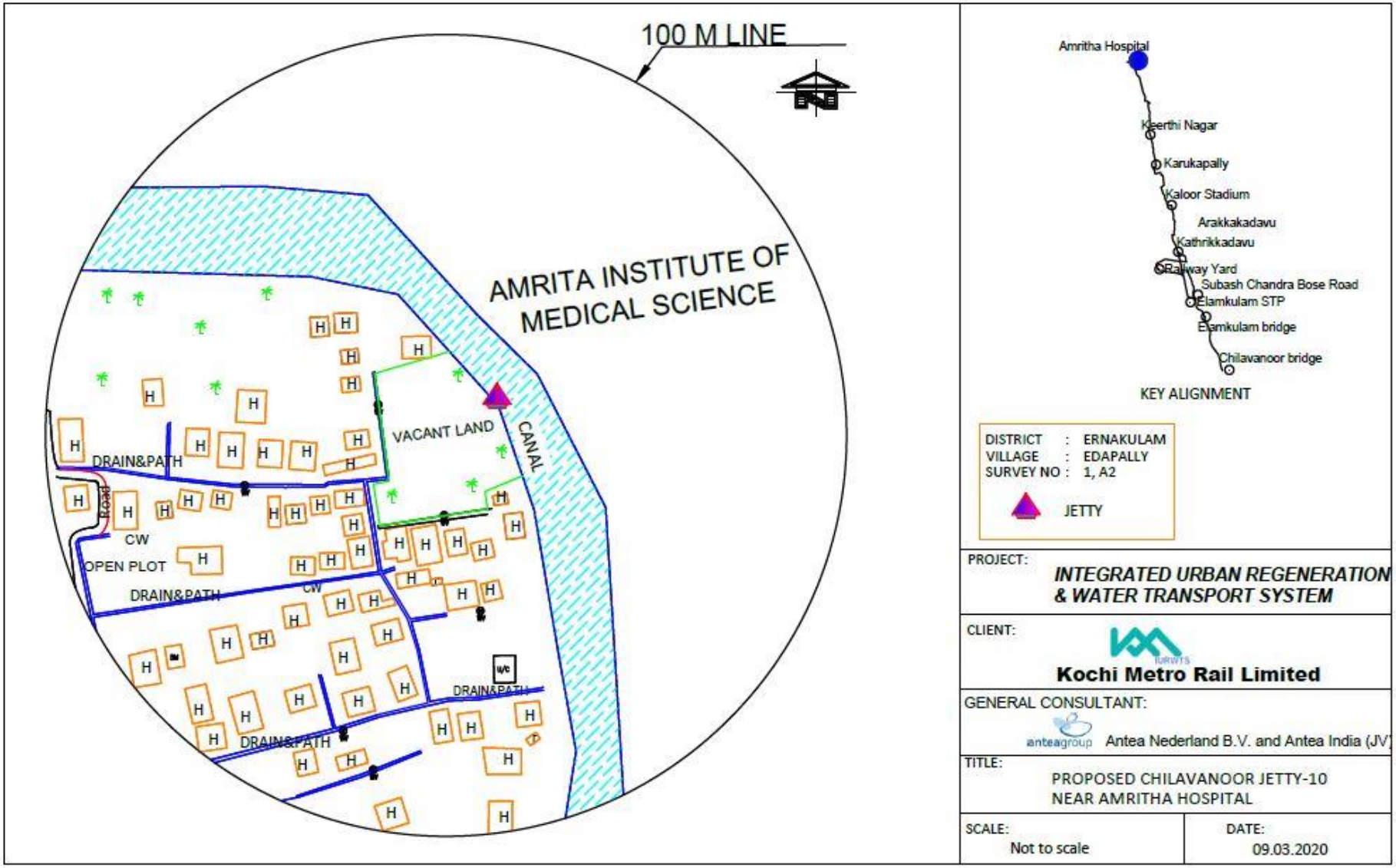
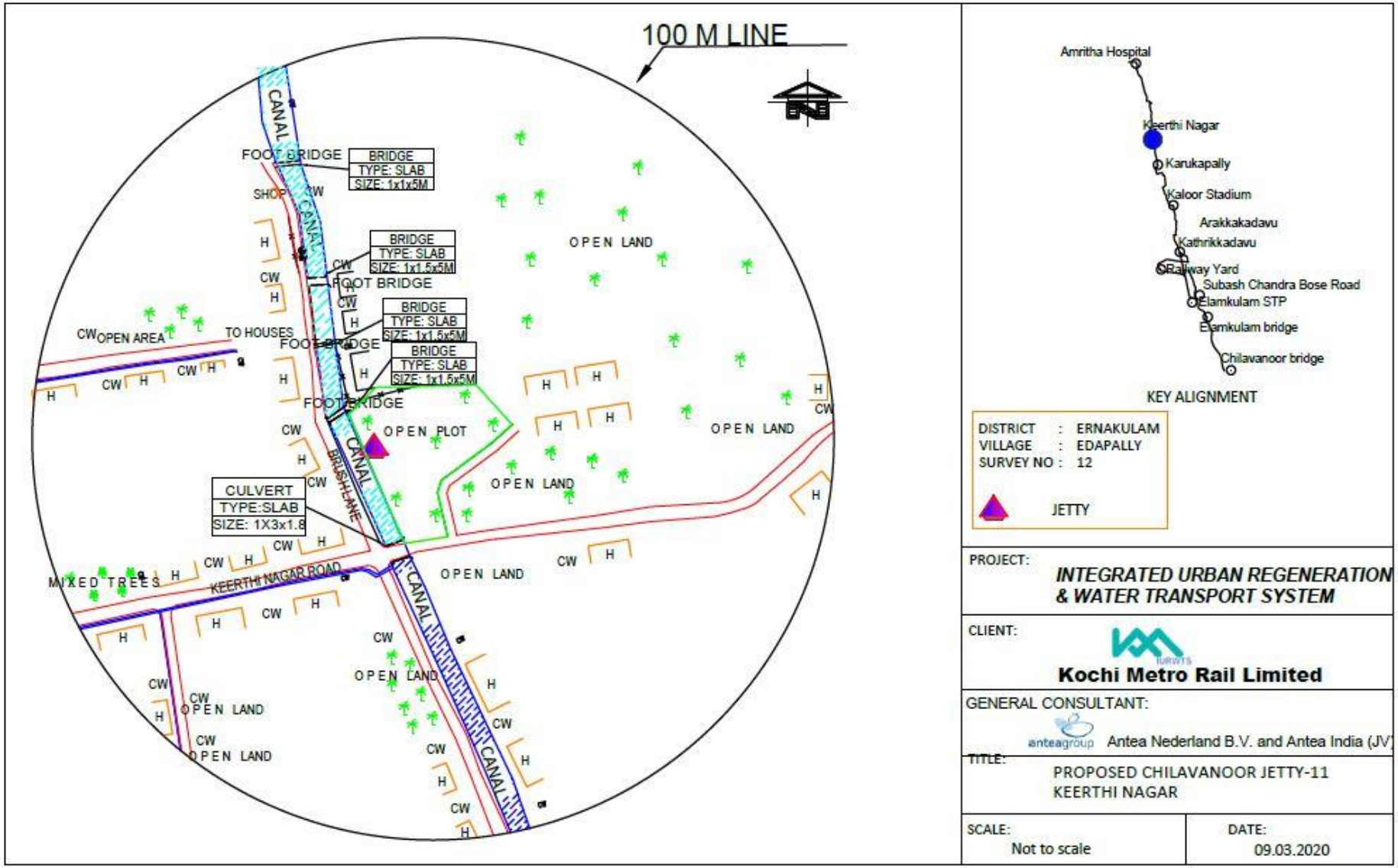


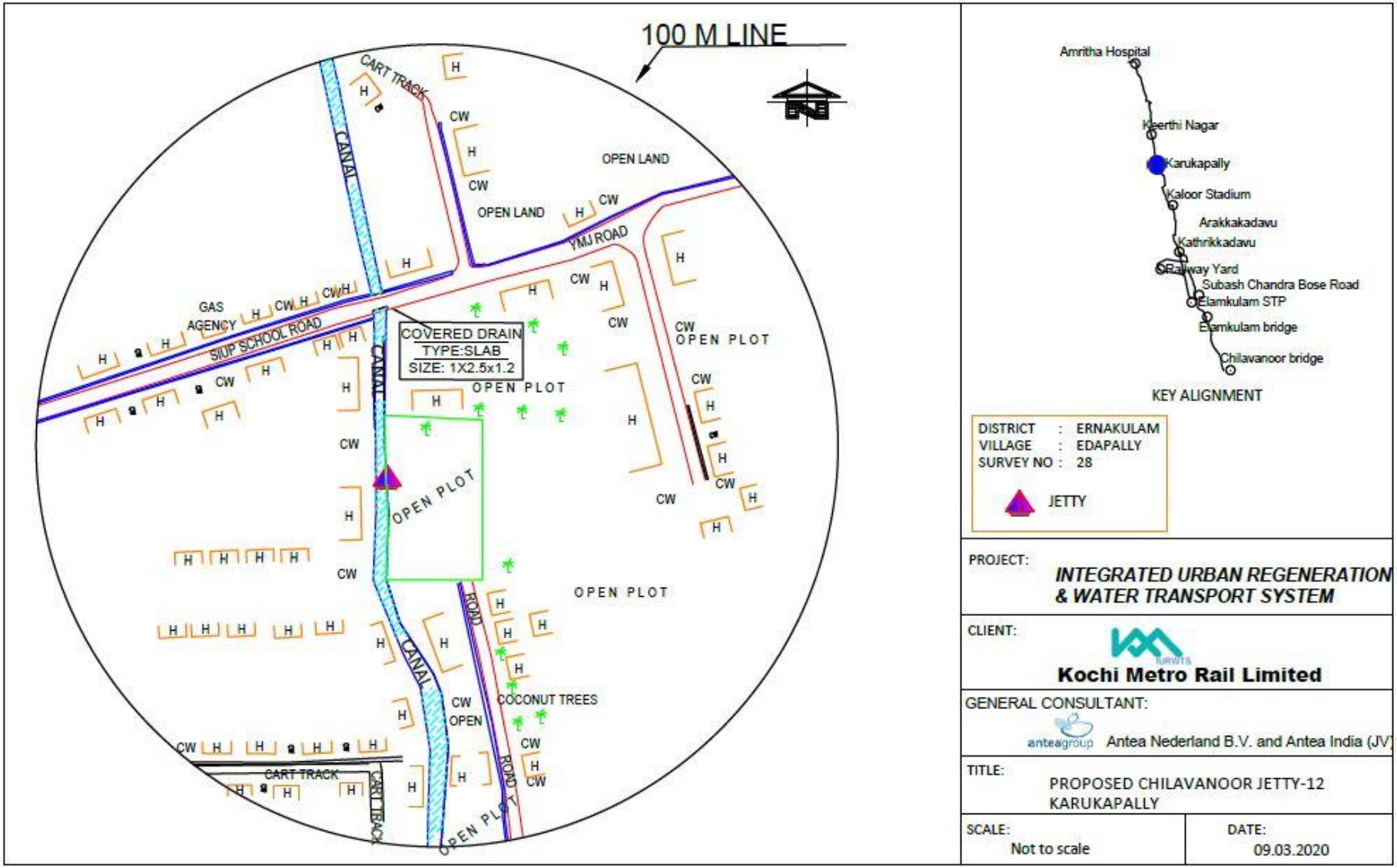
Chilavanoor Jetty 10



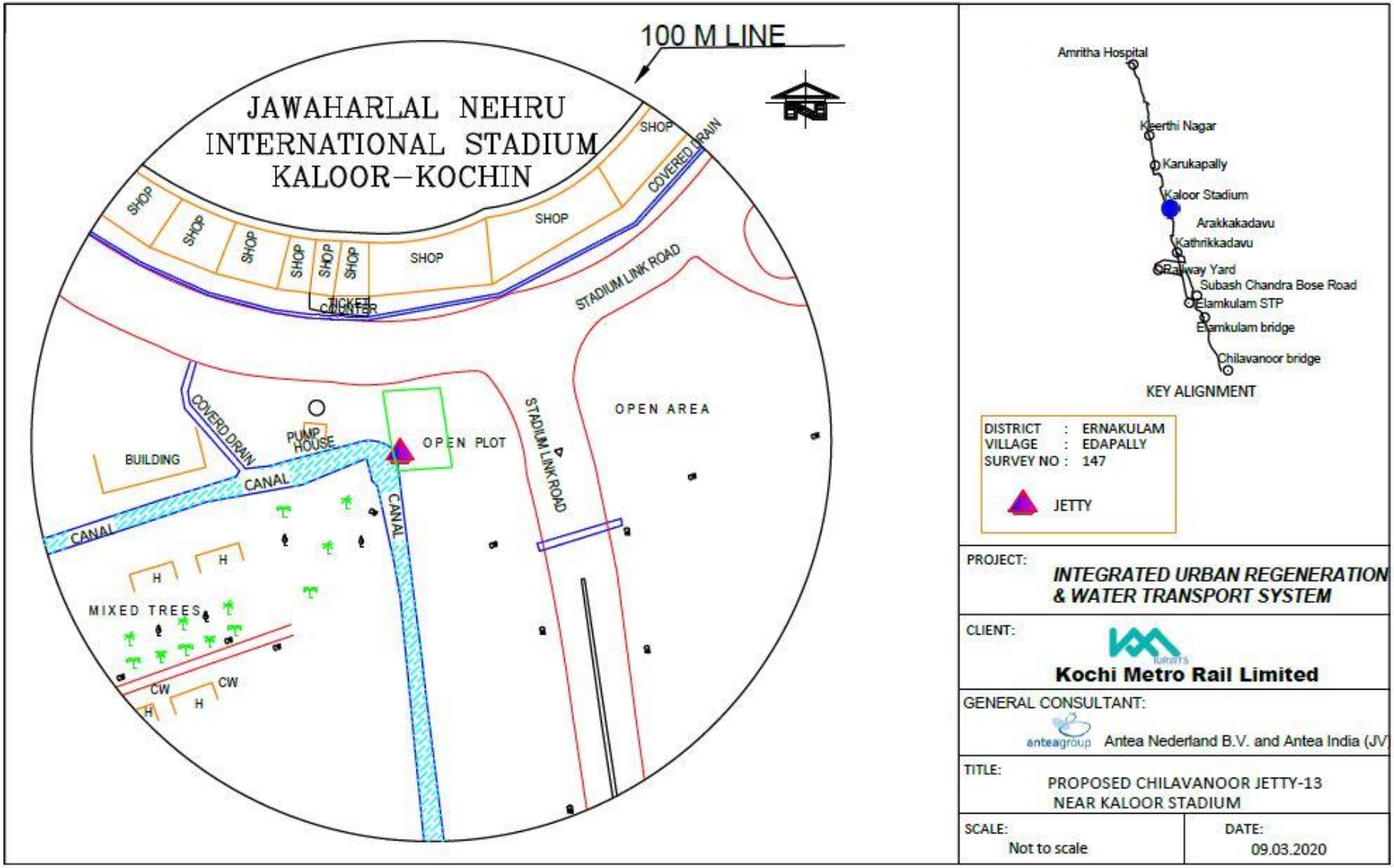
Chilavanoor Jetty 11



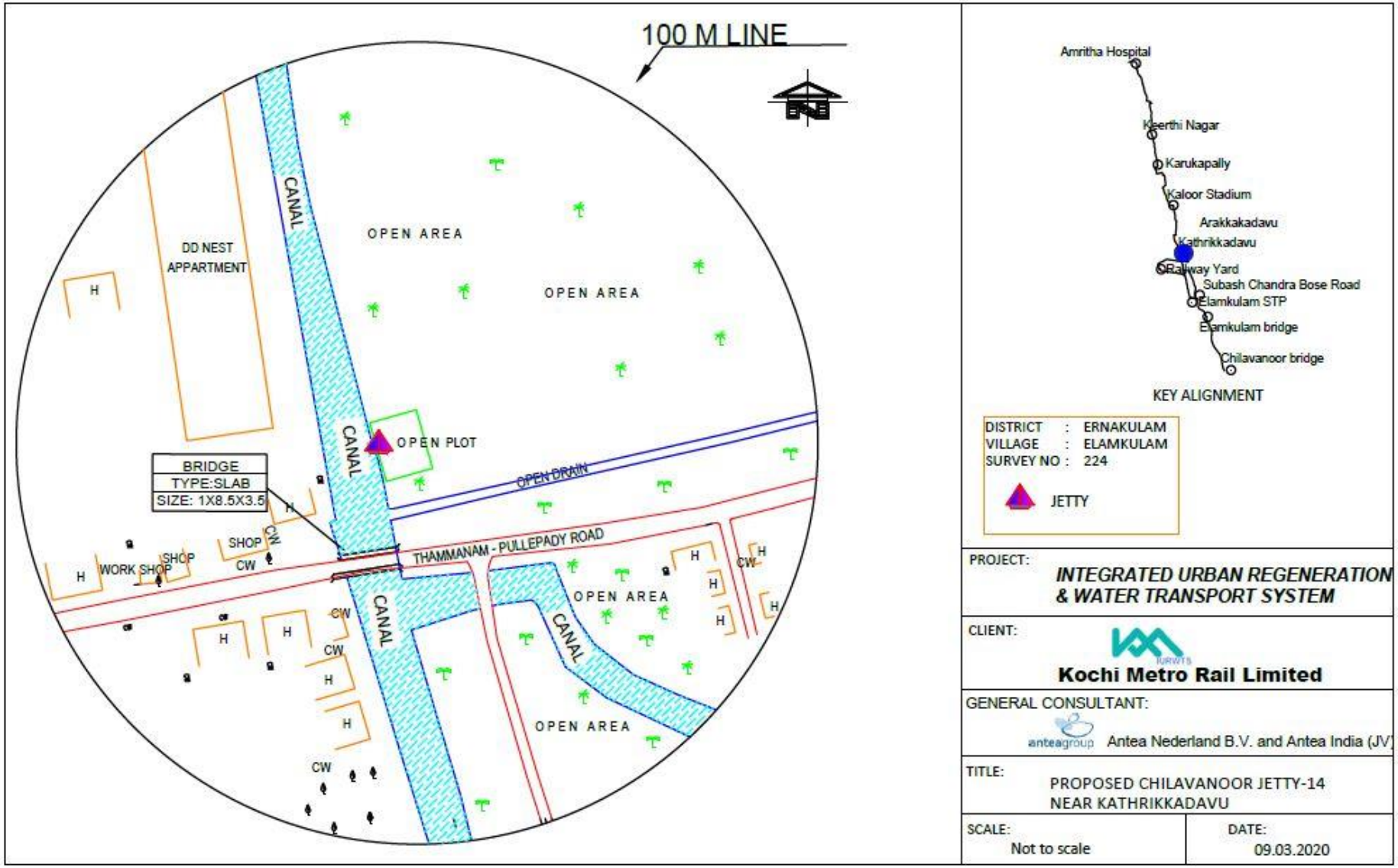
Chilavanoor Jetty 12



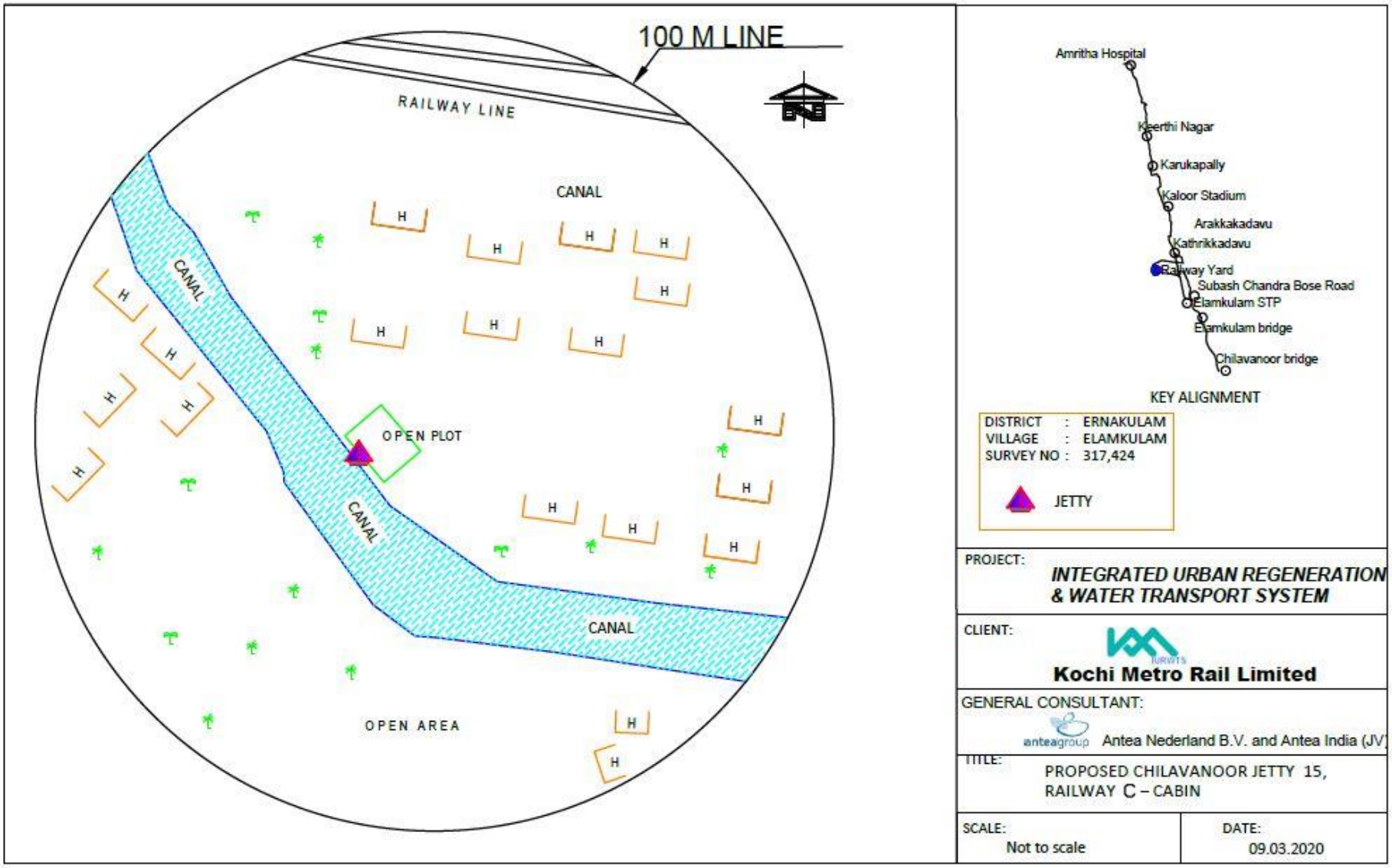
Chilavanoor Jetty 13



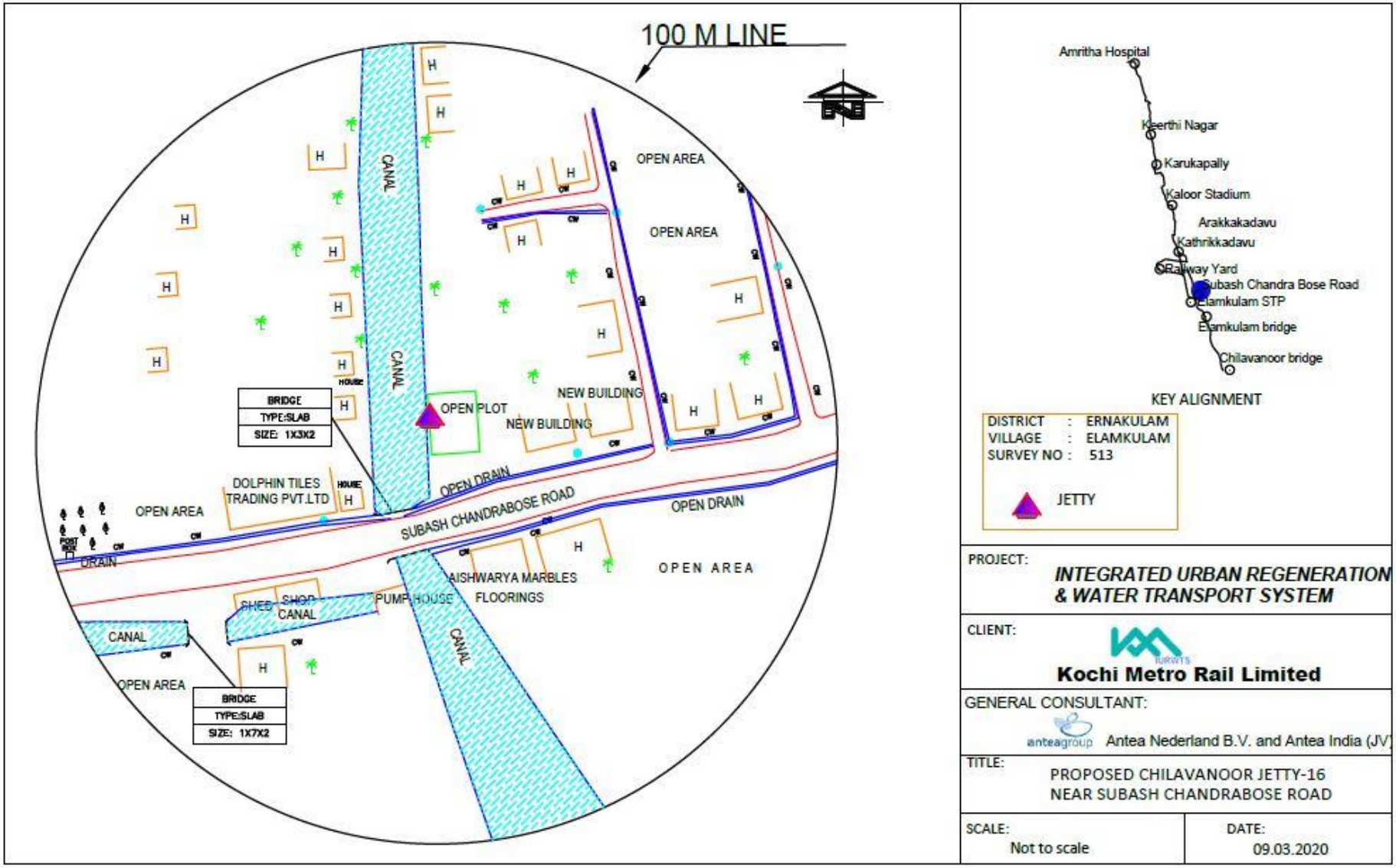
Chilavanoor Jetty 14



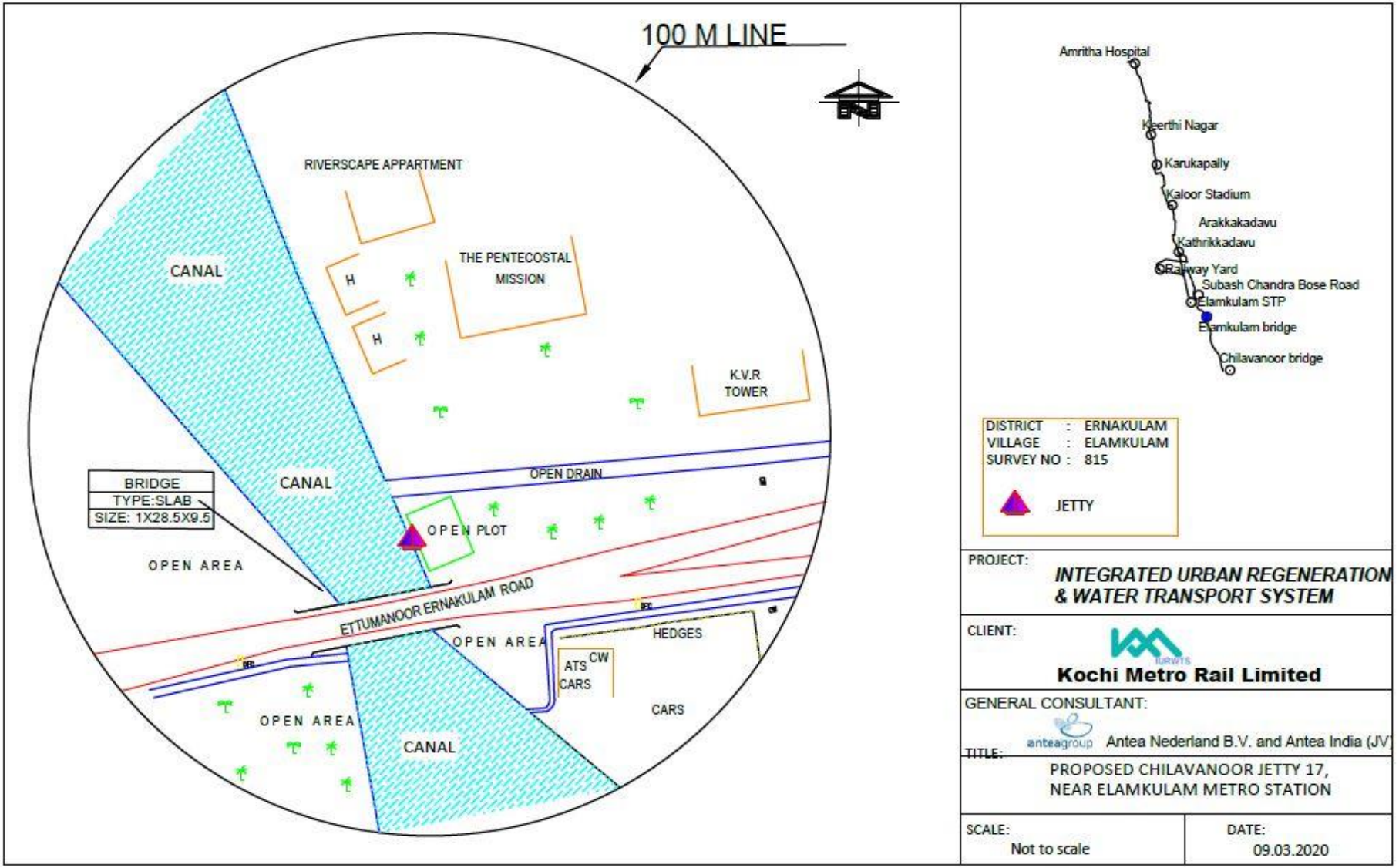
Chilavanoor Jetty 15



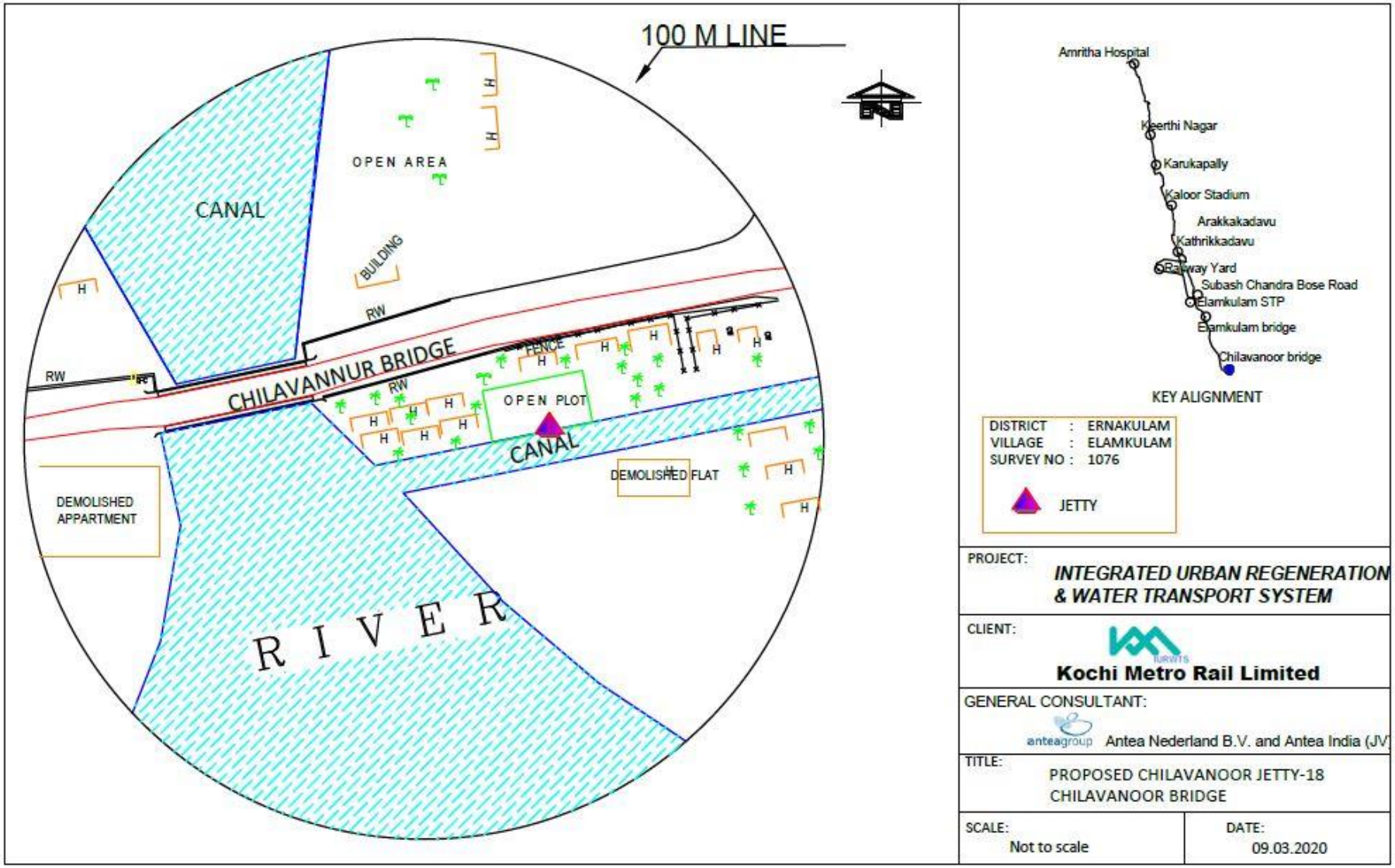
Chilavanoor Jetty 16



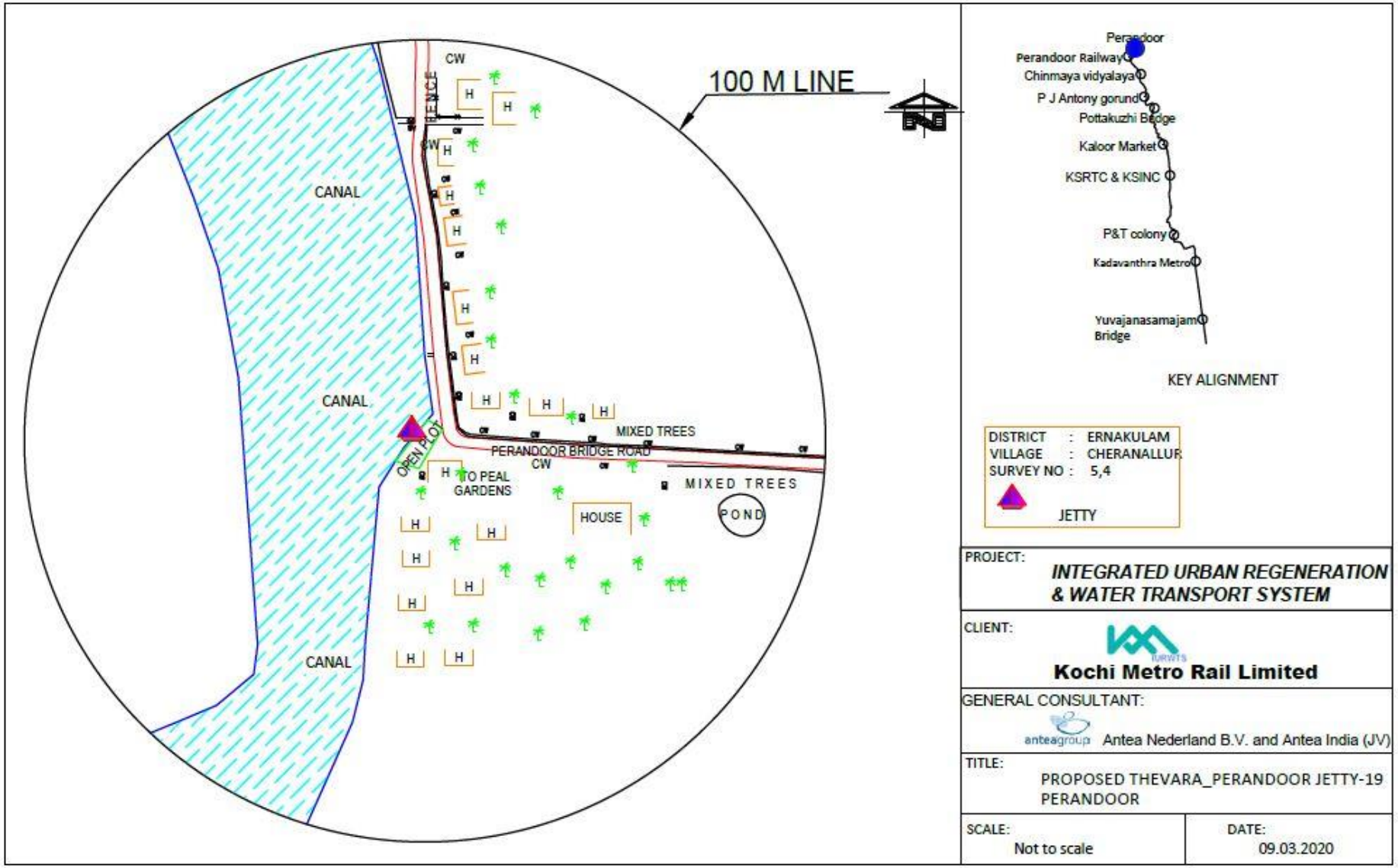
Chilavanoor Jetty 17



Chilavanoor Jetty 18



Thevara Perandoor Jetty 19



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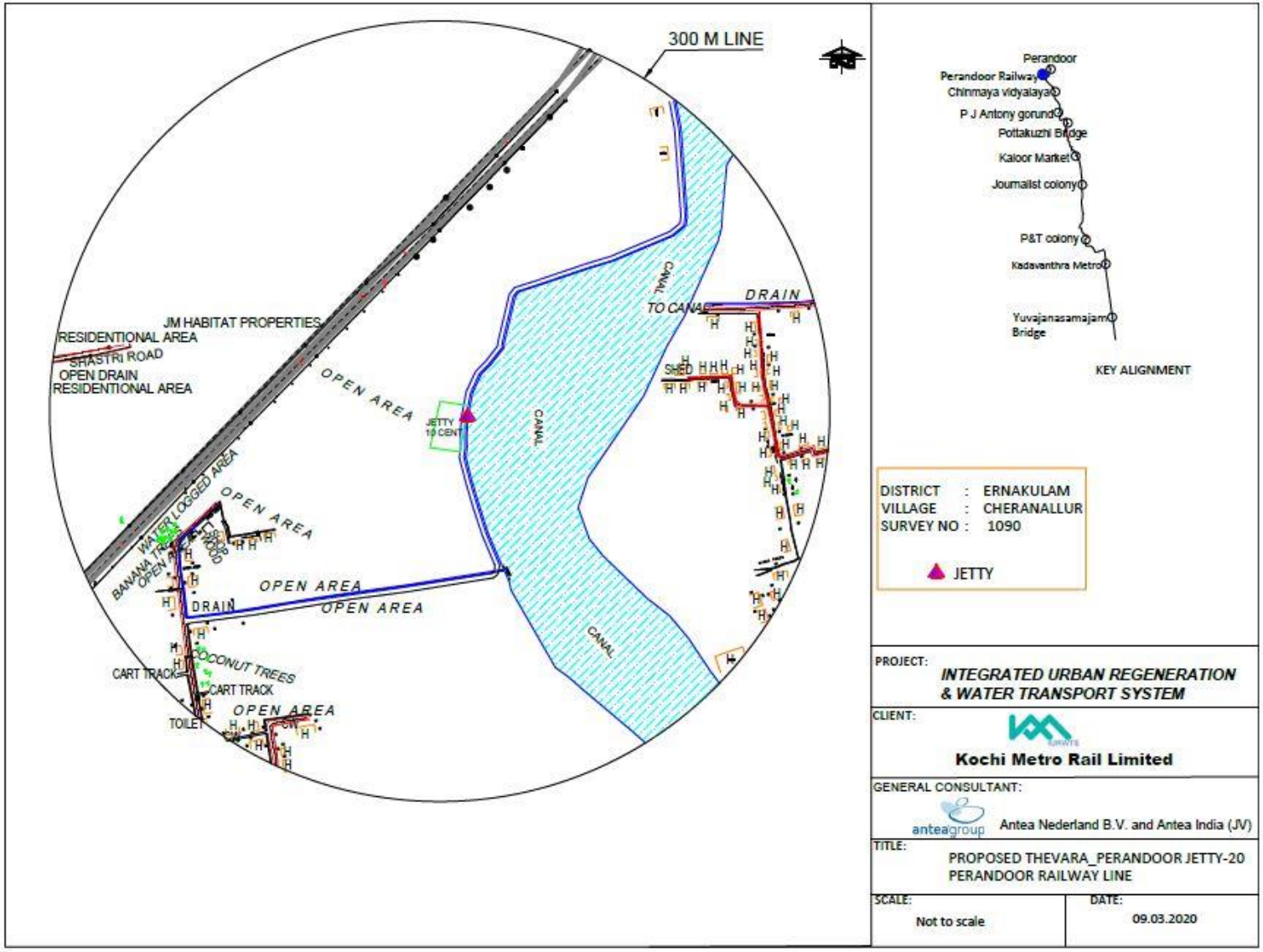

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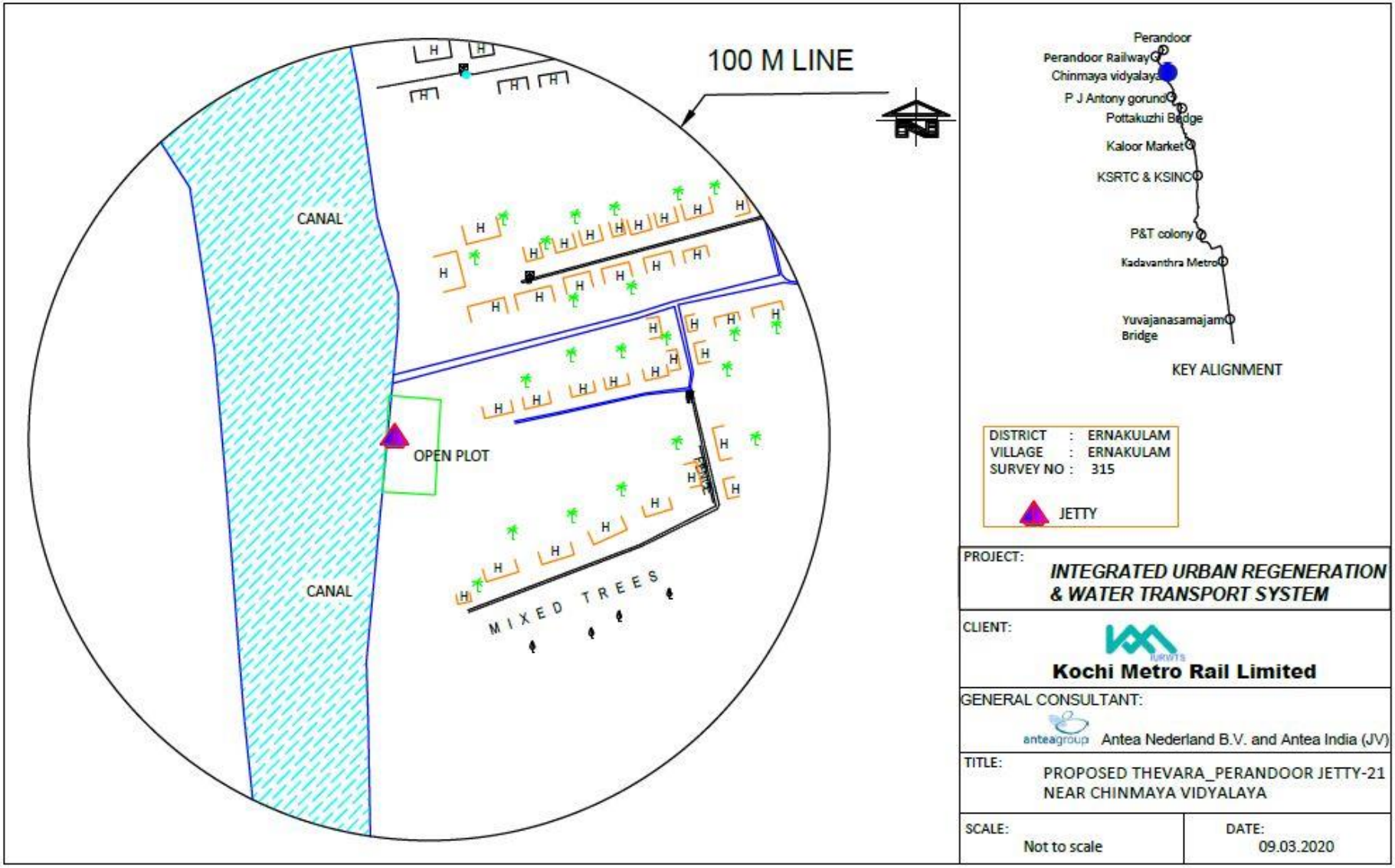

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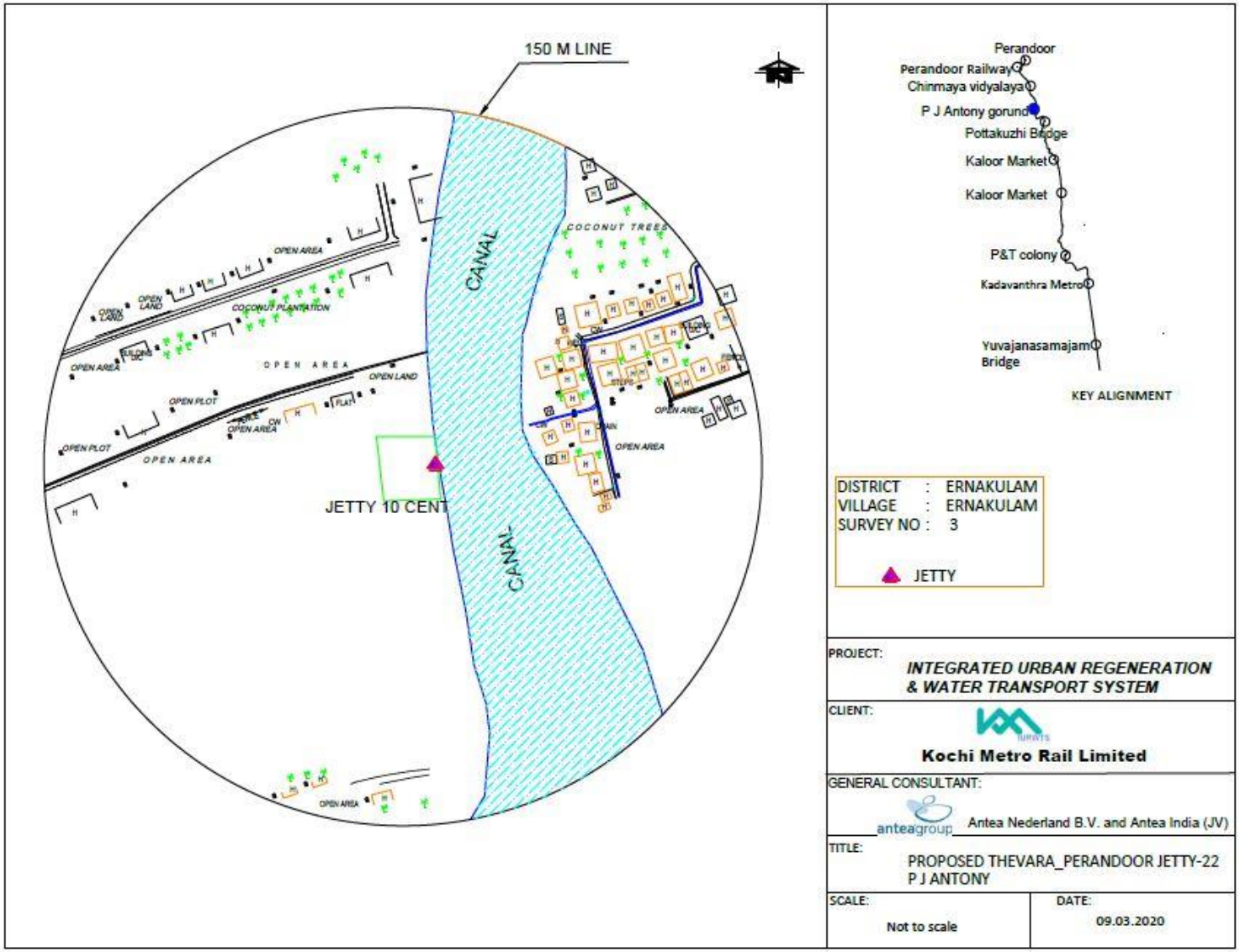

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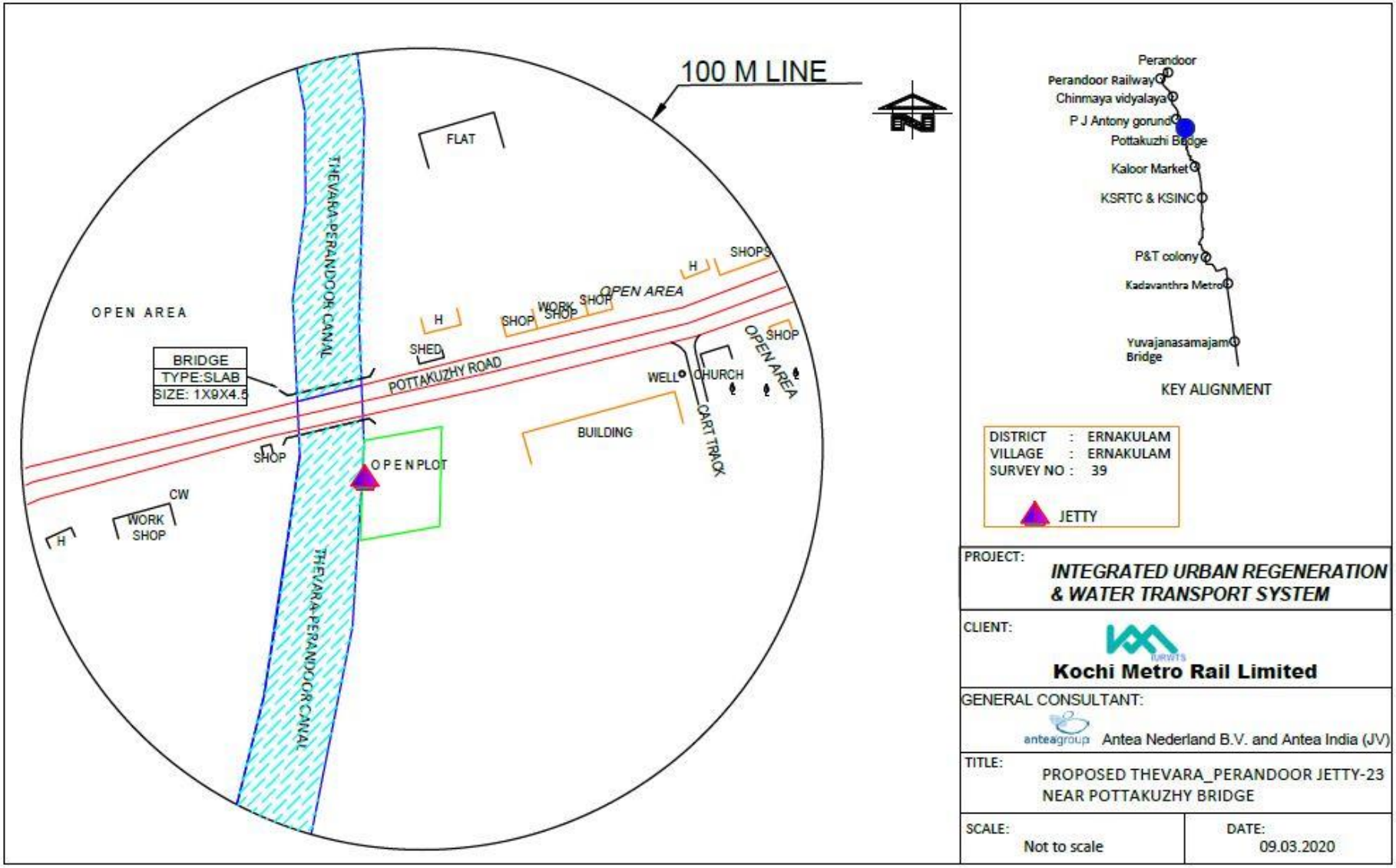

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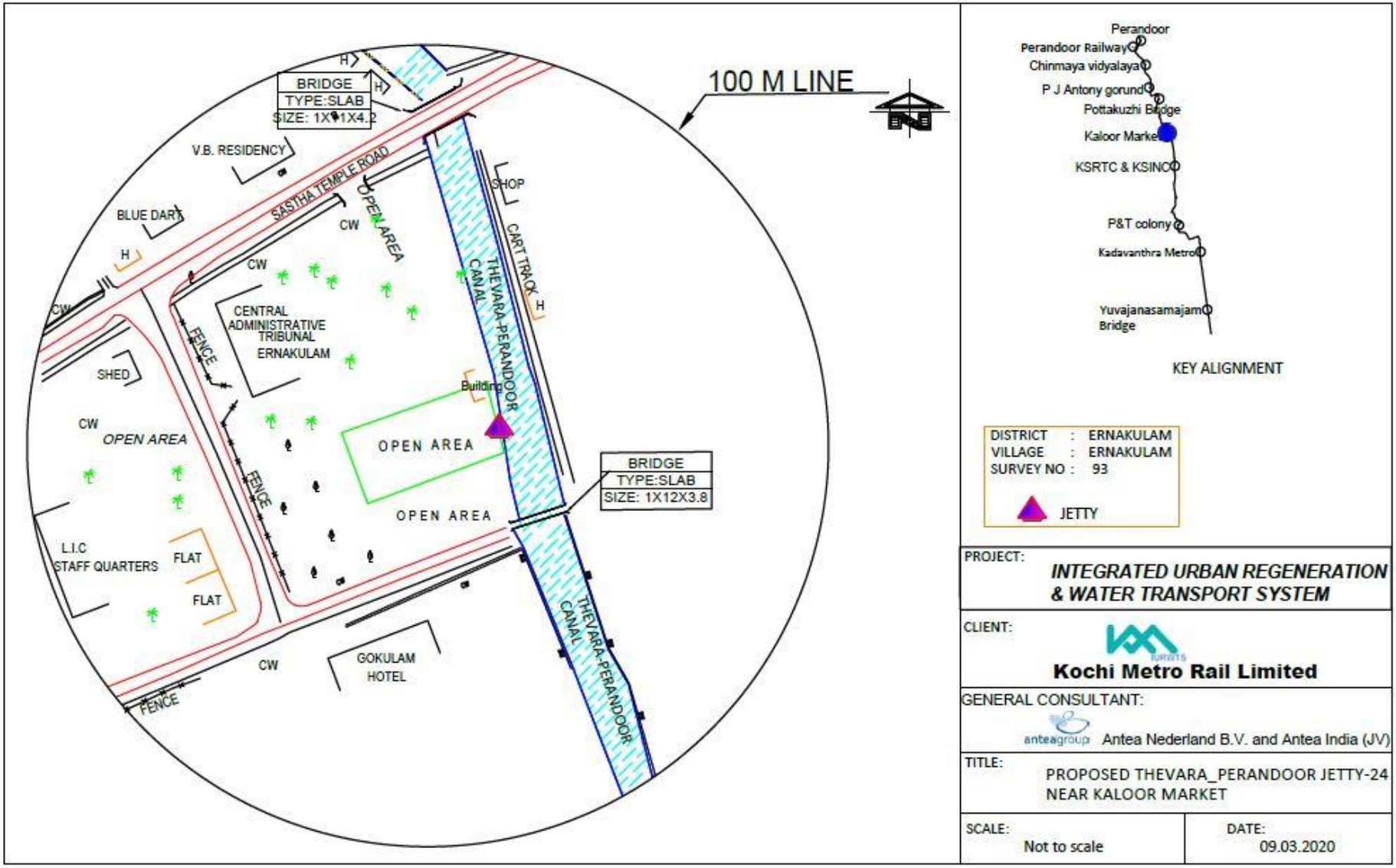

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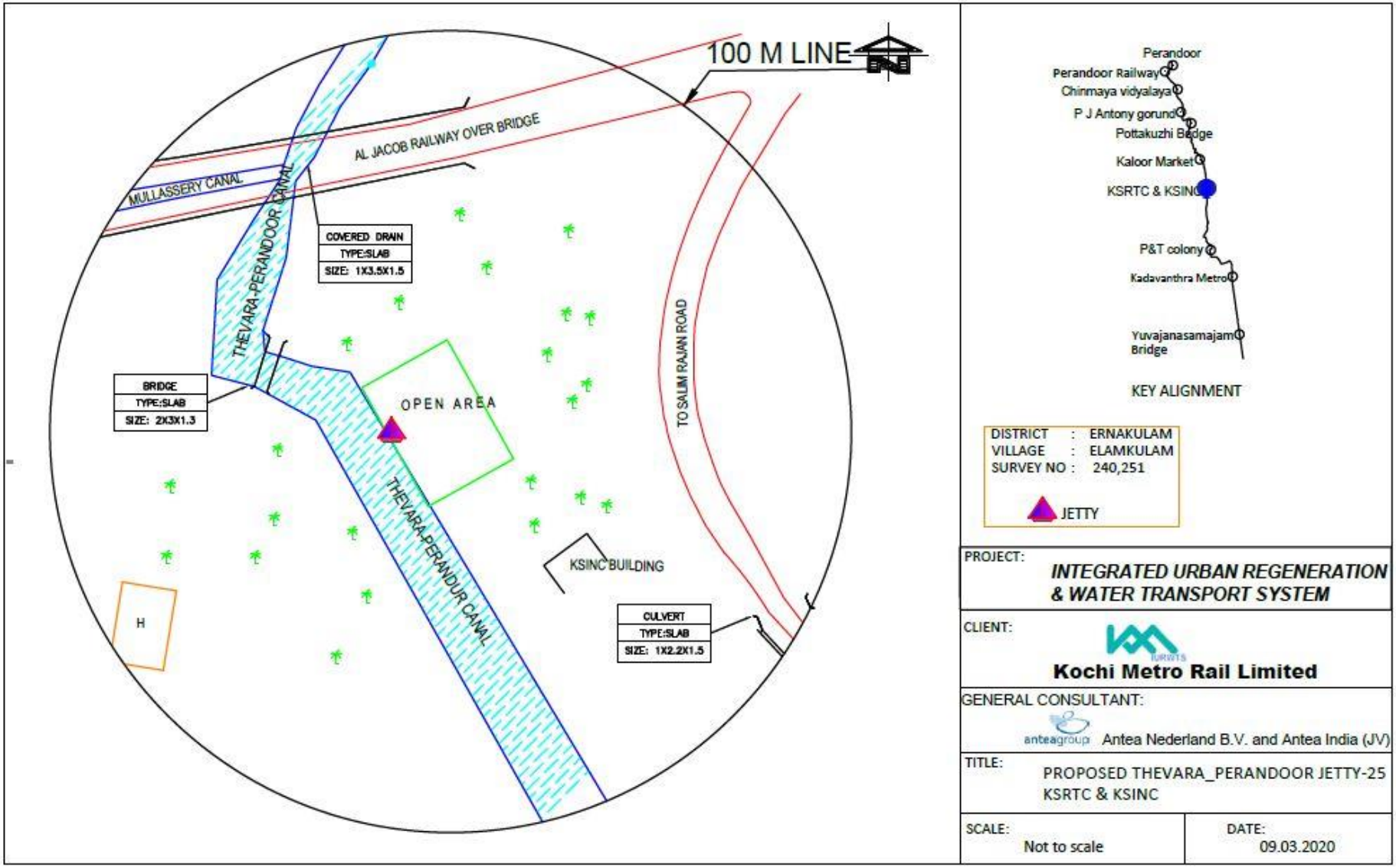

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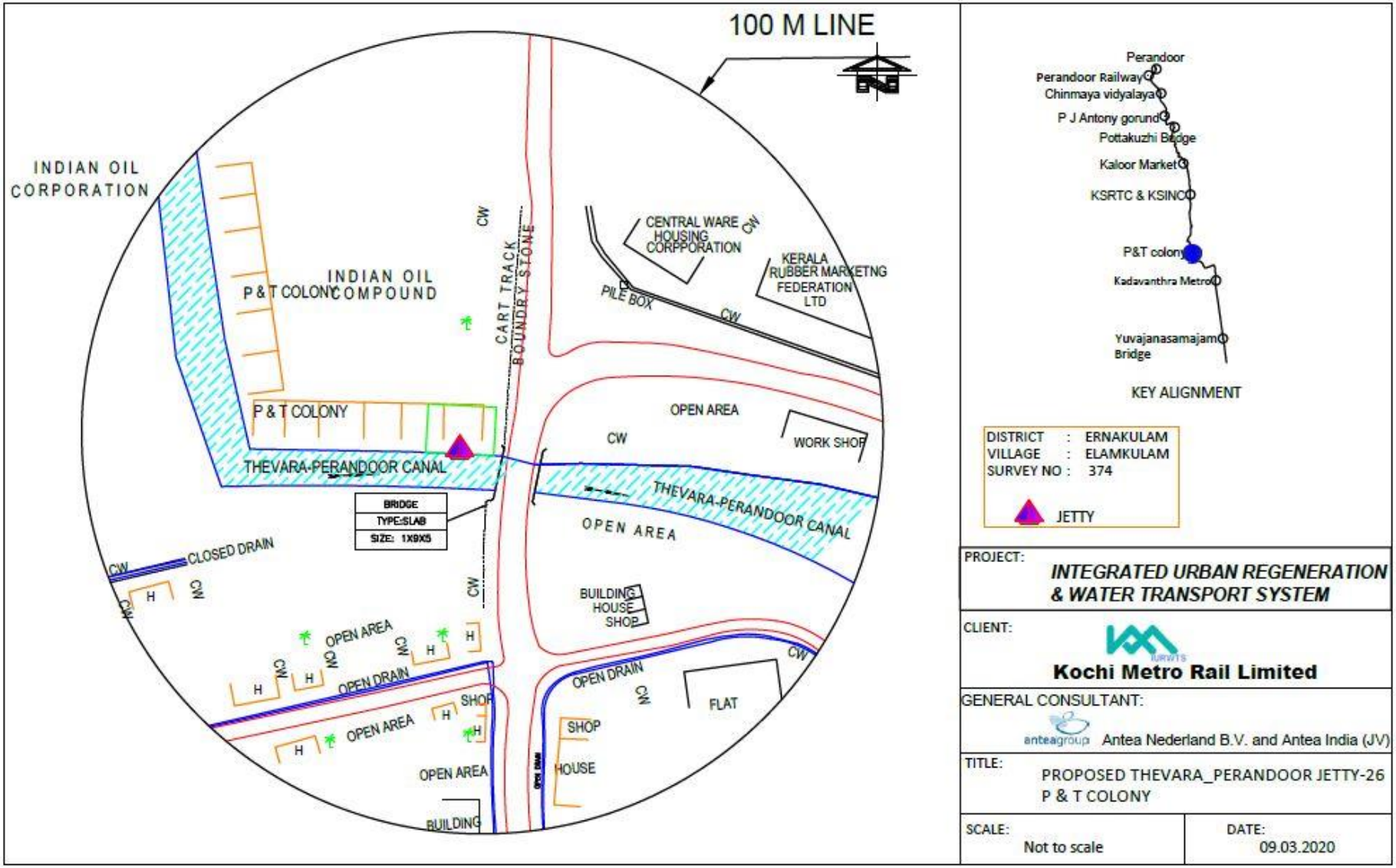

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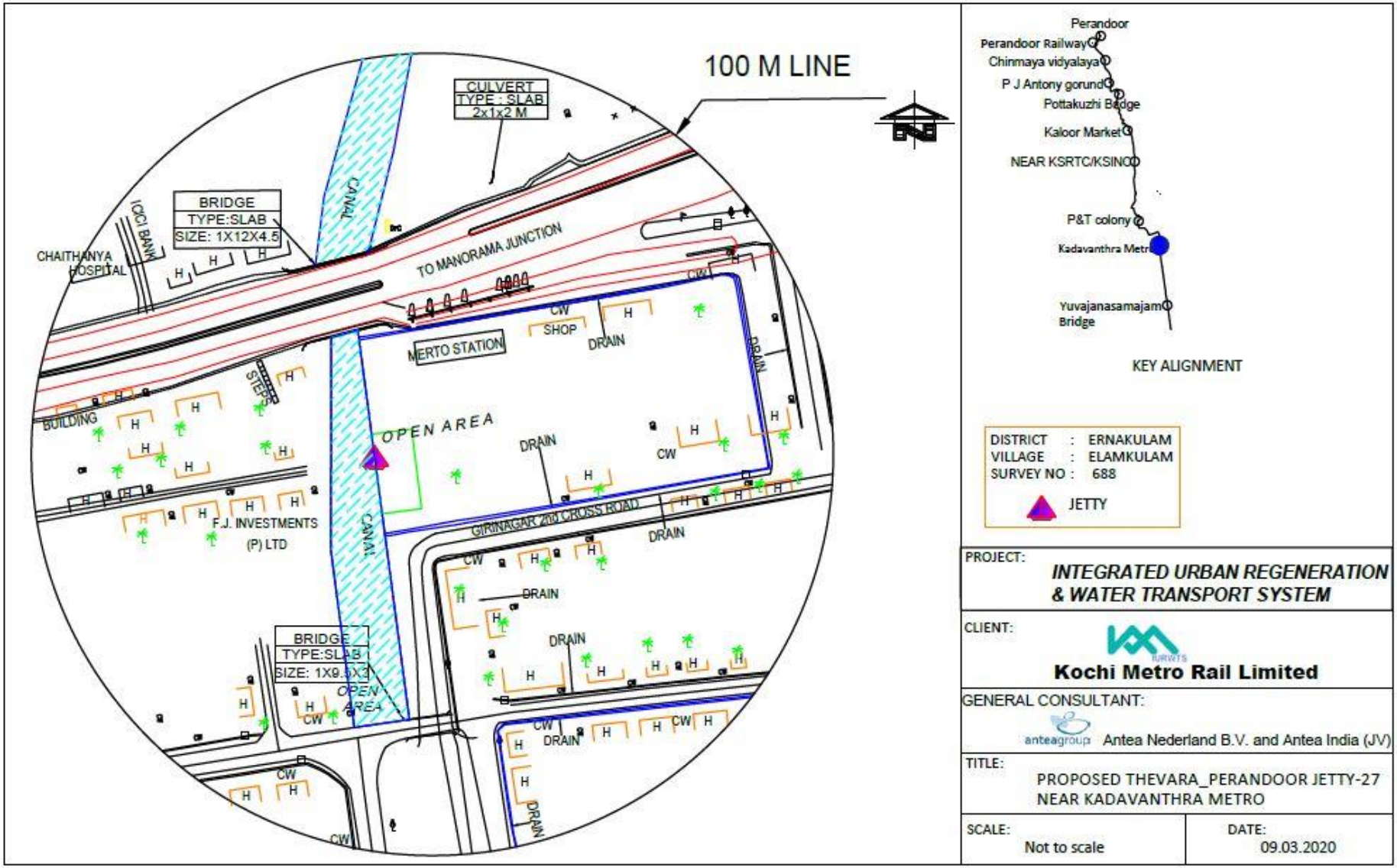

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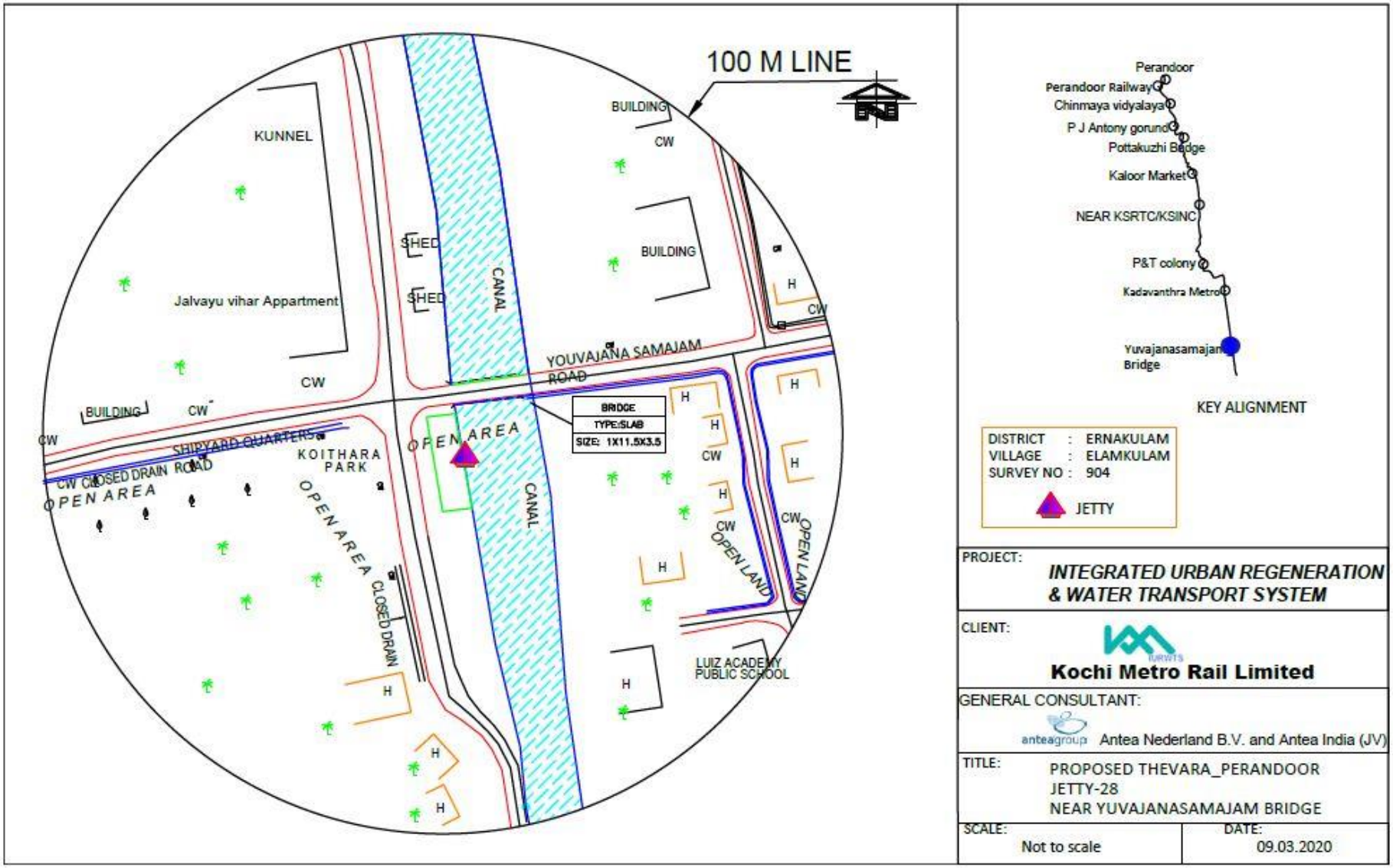

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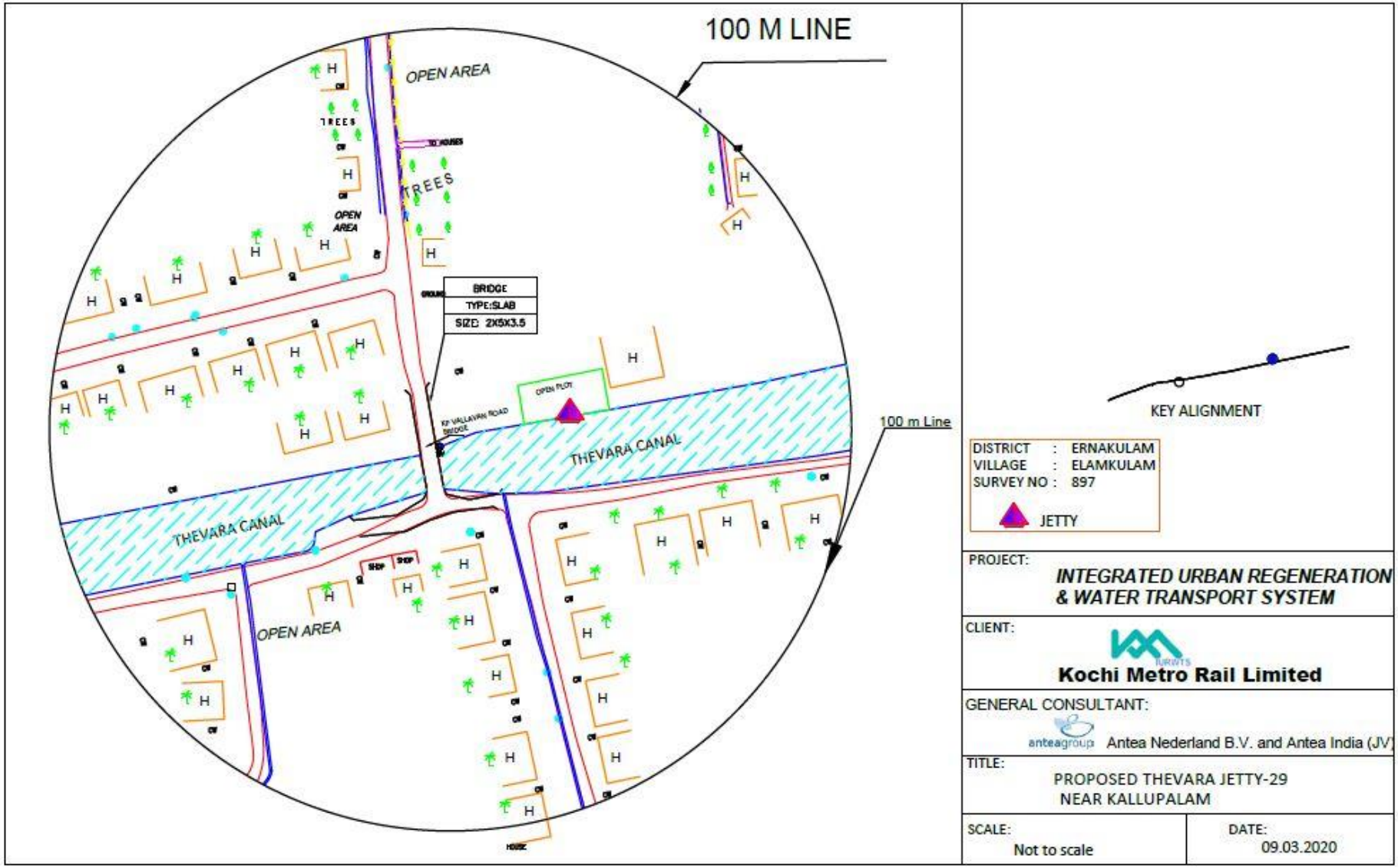

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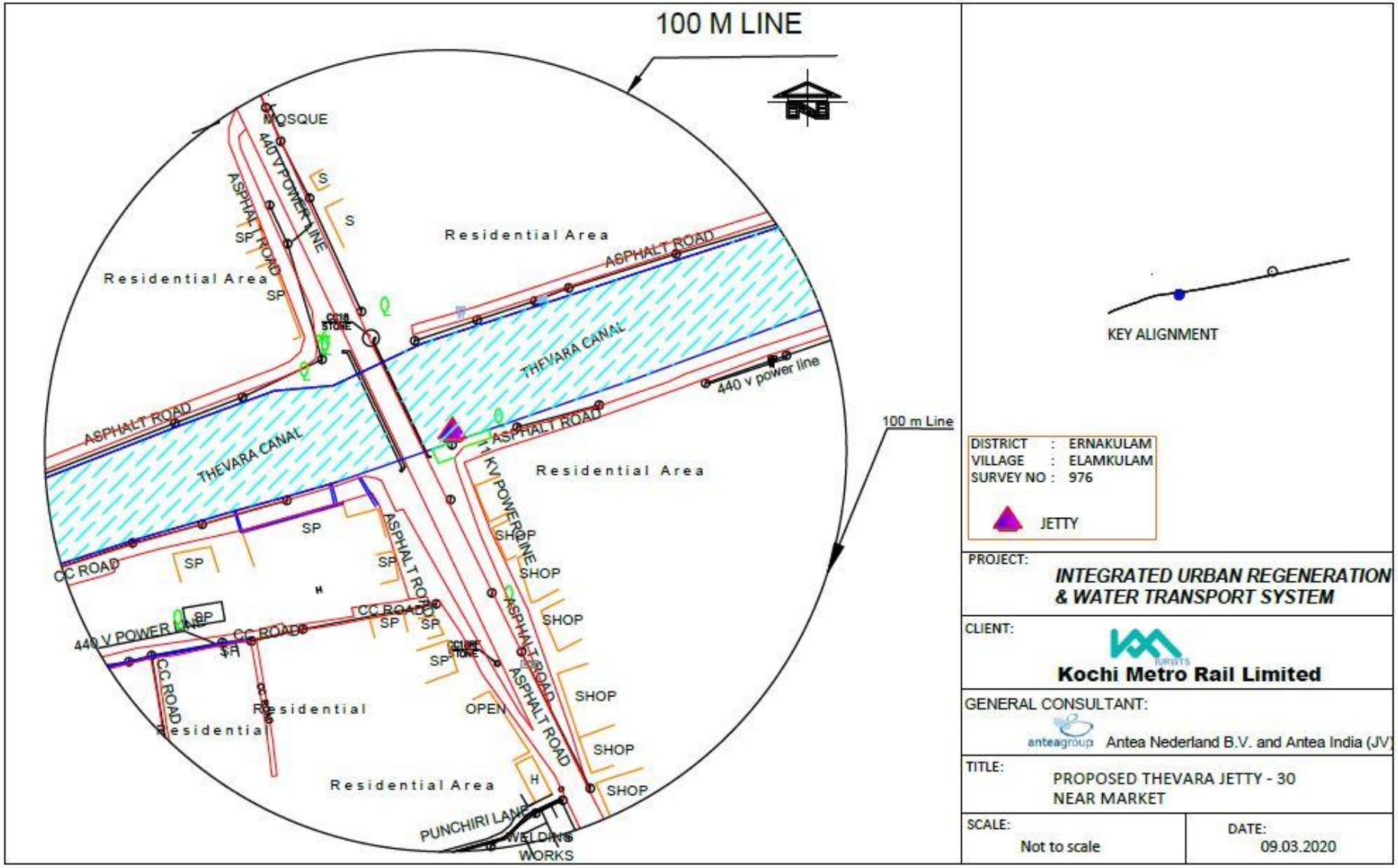


ANNEXURE 3A.7

Existing Road and Foot Bridges in IURWTS canals

Sl No	Canal	Bridges as per NATPAC Report	Bridges as per Antea		
			Roads to be reconstructed	Private Road Bridges	Bridges to be retained
1	Edappally Canal	17	11	4	2
2	Thevara Perandoor Canal	26	23	2	1
3	Chilavanoor Canal	32	20	10	2
4	Thevara Canal	2	2	0	0
5	Market Canal	3	0	0	3
	Total	**80**	**56**	**16**	**8**
			80		

Existing Road Bridges in Edappally Canal

Sl. No	Co-ordinates			Chainage (m)	Name of Bridge /Location
		Right	left		
I	Lat:	10° 2'22"	10° 2'22"	652	Crossing Indriaji Road Bridge.
	Lon:	76°18'8"	76°18'8"		
2	Lat:	10° 1'58"	10° 1'58"	1513	Crossing Chambokadavu Road Bridge.
	Lon:	76°18'16"	76°18'16"		
3	Lat:	10° 1'31"	10° 1'32"	2500	Crossing Salem-Kochi Kanyakumari Highway. Edappally bridge (NH)-1
	Lon:	76°18'30"	76°18'30"		
4	Lat:	10° 1'31"	10° 1'32"	2500	Crossing Salem-Kochi Kanyakumari Highway. Edappally bridge (NH)-2
	Lon:	76°18'30"	76°18'30"		
5	Lat:	10° 1'22"	10° 1'23"	2872	Crossing Marottichuvadu Road Bridge.
	Lon:	76°18'37"	76°18'38"		
6	Lat:	10° 0'52"	10° 0'53"	4188	Crossing PipeLine Road Bridge.
	Lon:	76°18'57"	76°18'57"		
7	Lat:	10° 0'37"	10° 0'37"	5112	Crossing Ayyanadu Road Bridge
	Lon:	76°19'11"	76°19'11"		
8	Lat:	10° 0'37"	10° 0'37"	5112	Crossing Ayyanadu Road Bridge.
	Lon:	76°19'11"	76°19'11"		
9	Lat:	9°59'58"	9°59'58"	7255	Crossing VennalaPalachuvadu Road Bridge.
	Lon:	76°19'49"	76°19'50"		
10	Lat:	9°59'27"	9°59'26"	9300	Crossing Eroor Road Arakkakadavu Bridge.
	Lon:	76°19'41"	76°19'42"		
11	Lat:	9°58'55"	9°58'56"	10483	Crossing Kuzhuvelippalam Road Bridge.
	Lon:	76°19'36"	76°19'38"		

Existing Road Bridges in Chilavanoor Canal

Sl. No	Co-ordinates			Chainage (m)	Bridge Name/Location
		Right	left		
1	Lat:	10° 1'10"	10° 1'10"	1724	Crossing Edappally Raghavan Pillai Road Bridge
	Lon:	76°17'42"	76°17'43"		
2	Lat:	10° 0'51"	10° 0'52"	2295	Crossing BTS Road Bridge
	Lon:	76°17'43"	76°17'43"		
3	Lat:	10° 0'47"	10° 0'47"	2457	Crossing Keerthi Nagar Road Bridge
	Lon:	76°17'44"	76°17'44"		
4	Lat:	10,0'27"	76°17'48"	3070	SIUPS Road Bridge
	Lon:	10,0'27"	76°17'48"		
5	Lat:	10,0'23"	76°17'49"	3190	National Public Road Comrade Nagar
	Lon:	10,0'23"	76°17'49"		
6	Lat:	10,0'12"	10,0'12"	4200	Crossing George Eden Road
	Lon:	76,17'53"	76,17'53"		
7	Lat:	9,59'51"	9,59'51"	4520	Crossing Road Bridge, Near Stadium Gate
	Lon:	76,17'57"	76,17'57"		
8	Lat:	9,59'44"	9,59'44"	4800	Crossing Road Bridge, Near Stadium Complex Gate
	Lon:	76,18'04"	76,18'04"		
9	Lat:	9°59'22"	9°59'22”	5578	Crossing Vyloppilly Lane Bridge
	Lon:	76°18'6"	76°18'6"		
10	Lat:	9°59'2"	9°59'2"	6325	Crossing Chamber Bridge/ Karanakonam
	Lon:	76°18'8"	76°18'9"		
11	Lat:	9°59'2"	9°59'2"	6325	Crossing Chamber Bridge/ Karanakonam
	Lon:	76°18'8"	76°18'9"		
12	Lat:	9,58'53"	9,58'53"	7180	Bridge crossing,Near Railway Quarters Bridge marshalling yard
	Lon:	76,17'51"	76,17'51"		
13	Lat:	9°58'42"	9°58'42"	8020	Crossing Rail Nagar Bridge
	Lon:	76°18'10"	76°18'10"		
14	Lat:	9°58'41"	9°58'41"	8142	Crossing Rail Nagar Bridge KujanBava Road Bridge
	Lon:	76°18'13"	76°18'14"		
15	Lat:	9,58'39"	9,58'39"	8200	Palathuruth VV road bridge Crossing,
	Lon:	76,18'14"	76,18'14"		
16	Lat:	9,58'36"	9,58'36"	8280	St. Sebastin road bridge
	Lon:	76,18'15"	76,18'15"		
17	Lat:	9°58'21"	9°58'21"	8800	Crossing Subhash Chandra Bose Road
	Lon:	76°18'18"	76°18'19"		
18	Lat:	9°58'1"	9°58'2"	9600	Crossing Ettumanoor Ernakulam Road Elamkulam Bridge -1
	Lon:	76°18'32"	76°18'34"		
19	Lat:	9°58'1"	9°58'2"	9600	Crossing Ettumanoor Ernakulam Road Elamkulam Bridge -2
	Lon:	76°18'32"	76°18'34"		
20	Lat:	9°57'15"	9°57'16"	11150	Crossing Chilavanoor RCC Road Bridge (Chilavanoor) Bridge.
	Lon:	76°18'44"	76°18'53"		

Existing Road Bridges in Thevara-Perandoor Canal

Sl. No	Co-ordinates			Chainage (m)	Name of Bridge /Location
		Right	Left		
1	Lat:	10° 0'16"	10° 0'16"	2200	Crossing Pottakuzhi Road Bridge
	Lon:	76°17'14"	76°17'14"		
2	Lat:	9°59'46"	9°59'46"	3475	Crossing Shastha Temple Road Bridge
	Lon:	76°17'23"	76°17'23"		
3	Lat:	9°59'43"	9°59'43"	3580	Crossing Kaloor Manapattiparambu Road Bridge
	Lon:	76°17'23"	76°17'24"		
4	Lat:	9°59'37"	9°59'36"	3580	Crossing Kaloor old Road Bridge
	Lon:	76°17'26"	76°17'26"		
5	Lat:	9°59'36"	9°59'36"	3800	Crossing Banerji Kaloor Road bridge
	Lon:	76°17'26"	76°17'26"		
6	Lat:	9°59'30"	9°59'30"	4015	Crossing RBI Quarters Road Bridge
	Lon:	76°17'27"	76°17'28"		
7	Lat:	9°59'27"	9°59'27"	4092	Crossing Judges Avenue Road Bridge
	Lon:	76°17'27"	76°17'28"		
8	Lat:	9°59'22"	9°59'22"	4227	CrossingSkyLine/St.SebastianRoad Bridge
	Lon:	76°17'28"	76°17'28"		
9	Lat:	9°59'14"	9°59'14"	4490	Crossing Chemmani Road Bridge
	Lon:	76°17'28"	76°17'28"		
10	Lat:	9°59'6"	9°59'6"	4748	Crossing St.Francis Xaviers Church Road Bridge
	Lon:	76°17'29"	76°17'29"		
11	Lat:	9°58'58"	9°58'58"	4983	Crossing Thammanam Pullepady Road Bridge
	Lon:	76°17'28"	76°17'28"		
12	Lat:	9°58'33"	9°58'33"	5815	Crossing Bridge Near Kochi Refinery pipeline
	Lon:	76°17'26"	76°17'26"		
13	Lat:	9°58'15"	9°58'16"	6593	Crossing Karshaka Road Bridge
	Lon:	76°17'35"	76°17'35"		
14	Lat:	9°58'10"	9°58'11"	6848	Crossing Kadavanthara Market Road Bridge
	Lon:	76°17'41"	76°17'41"		
15	Lat:	9°57'59"	9°57'59"	7578	Crossing Sahodaran Ayyappan Road Bridge-1
	Lon:	76°17'51"	76°17'51"		
16	Lat:	9°57'59"	9°57'59"	7578	Crossing Sahodaran Ayyappan Road Bridge-2
	Lon:	76°17'51"	76°17'51"		
17	Lat:	9°57'54"	9°57'55"	7695	Crossing Elders Forum Road Bridge
	Lon:	76°17'51"	76°17'51"		
18	Lat:	9°57'33"	9°57'33"	8371	Crossing Panampally Nagar GiriNagar Bridge
	Lon:	76°17'54"	76°17'55"		
19	Lat:	9°57'22"	9°57'22"	8710	Crossing Panampally Nagar Link Road Bridge
	Lon:	76°17'56"	76°17'56"		
20	Lat:	9°57'17"	9°57'17"	8849	Crossing Panampally Nagar VidhyaNagar Road Bridge
	Lon:	76°17'56"	76°17'57"		
21	Lat:	9°57'6"	9°57'6"	9205	Crossing YovajanaSamajam Road Bridge
	Lon:	76°17'58"	76°17'58"		
22	Lat:	9°56'55"	9°56'55"	9552	Crossing JVK Road Bridge
	Lon:	76°18'0"	76°18'0"		
23	Lat:	9°56'45"	9°56'46"	9845	Crossing Anamthuruthu Road Bridge

Sl. No	Co-ordinates			Chainage (m)	Name of Bridge /Location
		Right	Left		
	Lon:	76°18'1"	76°18'1"		

Existing Road Bridges in Thevara Canal

Sl. No	Co-ordinates			Chainage (m)	Name of Bridge /Location
		Right	Left		
1	Lat:	9°56'39"	9°56'40"	224	Crossing Pandit Karuppan Road Bridge Near Thevara Market
	Lon:	76°17'39"	76°17'38"		
2	Lat:	9°56'46"	9°56'46"	1294	Crossing K.P Vallon Road Bridge, Kallupalam
	Lon:	76°18'13"	76°18'12"		

Existing Foot Bridges in edapally Canal

Sl. No	Co-ordinates			Chainage (m)	Name of Bridge /Location
		Right	left		
1	Lat:	10° 2'35"	10° 2'35"	300	Near Muttarkadavu
	Lon:	76°18'11"	76°18'11"		

Existing Foot Bridges in Chilavanoor Canal

Sl. No	Co-ordinates			Chainage (m)	Name of Bridge /Location
		Right	left		
1	Lat:	10,0'52"	10,0'52"	2250	Near BTS Road
	Lon:	76,17'48"	76,17'48"		
2	Lat:	10,0'52"	10,0'52"	2250	Near BTS Road
	Lon:	76,17'48"	76,17'48"		
3	Lat:	10°0'50.31"	10°0'50.31"	2350	Near Keerthi Nagar
	Lon:	76°17'43.36"	76°17'43.36"		
4	Lat:	10°0'49.88"	10°0'49.88"	2370	Near Keerthi Nagar
	Lon:	76°17'43.5"	76°17'43.5"		
5	Lat:	10°0'49.21"	10°0'49.21"	2380	Near Keerthi Nagar
	Lon:	76°17'43.62"	76°17'43.62"		
6	Lat:	10°0'48.94"	10°0'48.94"	2400	Near Keerthi Nagar
	Lon:	76°17'43.73"	76°17'43.73"		
7	Lat:	10°0'44.89"	10°0'44.89"	2530	Near Vellakadaparambu lane
	Lon:	76°17'45.27"	76°17'45.27"		
8	Lat:	10°0'44.1"	10°0'44.1"	2550	Near Vellakadaparambu lane
	Lon:	76°17'45.32"	76°17'45.32"		
9	Lat:	10°0'41.31"	10°0'41.31"	2640	Near Vellakadaparambu lane
	Lon:	76°17'45.89"	76°17'45.89"		
10	Lat:	10,0'14"	10,0'14"	3550	Near Greenz Villa
	Lon:	76,17'48"	76,17'48"		
11	Lat:	9,59'32"	9,59'32"	5260	Near Vylopally road
	Lon:	76,18'04"	76,18'04"		
12	Lat:	9,58'58"	9,58'58"	6440	North Palathuruth Avenue close by
	Lon:	76,18'9"	76,18'9"		

Sl. No	Co-ordinates			Chainage (m)	Name of Bridge /Location
		Right	left		
13	Lat:	9,58'46"	9,58'46"	7320	PipeLine Road BPCL Jetty Line
	Lon:	76,18'12"	76,18'12"		
14	Lat:	9,58'20"	9,58'20"	8850	Pipeline Road Wooden foot bridge
	Lon:	76,18'20"	76,18'20"		
15	Lat:	9,58'20"	9,58'20"	8860	Pipeline Road iron foot bridge
	Lon:	76,18'20"	76,18'20"		
16	Lat:	9,58'20"	9,58'20"	8800	Pipeline Road
	Lon:	76,18'20"	76,18'20"		

Existing Foot Bridges in Thevara_Perandoor Canal

Sl. No	Co-ordinates			Chainage (m)	Name of Bridge /Location
		Right	left		
1	Lat:	9,59'16"	9,59'16"	4420	Near Chemmani Road
	Lon:	76,17'28"	76,17'28"		
2	Lat:	9,59'14"	9,59'14"	4610	Near Kottaicanal
	Lon:	76,17'28"	76,17'28"		
3	Lat:	9,59'09"	9,59'09"	4829	Near Kottaicanal
	Lon:	76,17'28"	76,17'28"		
4	Lat:	9,59'05"	9,59'05"	4845	Near St. Francis Xavier
	Lon:	76,17'29"	76,17'29"		
5	Lat:	9,59'05"	9,59'05"	4941	Near St. Francis Xavier
	Lon:	76,17'29"	76,17'29"		
6	Lat:	9,58'49"	9,58'49"	5200	Near CBI Office
	Lon:	76,17'29"	76,17'29"		
7	Lat:	9,58'49"	9,58'49"	5252	Near CBI Office
	Lon:	76,17'29"	76,17'29"		
8	Lat:	9,58'43"	9,58'43"	5490	Kammattipadam
	Lon:	76,17'29"	76,17'29"		
9	Lat:	9,58'43"	9,58'43"	5493	Kammattipadam
	Lon:	76,17'29"	76,17'29"		
10	Lat:	9,58'28"	9,58'28"	6032	near Lakshadweep guest house
	Lon:	76,17'29"	76,17'29"		
11	Lat:	9,58'23"	9,58'23"	6026	Mother Theresa Nagar community hall building nearby. Udhaya Nagar
	Lon:	76,17'33"	76,17'33"		
12	Lat:	9,57'44"	9,57'44"	8023	Panampally Nagar
	Lon:	76,17'52"	76,17'52"		
13	Lat:	9,56'57"	9,56'57"	9457	Panampally Nagar
	Lon:	76,18'0"	76,18'0"		

Existing Bridge in Market Canal

Sl #	Co-ordinates			Chainage (m)	Name of Bridge /Location
		Right	**left**		
1	Lat:	9,58'55"	9,58'55"	0037	Ernakulam Market Canal Bridge RCC Foot Bridge.
	Lon:	76,16'37"	76,16'37"		

Existing Road and Foot Bridges in IURWTS canals

Sl. No	Name of the Canal	No. of Road Bridges	No. of Foot Bridges
1	Edappally Canal	11	01
2	Chilavanoor Canal	20	16
3	Thevara_Perandoor Canal	23	13
4	Thevara Canal	02	-
5	Market Canal	-	1
	Total	**56**	**31**

ROAD BRIDGE EDAPPALLY CANAL				
Sl. No	**Coordinates**	**Location**	**Description**	**Photos**
1.	Lat- 10,2'22" Lon-76,18'8"	Near Damro furniture Pvt ltd.	Indiraji road bridge crossing. 1nos water pipeline & 2 no's cable pipeline crossing.	
2.	Lat- 10,2'58" Lon-76,18'16"	Chambukadavu Bridge	Chambukadavu bridge crossing. 2 no's drain connection on the sides. 4 no's electric post alonside.	

ROAD BRIDGE EDAPPALLY CANAL				
Sl. No	**Coordinates**	**Location**	**Description**	**Photos**
3.	Lat- 10,1'34" Lon-76,18'24"	Edappally Bridge	Crossing Salem-Kochi Kanyakumari Highway. Edappally bridge (NH)-1	
4.	Lat- 10,1'34" Lon-76,18'24"	Edappally Bridge	Crossing Salem-Kochi Kanyakumari Highway. Edappally bridge (NH)-2	

ROAD BRIDGE EDAPPALLY CANAL				
Sl. No	**Coordinates**	**Location**	**Description**	**Photos**
5	Lat- 10,1'23" Lon-76,18'38"	Marottichodu Road Bridge	Marottichodu bridge crossing. 2nos cable pipeline, 1 no's water pipeline crossing.	
6	Lat- 10,0'52" Lon-76,18'57"	Pipeline Road	Pipeline road bridge crossing. 3no's water pipeline crossing	

ROAD BRIDGE EDAPPALLY CANAL				
Sl. No	**Coordinates**	**Location**	**Description**	**Photos**
7	Lat- 10,0'37" Lon-76,19'11"	Near St. Michaels parish Hall Entrance of Thrikkakkara Muncipality	Ayyananadu Bridge crossing.1 3no's water pipeline 11no's cable pipeline crossing. (Chembumukku)	
8	Lat- 10,0'37" Lon-76,19'11"	Chembumukku.	Ayyananadu Bridge crossing.1 (Chembumukku)	

ROAD BRIDGE EDAPPALLY CANAL				
Sl. No	**Coordinates**	**Location**	**Description**	**Photos**
9	Lat- 9,59'58" Lon-76,19'50"	Vennala Palachuvadu	Palachuvadu bridge crossing. 6nos cable pipeline crossing. RMC Palant and 1no's HT Tower nearby.	
10	Lat- 9,59'27" Lon-76,19'41"	Arakkakadvu Bridge	Arakkakadvu Bridge Crossing Crossing Eroor Road Arakkakadavu Bridge. Pipe line crossing	

ROAD BRIDGE EDAPPALLY CANAL				
Sl. No	**Coordinates**	**Location**	**Description**	**Photos**
11	Lat- 9,58'55" Lon-76,19'36"	Kuzhuvelippalam Road	Crossing Kuzhuvelippalam Road Bridge.	

FOOT BRIDGE – EDAPPALLY				
Sl. No	**Coordinates**	**Location**	**Description**	**Photos**
1.	Lat- 10,2'35" Lon-76,18'12"	Near Muttarkadavu	Road bridge crossing. Drain connection on the sides.	

RAILWAY LINE BRIDGE – EDAPPALLY				
Sl. No	**Coordinates**	**Location**	**Description**	**Photos**
1	Lat- 10,2'9" Lon-76,18'13"	Railway bridge	Railway bridge crossing. 7nos cable pipeline & 1 no's water pipeline crossing.	

PIPELINE CROSSING EDAPPALLY CANAL				
Sl. No	**Coordinates**	**Location**	**Description**	**Photos**
1.	Lat- 10,2'22" Lon-76,18'8"	Near Damro furniture pvt ltd.	Indiraji road bridge crossing. 1nos water pipeline & 2 no's cable pipeline crossing.	
2.	Lat- 10,2'9" Lon-76,18'13"	Railway bridge	Railway bridge crossing. 7nos cable pipeline & 1 no's water pipeline crossing.	

PIPELINE CROSSING EDAPPALLY CANAL				
Sl. No	**Coordinates**	**Location**	**Description**	**Photos**
3.	Lat- 10,1'34" Lon-76,18'24"	Lulu Mall	Lulu Mall bridge crossing. 7nos cable pipeline, 2 no's fire pipeline, 14 no's water pipeline crossing	
4.	Lat- 10,1'32" Lon-76,18'30"	Edappally flyover	Edappally flyover crossing. 9nos cable pipeline, 1 no's water pipeline crossing.	

PIPELINE CROSSING EDAPPALLY CANAL				
Sl. No	**Coordinates**	**Location**	**Description**	**Photos**
5.	Lat- 10,1'23" Lon-76,18'38"	Marottichodu bridge	Marottichodu bridge crossing. 2nos cable pipeline, 1nos water pipeline crossing.	
6.	Lat- 10,0'52" Lon-76,18'57"	Pipeline road	Pipeline road bridge crossing. 3nos water pipeline crossing	

PIPELINE CROSSING EDAPPALLY CANAL				
Sl. No	**Coordinates**	**Location**	**Description**	**Photos**
7.	Lat- 10,0'37" Lon-76,19'11"	Near St. Michaels parish Hall Entrance of Thrikkakkara Muncipality	Iyyanaru bridge crossing. 3nos water pipeline 11nos cable pipeline crossing. (Chembumukku)	
8.	Lat- 9,59'58" Lon-76,19'50"	Palachuvadu bridge	Palachuvadu bridge crossing. 6nos cable pipeline crossing. RMC Palant and 1 nos HT Tower nearby.	

PRIVATE ROAD BRIGES-EDAPPALLY Canal				
Sl. No	**Coordinates**	**Location**	**Description**	**Photos**
1.	Lat- 10,1'34" Lon-76,18'24"	Lulu Mall	Lulu Mall bridge crossing. 7nos cable pipeline, 2 no's fire pipeline, 14 no's water pipeline crossing	
2.	Lat- 10,1'1" Lon-76,18'43"	Puravankara Land 2Nos	Puravankara land bridge crossing	

PRIVATE ROAD BRIGES-EDAPPALLY Canal				
Sl. No	**Coordinates**	**Location**	**Description**	**Photos**
3	Lat- 10,1'12" Lon-76,18'40"	Oriental Saw mil	Bridge crossing Oriental Timber	 

ROAD BRIDGE - CHILAVANOOR				
Sl. No	**Coordinates**	**Location**	**Description**	**Photos**
1.	Lat- 9,57'15" Lon-76,18'44" Chainage:11150	Chilavanoor Bridge	Chilavanoor Bridge	
2.	Lat- 9,58'02" Lon-76,18'33" Chainage:9600	Elamkulam Metro station	Elamkulam bridge Ettumanoor-Ernakulam Road crossing. 2nos water pipeline, 1 nos cable pipeline crossing. Drain connection on both sides	

3.	Lat- 9,58'21" Lon-76,18'23" Chanage:8800	Subhash Chandra Bose Road	Subhash Chandra Bose road crossing. 2nos water pipeline, 3 nos cable pipeline crossing	
4.	Lat- 9,58'36" Lon-76,18'15" Chainage:8280	St. Sebastin road bridge	St.Sebastin road bridge crossing. 4nos pipeline crossing. Drainage lines connected to the sides.	

5.	Lat- 9,58'39" Lon-76,18'14" Chainage:8200	VV road bridge Palathuruthu	**Pipe Line Road** VV road bridge crossing. 2nos pipeline crossing	
6.	Lat- 9,58'42" Lon-76,18'18" Chainage:8142	KunjanBava Road	KunjuBava road bridge crossing. Drain connection on both sides.	

7.	Lat- 9,58'41" Lon-76,18'14" Chainage:8020	Crossing Rail Nagar Bridge	Crossing Rail Nagar Bridge Near KujanBava Road	
8.	Lat- 9,59'02" Lon-76,18'09" Chainage:7180	Bridge crossing,Near Railway Quarters Bridge marshalling yard	Bridge crossing,Near Railway Quarters Bridge marshalling yard	

9.	Lat- 9,59'02" Lon-76,18'09" Chainage:6325	Chamber Road Bridge-2 Karanakkonam	Chamber Road Bridge crossing	
10.	Lat- 9,59'02" Lon-76,18'09" Chainage:6325	Chamber Road Bridge-2 Karanakkonam	Chamber Road Bridge crossing	

11.	Lat- 9,59'22" Lon-76,18'06" Chainage:5578	Vyloppily Road	Vyloppily road bridge crossing. 3nos pipeline crossing.	
12.	Lat- 9,59'44" Lon-76,18'04" Chainage:4800	Crossing Road Bridge, Near Stadium Gate	Small concrete Road bridge crossing	

13.	Lat- 9,59'51" Lon-76,17'57" Chainage:4520	Crossing Road Bridge, Near Stadium Gate	Crossing Road Bridge, Near Stadium Gate	
14	Lat- 10,0'12" Lon-76,17'53" Chainage:4200	George Eden road	George Eden road crossing. Drain connection on both sides.	

15	Lat- 9,59'59" Lon-76,17'54" Chainage:4400	JLN Stadium metro station	JLN Stadium Metro Station Road crossing. 2nos drain connection on the sides.	
16.	Lat- 10,0'23" Lon-76,17'49" Chainage:3190	National public School.	National publicschool bridge crossing. Drain connection on both sides. 1nos electric post alongside.	

17	Lat- 10,0'27" Lon-76,17'48" Chainage:3070	Near Oriental Garden apartment SUIPS Road	Pottakuzhi Mamngalam Road Bridge crossing. 3nos cable pipeline, 1 nos water pipeline crossing. Drain connection on both sides.	
18.	Lat- 10,0'47" Lon-76,17'44" Chainage:2457	Keerthi Nagar Road	Keerthi Nagar road bridge crossing 5nos water pipeline crossing. Drain connection on the sides. 2 nos electric post alongside.	

19	Lat- 10,0'52" Lon-76,17'48" Chainage:2295	BTS Road bridge Elamakkara	BTS Road bridge Elamakkara crossing. 4nos Cable pipeline, 2nos water pipeline crossing.	
20	Lat- 10,1'10" Lon-76,17'42" Chainage:1724	Edappally Raghavan Pillai Road	Edappally Raghavan Pillai Road bridge crossing. 4nos water pipeline, 2nos Cable line crossing. Drain connection on the sides.	

FOOTBRIDGE CHILAVANOOR				
Sl. No	**Coordinates**	**Location**	**Description**	**Photos**
1.	Lat- 9,59'32" Lon-76,18'04" Chainage:5260		Small bridge crossing. Small canal joining from the right side.	
2.	Lat- 10,0'14" Lon-76,17'48" Chainage:3550	Near Greenz Villa	Concrete slab crossing. 1nos pipeline crossing. 1nos electric post alongside. Drain connection on the sides.	

3.	Lat- 10,0'44" Lon-76,17'45" Chainage:2640, 2550,2530		4nos Concrete Foot bridge crossing. 2nos pipeline crossing. 25mtrs before H.T. Tower on the side. 3nos electric post, 1no water pipe alongside.	
4.	Lat -10,0'47" Lon-76,17'44" Chainage:2400-2350		After 20 mtrs 4nos foot bridges at every 10mtr interval crossing	

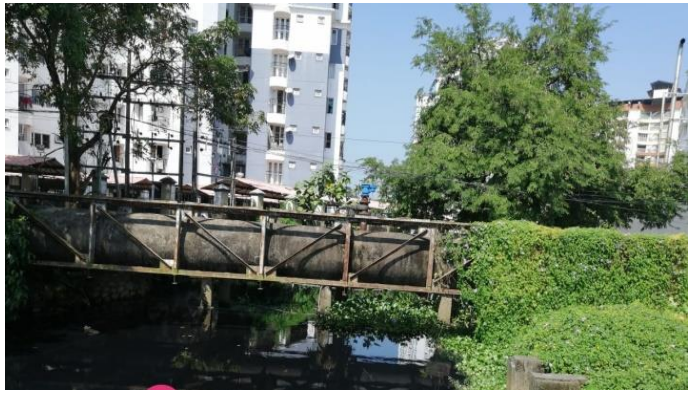
5.	Lat- 10,0'52" Lon-76,17'48" Chainage:2250		After 30mts, 2nos concrete footbridges crossing. Drain connection on the sides.	
6.	Lat- 9,58'20" Lon-76,18'20" Chainage:8850		**Pipe Line Road** Iron bridge crossing. Before 20 mtr from this point wooden bridge is crossing	

7.	Lat- 9,58'46" Lon-76,18'12" Chainage:7320		**Pipe Line Road** BPCL Jetty Line canal crossing. Iron bridge crossing. 9nos pipeline crossing	

RAIL BRIDGE - CHILAVANOOR				
Sl No	**Coordinates**	**Location**	**Description**	**Photos**
1.	Lat- 10,1'46" Lon-76,17'29" Chainage:415	Near Amritha Hospital	Railway line crossing. 1noswater pipeline, 3nos cable pipeline crossing.	

2.	Lat- 9,58'50" Lon-76,17'49" Chainage:	'C' Cabin	Railway line crossing. 7nos cable pipeline crossing.	
3.	Lat- 9,58'46" Lon-76,18'12" Chainage:	Railwayyard	Railway crossing culvert. 7nos cable line crossing	

PIPELINE CROSSING CHILAVANOOR				
Sl No	**Coordinates**	**Location**	**Description**	**Photos**
1.	Lat- 9,58'02" Lon-76,18'33"	Eleamkulam Metro station	Elamkulam bridge crossing. 2nos water pipeline, 1 nos cable pipeline crossing. Drain connection on both sides	
2.	Lat- 9,58'21" Lon-76,18'23"	Subhash Chandra Bose road	Subhash Chandra Bose road crossing. 2nos water pipeline, 3 nos cable pipeline crossing	

3.	Lat-9,59'07" Lon 76,18'08"	Near Chamber Bridge	4 nos. water pipeline, 3nos cable pipeline crossing. 2nos drain connection on the sides. 3 nos. electric post along the sides.	
4.	Lat- 9,59'07" Lon-76,18'08"	Near Chamber Bridge	5 nos. water pipeline crossing. Drain connection on the sides	

5.	Lat- 10,0'3" Lon-76,17'56"	KSEB	Compound wall of KSEB Asst Engineer office crossing. 8nos cable lines and 1 nos. water pipeline crossing. Drain connection on the sides. 1nos electric post along canal side.	
6.	Lat- 10,0'3" Lon-76,17'56"	KSEB Compound	Drain connection on the sides. 8nos cable pipeline and 3nos water pipeline crossing.	

7.	Lat- 10,0'8" Lon-76,17'55"	KSEB Compound	Bridge crossing. 8nos cable pipeline crossing	
8.	Lat- 10,0'27" Lon-76,17'48"	Near Oriental Garden apartment Pottakuzhi Mamangalam Road	Bridge crossing. 3nos cable pipeline, 1 nos. water pipeline crossing. Drain connection on both sides.	

9.	Lat- 10,0'52" Lon-76,17'48"	Elamakkara	BTS Road bridge Elamakkara crossing. 4nos Cable pipeline, 2nos water pipeline crossing.	
10.	Lat- 10,1'10" Lon-76,17'42"	Edappally RaghavanPilla Road	Edappally RaghavanPilla road bridge crossing. 4 nos water pipeline, 2nos Cable line crossing. Drain connection on the sides.	

11.	Lat- 10,1'46" Lon-76,17'29"	Near Amrutha Hospital	Railway line crossing. 1noswater pipeline, 3nos cable pipeline crossing.	
12.	Lat- 9,58'21" Lon-76,18'18"	Subhash Chandra Bose Road	**Pipe Line Road** Road bridge, 4nos water line crossing. 1 nos cable pipe line crossing	

13.	Lat- 9,58'46" Lon-76,18'12"	Railwayard	BPCL Jetty Line canal crossing. Iron bridge crossing. 9nos pipeline crossing	

THEVARA PERANDOOR CANAL ROAD BRIDGE				
Sl. No	**Coordinates**	**Location**	**Description**	**Photos**
1.	Lat- 9,56'46" Lon-76,18'1"	Starting of TP canal Ananthururh Road Bridge crossing	Near 3mtr at boundary of canal line Southern Railway Substation 1 no's water pipe line & 4 no's electrical cable line Ananthururh Road Bridge crossing	
2.	Lat-9,56'55" Lon-76,18'0"	JVK Road Krishnaiyar Bridge	Bridge crossing canal / JVK road. 1nos. Electric cable. 1no's. Electric post 2no's light post	

THEVARA PERANDOOR CANAL ROAD BRIDGE				
Sl. No	**Coordinates**	**Location**	**Description**	**Photos**
3.	Lat-9,57'6" Lon-76,17'58"	Yuvajana Samajam Road	Bridge crossing Yuvajana Samajam road 3 no's cable pipe line 1nos water pipe line 3 electrical post on the left side and 1 on the right side	
4.	Lat-9,57'10" Lon-76,17'57"	Shihab Thangal Road bridge	A canal connection with Shihab Thangal road bridge crossing	

THEVARA PERANDOOR CANAL ROAD BRIDGE				
Sl. No	**Coordinates**	**Location**	**Description**	**Photos**
5.	Lat-9,57'18" Lon-76,17'58"	Panampilly nagar	Bridge crossing-Panampilly nagar and Vidhya nagar bridge Cable pipe line 3nos. Sewage drain connection right side of canal and after 50m another drain connected	
6.	Lat-9,57'21" Lon-76,17'56"	Panampilli nagar link road bridge crossing (Koithara Canal)	Panampilli nagar link road bridge crossing (Koithara Canal) 2 electrical pipe lines and 1 water meter pipeline crossing Sewerage drain connection on both sides.	

THEVARA PERANDOOR CANAL ROAD BRIDGE				
Sl. No	**Coordinates**	**Location**	**Description**	**Photos**
7.	Lat-9,57'33" Lon-76,17'54"	Panampilli nagar Girinagar bridge	Panampilli nagar Giri nagar bridge crossing 1 no Transformer nearby canal	
8.	Lat-9,57'54" Lon-76,17'52"	Panampilli nagar	Bridge crossing. 9 no's electric cable lines and 1 no water line crossing. 1nos Transformer on the left side. 2 no's sewage drain connections 60mtrs apart on left side. In between drain and transformer, 5nos electrical post on the right side and 3 nos on the left side. After 50mtrs from the bridge 1 no's transformer on the right side of canal. {backside of Kadavanthara metro station)	

THEVARA PERANDOOR CANAL ROAD BRIDGE				
Sl. No	**Coordinates**	**Location**	**Description**	**Photos**
9.	Lat-9,57'59" Lon-76,17'51"	Near Kadavanthara metro station	Bridge crossing near Kadavanthara metro station. 2nos water pipe lines and 11 no's cable pipe lines crossing.	

THEVARA PERANDOOR CANAL ROAD BRIDGE				
Sl. No	**Coordinates**	**Location**	**Description**	**Photos**
10.	Lat-9,58'11" Lon-76,17'40"	Kadavanthara Market Bridge Opposite 'P' Square Interior furnishing	Kadavanthara Market bridge crossing. 1 no's water pipe line crossing. After 50 mtrs drain connection on the right side. 1nos transformer nearby.	
11.	Lat-9,58'15" Lon-76,17'35"	Crossing Karshaka Road Bridge Near P&T Colony	Udaya Nagar road bridge crossing. Warehouse road nearby. 1nos drain connection on the left side near bridge. 1nos pipe line crossing. 1nos drain connection on right side.	

THEVARA PERANDOOR CANAL ROAD BRIDGE				
Sl. No	**Coordinates**	**Location**	**Description**	**Photos**
12.	Lat-9,58'33" Lon-76,17'26"	Crossing RCC Road Bridge Near Kochi Refinery Pipeline	AL Jacob railway bridge crossing over head. 1nos pipeline crossing. 2 no's electric post & telephone post nearby	
13.	Lat-9,58'58" Lon-76,17'28"	Thammanam-Pullepady Road	Thammanam-Pullepady bridge crossing. 4nos cable line, 1nos water line crossing. 1nos electric post nearby.	

THEVARA PERANDOOR CANAL ROAD BRIDGE				
Sl. No	**Coordinates**	**Location**	**Description**	**Photos**
14.	Lat-9,59'05" Lon-76,17'29"	St.Francis Xavier Road	St.Francis Xavier bridge crossing. 2nos water pipeline and 3nos cable line crossing. 1nos Transformer nearby	
15.	Lat-9,59'14" Lon-76,17'28"	Chemmani Road Bridge Kottai Canal bridge	Kottai Canal bridge crossing. 2 nos electric cable lines and 1 no water line crossing. 1nos Transformer on the left side. 2 nos sewage drain connections 30mtrs apart on left	

THEVARA PERANDOOR CANAL ROAD BRIDGE				
Sl. No	**Coordinates**	**Location**	**Description**	**Photos**
16.	Lat-9,59'23" Lon-76,17'28"	Skyline Road Bridge crossing. Skyline Apartment Marble Arcade	Skyline Road Bridge crossing. Drain connection on left side. 2no's cable pipeline crossing. 1no's Transformer nearby. 9 electrical post along the sides	
17.	Lat-9,59'27" Lon-76,17'17"	Judges Avenue Road Bridge Sebastin Road bridge.	Judges Avenue Road Bridge Sebastin Road bridge crossing. 3nos electric cable line crossing. 3nos electric post nearby.	

THEVARA PERANDOOR CANAL ROAD BRIDGE				
Sl. No	**Coordinates**	**Location**	**Description**	**Photos**
18.	Lat-9,59'29" Lon-76,17'27"	Reserve bank staff quarters	Concrete bridge crossing for Reserve bank staff quarters	
19.	Lat-9,59'36" Lon-76,17'26"	Crossing Kaloor old Road Bridge	Crossing Kaloor old Road Bridge	

THEVARA PERANDOOR CANAL ROAD BRIDGE				
Sl. No	**Coordinates**	**Location**	**Description**	**Photos**
20.	Lat-9,59'36" Lon-76,17'26"	Kaloor Metro pillar # 598 Near Gokulam Park.	Road bridge crossing. 7nos electric cable line and 1nos water pipeline crossing. 1nos Transformer nearby.	
21.	Lat-9,59'43" Lon-76,17'24"	Kaloor ManppattiParambu	Kaloor ManppattiParambu bridge crossing. 1nos water pipeline crossing. 3nos electric post by the sides. Drain connection on right sides 20m apart	

THEVARA PERANDOOR CANAL ROAD BRIDGE				
Sl. No	**Coordinates**	**Location**	**Description**	**Photos**
22.	Lat-9,59'46" Lon-76,17'23"	Sastha Temple Road	Sastha Temple Road bridge crossing. Crossing 1Nos pipeline	
23.	Lat-10,0'16" Lon-76,17'14"	Pottakuzhi Road	Pottakuzhi Road bridge crossing	

THEVARA PERANDOOR CANAL FOOT BRIDGE				
Sl. No	**Coordinates**	**Location**	**Description**	**Photos**
1.	Lat-9,56'57" Lon-76,18'0"	Panampally Nagar	After 200mtrs from the HT Tower small iron bridge crossing 2nos sewerage lines at right side of canal, drain on sides and 1 nos electrical post	
2.	Lat-9,57'44" Lon-76,17'52"	Panampally Nagar	Iron bridge crossing. 5nos. electric cable pipe line crossing. 2nos. drain on the left side and 1 no on the right side	

THEVARA PERANDOOR CANAL FOOT BRIDGE				
Sl. No	**Coordinates**	**Location**	**Description**	**Photos**
3.	Lat-9,58'23" Lon-76,17'33"	Mother Theresa Nagar community hall	Iron bridge crossing. Mother Theresa Nagar community hall building nearby. Ater 10 and 30 mtrs sewage drain connections on left and right side	
4.	Lat-9,58'28" Lon-76,17'29"	near Lakshadweep guest house	Iron foot bridge crossing. 1nos electric light post nearby.	

THEVARA PERANDOOR CANAL FOOT BRIDGE				
Sl. No	**Coordinates**	**Location**	**Description**	**Photos**
5.	Lat-9,58'43" Lon-76,17'29"	Kammattipadam	2 NOS small bridges crossing. 1nos water pipe line crossing. 2nos electric post on left side	
6.	Lat-9,58'49" Lon-76,17'29"	Near CBI Office	Small bridge crossing. 1 nos pipeline crossing.	

THEVARA PERANDOOR CANAL FOOT BRIDGE				
Sl. No	**Coordinates**	**Location**	**Description**	**Photos**
7.	Lat-9,58'49" Lon-76,17'29"	Near CBI Office	After 40mtrs another Small Foot bridge crossing. 2nos electric post nearby.	
8.	Lat-9,58'49" Lon-76,17'29"		After 25mtrs Iron bridge crossing. 1nos drain connection.	

THEVARA PERANDOOR CANAL FOOT BRIDGE				
Sl. No	**Coordinates**	**Location**	**Description**	**Photos**
9.	Lat-9,59'05" Lon-76,17'29"		2 small Iron bridges crossing. 5nos electric posts nearby	
10.	Lat-9,59'09" Lon-76,17'28"		1nos drain connection. After 25mtrs small concrete bridge. 2nos electric post nearby	

THEVARA PERANDOOR CANAL FOOT BRIDGE				
Sl. No	**Coordinates**	**Location**	**Description**	**Photos**
11.	Lat-9,59'14" Lon-76,17'28"		After 30mtrs 1 small Iron bridge	

RAILWAY BRIDGE – THEVARA CANAL				
Sl. No	**Coordinates**	**Location**	**Description**	**Photos**
1.	Lat-9,58'46" Lon-76,17'30"	Kammattipadam Near Sales Tax and CBI office	drain connection on both sides. 1 no of electric post nearby canal.	
2.	Lat-10,1'12" Lon-76,16'56"	Perandoor Canal End	Perandoor Canal Railway line	

RAILWAY BRIDGE – THEVARA CANAL				
Sl. No	**Coordinates**	**Location**	**Description**	**Photos**
3.	Lat-10,1'12" Lon-76,16'56"	Perandoor Canal End	Perandoor Canal Railway line	
4.	Lat-10,1'12" Lon-76,16'56"	Perandoor Canal End	Perandoor Canal Railway line	

PIPELINE CROSSING THEVARA CANAL				
Sl. No	**Coordinates**	**Location**	**Description**	**Photos**
1	Lat-9,57'6" Lon-76,17'58"	Bridge crossing YuvajanaSamajam road	YuvajanaSamajam Bridge crossing road pipeline crossing.	
2	Lat-9,58'33" Lon-76,17'26"	Near KSRTC Bus Stand Ernakulam	Canal crossing #5, BPCL Jetty line crossing. 9nos pipeline crossing. Small road crossing	

PIPELINE CROSSING THEVARA CANAL				
Sl. No	**Coordinates**	**Location**	**Description**	**Photos**
3	Lat-9,58'43" Lon-76,17'29"	Kammattipadam	2 small bridges crossing. 2 nos water pipe line crossing. 2nos electric post on left side	
4	Lat-9,59'36" Lon-76,17'26"	Kaloor.	2nos water pipeline. 3nos cable pipeline crossing	

PIPELINE CROSSING THEVARA CANAL				
Sl. No	**Coordinates**	**Location**	**Description**	**Photos**
5	Lat-10,0'16" Lon-76,17'14"	Pottakuzhi	Pottakuzhi Road Bridge 1nos water pipeline.	

THEVARA CANAL				
Sl. No	**Coordinates**	**Location**	**Description**	**Photos**
1.	Lat- 9,56'37" Lon-76,17'30"	Starting Point of Thevara canal	Electrical post located 80 cm near the edge of then canal Sewage drain at 30 mtr from the starting point, in the left side of the canal	
2.	Lat-9,56'39" Lon-76,17'38"	Pandit Karuppan Road Thevara Market Bridge	at 10mtr from the bridge Sewage drain connected in the right side of the canal.	

3.	Lat-9,56'46" Lon-76,18'13"	Kallupalam Road Bridge	KP Vallon road bridge crossing 1m dia water pipeline crossing, 7nos cable pipe	
4.	Lat-9,56'46" Lon-76,18'17"	End of the Thevara Canal.	One H.T. tower in the centre of the canal.	

RAIL LINE BRIDGE – THEVARA CANAL				
Sl. No	**Coordinates**	**Location**	**Description**	**Photos**
1.	Lat-9,56'43" Lon-76,18'0"	Railway over bridge crossing	Railway over bridge crossing Small sewage drain connection	

PIPELINE CROSSING THEVARA CANAL				
Sl. No	**Coordinates**	**Location**	**Description**	**Photos**
1.	Lat-9,56'39" Lon-76,17'38"	Thevara Bridge	water pipeline crossing	
2.	Lat-9,56'46" Lon-76,18'13"	KP Vallon road bridge crossing	water pipeline crossing	

MARKET CANAL ROAD BRIDGE				
Sl. No	**Coordinates**	**Location**	**Description**	**Photos**
1.	Lat- 9,58'47" Lon-76,16'30"	Marine drive walkway	Crossing Rainbow Foot Bridge	
2.	Lat- 9,58'49" Lon-76,16'32"	Shanmugam Road	Crossing Shanmugam Road Bridge-2 Crossing 5Nos Pipeline	

FOOT BRIDGE – MARKET CANAL				
Sl. No	**Coordinates**	**Location**	**Description**	**Photos**
1.	Lat- 9,58'51" Lon-76,16'35"	Broadway	Broadway Road Crossing Crossing 3Nos pipeline	
2.	Lat- 9,58'49" Lon-76,16'32"	Crossing Market	Crossing Market Canal RCC Foot Bridge Near market	

ANNEXURE 3B.1

Ward wise Population Projection for Kochi Corporation

Ward	Ward Name	Ward Area (hectare)	Population		Projected Population			Population Density		Projected Population Density				Population
			2001	2011	2021	2031	2041	2001	2011	2021	2031	2041	2051	2051
1	Fort Kochi	143.58	12608	13742	14491	14882	14796	87.81	95.71	100.93	103.65	103.05	102.45	14710
2	Kalvathi	38.23	8236	8977	9466	9721	9665	215.43	234.82	247.61	254.28	252.81	251.35	9609
3	Iraveli	17.39	9074	9890	10429	10710	10649	521.79	568.72	599.71	615.87	612.36	608.86	10588
4	Karippalam	39.62	10733	11698	12336	12668	12595	270.90	295.25	311.36	319.74	317.90	316.05	12522
5	Mattanchery	62.11	12984	14152	14923	15325	15237	209.05	227.85	240.27	246.74	245.32	243.91	15149
6	Kochangadi	31.71	8035	8758	9235	9484	9429	253.39	276.19	291.23	299.09	297.35	295.62	9374
7	Cheralai	60.96	10186	11102	11707	12023	11954	167.09	182.12	192.04	197.23	196.10	194.96	11885
8	Panayappilly	71.43	11385	12409	13085	13438	13361	159.39	173.72	183.19	188.13	187.05	185.97	13284
9	Chakkamadam	29.84	5382	5866	6186	6353	6316	180.36	196.58	207.31	212.90	211.66	210.42	6279
10	Karuvelippady	59.01	8307	9054	9548	9805	9749	140.77	153.43	161.80	166.16	165.21	164.26	9693
11	Thoppumpadi	98.71	9757	10635	11214	11516	11450	98.85	107.74	113.61	116.66	116.00	115.33	11384
12	Tharebhagam	83.81	8526	9293	9799	10063	10006	101.73	110.88	116.92	120.07	119.39	118.71	9949
13	Kadebhagam	61.75	9705	10578	11154	11455	11389	157.17	171.30	180.63	185.51	184.44	183.37	11323
14	Thazhuppu	90.09	10285	11210	11821	12140	12070	114.16	124.43	131.21	134.75	133.98	133.20	12000
15	Edakochi	104.4	7915	8627	9097	9342	9288	75.81	82.63	87.14	89.48	88.97	88.45	9234
16	Edakochi South	148.13	8532	9300	9806	10071	10013	57.60	62.78	66.20	67.99	67.60	67.20	9955
17	Perumpadappu	70.81	9074	9890	10429	10710	10649	128.15	139.67	147.28	151.25	150.39	149.53	10588
18	Konam	87.57	9176	10001	10546	10831	10768	104.78	114.21	120.43	123.68	122.96	122.25	10705
19	Palluruthy - Kacherippady	70.6	10114	11024	11624	11938	11869	143.26	156.15	164.65	169.09	168.12	167.14	11800
20	Nambyapuram	56.58	8122	8853	9335	9587	9531	143.55	156.47	164.99	169.44	168.45	167.46	9475
21	Pullardesham	76.22	10563	11513	12141	12468	12396	138.59	151.05	159.29	163.58	162.63	161.69	12324
22	Mundamveli	118.91	7808	8510	8974	9216	9163	65.66	71.57	75.47	77.50	77.06	76.61	9110
23	Manassery	62.01	8076	8802	9282	9532	9477	130.24	141.94	149.69	153.72	152.83	151.94	9422
24	Moolamkuzhi	59	7688	8380	8836	9074	9022	130.31	142.03	149.76	153.80	152.92	152.03	8970
25	Chullikkal	43.28	8017	8738	9214	9463	9408	185.24	201.89	212.89	218.65	217.38	216.10	9353
26	Nazarath	32.88	7140	7782	8206	8428	8379	217.15	236.68	249.57	256.33	254.84	253.35	8330
27	Fort Cochin Veli	57.36	6788	7399	7802	8012	7966	118.34	128.99	136.02	139.68	138.88	138.08	7920
28	Amaravathy	47.64	11240	12251	12919	13267	13190	235.94	257.16	271.18	278.48	276.87	275.25	13113
29	Wellington Island South	244.95	2729	2974	3137	3221	3203	11.14	12.14	12.81	13.15	13.08	13.00	3185
30	Wellington Island North	595.68	3060	3335	3517	3612	3591	5.14	5.60	5.90	6.06	6.03	5.99	3570
31	Vaduthala West	109.9	10290	11216	11827	12146	12076	93.63	102.06	107.62	110.52	109.88	109.24	12006
32	Vaduthala East	83.02	7229	7879	8309	8533	8483	87.08	94.90	100.08	102.78	102.18	101.58	8433
33	Elamakkara North	94	8939	9743	10274	10551	10490	95.10	103.65	109.30	112.24	111.60	110.95	10429
34	Puthukkalavattom	116.43	7880	8589	9057	9301	9247	67.68	73.77	77.79	79.88	79.42	78.96	9193
35	Ponekkara	112.59	8060	8785	9264	9513	9459	71.59	78.03	82.28	84.49	84.01	83.53	9405
36	Kunnumpuarm	206.58	8040	8763	9241	9490	9435	38.92	42.42	44.73	45.94	45.67	45.41	9380
37	Edappally	161.08	8185	8921	9407	9661	9605	50.81	55.38	58.40	59.98	59.63	59.28	9549
38	Devankulangara	177.59	9323	10162	10715	11004	10941	52.50	57.22	60.34	61.96	61.61	61.25	10878
39	Karukappilly	113.88	8185	8921	9407	9661	9605	71.87	78.34	82.60	84.83	84.34	83.85	9549

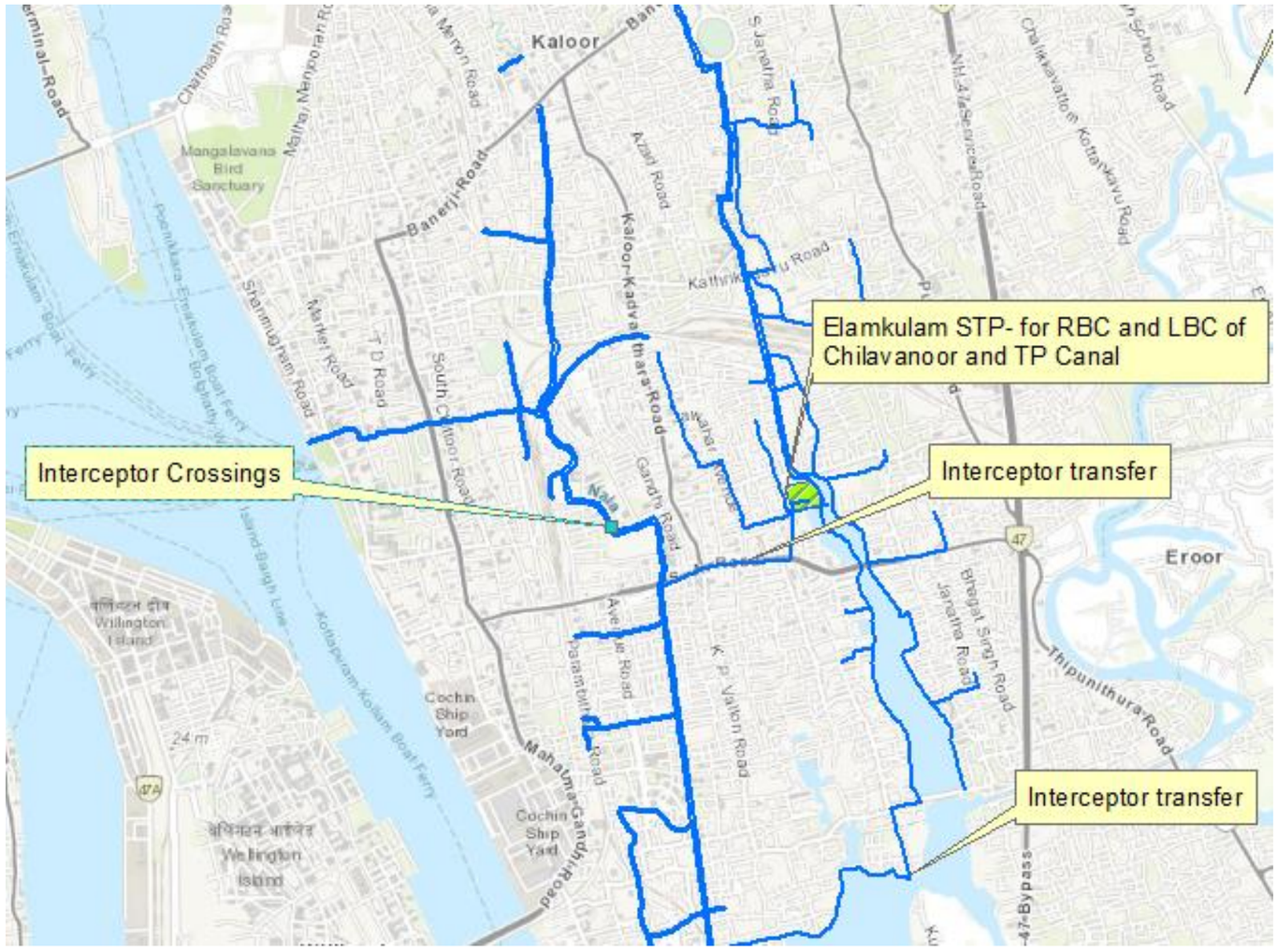
Ward	Ward Name	Ward Area (hectare)	Population		Projected Population			Population Density		Projected Population Density				Population
			2001	2011	2021	2031	2041	2001	2011	2021	2031	2041	2051	2051
40	Mamangalam	98.31	6003	6543	6899	7085	7045	61.06	66.55	70.18	72.07	71.66	71.25	7005
41	Vennala	201.59	10465	11406	12028	12352	12281	51.91	56.58	59.67	61.27	60.92	60.57	12210
42	Palarivattom	123.02	12087	13174	13892	14267	14184	98.25	107.09	112.92	115.97	115.30	114.62	14101
43	Karanakodam	131.56	9672	10542	11116	11416	11350	73.52	80.13	84.49	86.77	86.27	85.77	11284
44	Thammanam	129.53	7821	8524	8989	9231	9178	60.38	65.81	69.40	71.27	70.86	70.45	9125
45	Chakkraparambu	200.4	7991	8710	9184	9432	9378	39.88	43.46	45.83	47.07	46.80	46.53	9324
46	Chalikkavattom	82.39	5120	5581	5885	6043	6008	62.14	67.74	71.43	73.35	72.92	72.50	5973
47	Ponnurunny East	111.14	5407	5893	6215	6382	6345	48.65	53.02	55.92	57.42	57.09	56.76	6308
48	Vyttila	174.98	7855	8562	9028	9271	9218	44.89	48.93	51.59	52.98	52.68	52.38	9165
49	Poonithura	127.75	7122	7763	8186	8406	8358	55.75	60.77	64.08	65.80	65.42	65.05	8310
50	Vyttila Janatha	136.7	7913	8625	9095	9340	9286	57.89	63.09	66.53	68.32	67.93	67.53	9232
51	Ponnurnny	117.91	8376	9129	9627	9886	9829	71.04	77.42	81.65	83.84	83.36	82.88	9772
52	Elamkulam	130.33	8841	9636	10161	10435	10375	67.84	73.94	77.96	80.07	79.61	79.15	10315
53	Giri Nagar	93.49	7398	8063	8503	8732	8682	79.13	86.24	90.95	93.40	92.87	92.33	8632
54	Panampally Nagar	81.83	5885	6414	6764	6946	6906	71.92	78.38	82.66	84.88	84.39	83.91	6866
55	Kadavanthra	185.82	9268	10102	10652	10939	10876	49.88	54.36	57.32	58.87	58.53	58.19	10813
56	Konthuruthy	73.05	7321	7980	8414	8641	8591	100.22	109.24	115.18	118.29	117.60	116.92	8541
57	Thevara	92.54	4737	5163	5445	5591	5559	51.19	55.79	58.84	60.42	60.07	59.73	5527
58	Perumanoor	103.5	8526	9293	9799	10063	10006	82.38	89.79	94.68	97.23	96.68	96.13	9949
59	Ravipuram	147.55	6093	6641	7003	7192	7150	41.29	45.01	47.46	48.74	48.46	48.17	7108
60	Ernakulam South	155.92	7821	8524	8989	9231	9178	50.16	54.67	57.65	59.20	58.86	58.52	9125
61	Gandhi Nagar	158.08	9915	10807	11396	11703	11636	62.72	68.36	72.09	74.03	73.61	73.18	11569
62	Kathrukadavu	118.92	9076	9892	10432	10713	10651	76.32	83.18	87.72	90.09	89.56	89.04	10589
63	Kaloor South	113.44	7625	8311	8764	9000	8948	67.22	73.26	77.26	79.34	78.88	78.42	8896
64	Ernakulam Central	159.71	12002	13082	13794	14166	14085	75.15	81.91	86.37	88.70	88.19	87.68	14004
65	Ernakulam North	82.41	5017	5468	5766	5922	5888	60.88	66.35	69.97	71.86	71.45	71.04	5854
66	Ayyappankavu	163.21	6718	7322	7721	7929	7884	41.16	44.86	47.31	48.58	48.31	48.03	7839
67	Thrikkanar Vattom	68.4	9345	10186	10741	11030	10967	136.62	148.92	157.03	161.26	160.34	159.42	10904
68	Kaloor North	103.29	8424	9182	9682	9943	9886	81.56	88.90	93.74	96.26	95.71	95.16	9829
69	Elamakkara South	96.72	13057	14231	15007	15412	15323	135.00	147.14	155.16	159.35	158.43	157.51	15234
70	Pachalam	109.07	8044	8768	9245	9495	9440	73.75	80.39	84.76	87.05	86.55	86.05	9385
71	Thattazham	111.52	8152	8885	9369	9622	9567	73.10	79.67	84.01	86.28	85.79	85.29	9512

(Source: Kochi Corporation)

(Ward area provided in the table is excluding the major water bodies and restricted areas)

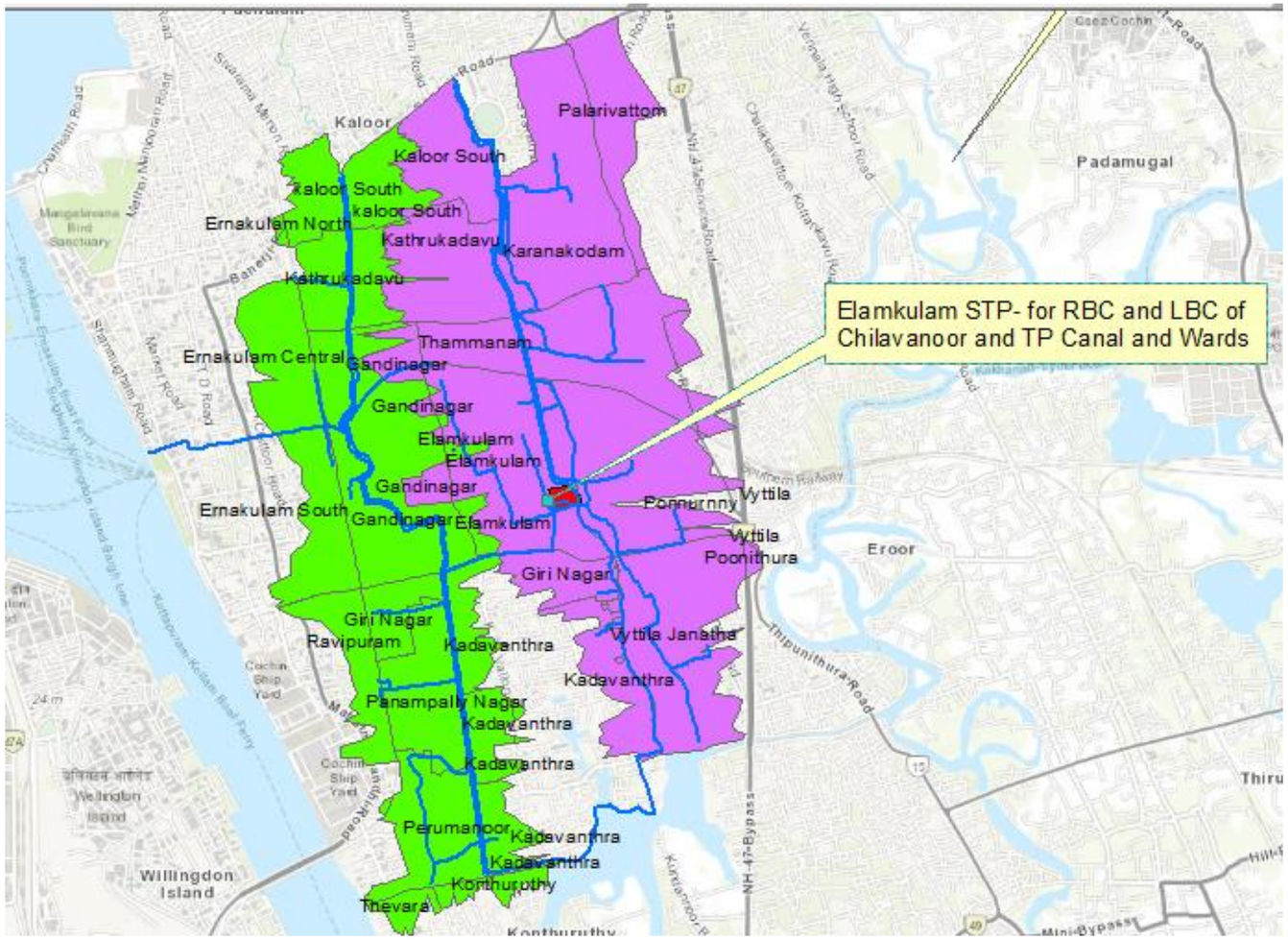
1. Elamkulam STP network (RBC and LBC of Chilavanoor and TP canals and wards)

FID	Shape *	OID_	Name	SymbolID	AltMode	Shape_Leng	Length
0	Polyline ZM	0	Placemark	3	-1	0.051232	5.65779
1	Polyline ZM	0	Placemark	3	-1	0.053458	5.90136
2	Polyline ZM	0	1.44 km	7	-1	0.011684	1.28461
3	Polyline ZM	0	2.26 km	7	-1	0.020584	2.26463
4	Polyline ZM	0	Placemark	3	-1	0.054591	6.03
5	Polyline ZM	0	Placemark	3	-1	0.0546	6.03079
						Total Network Length	27.17



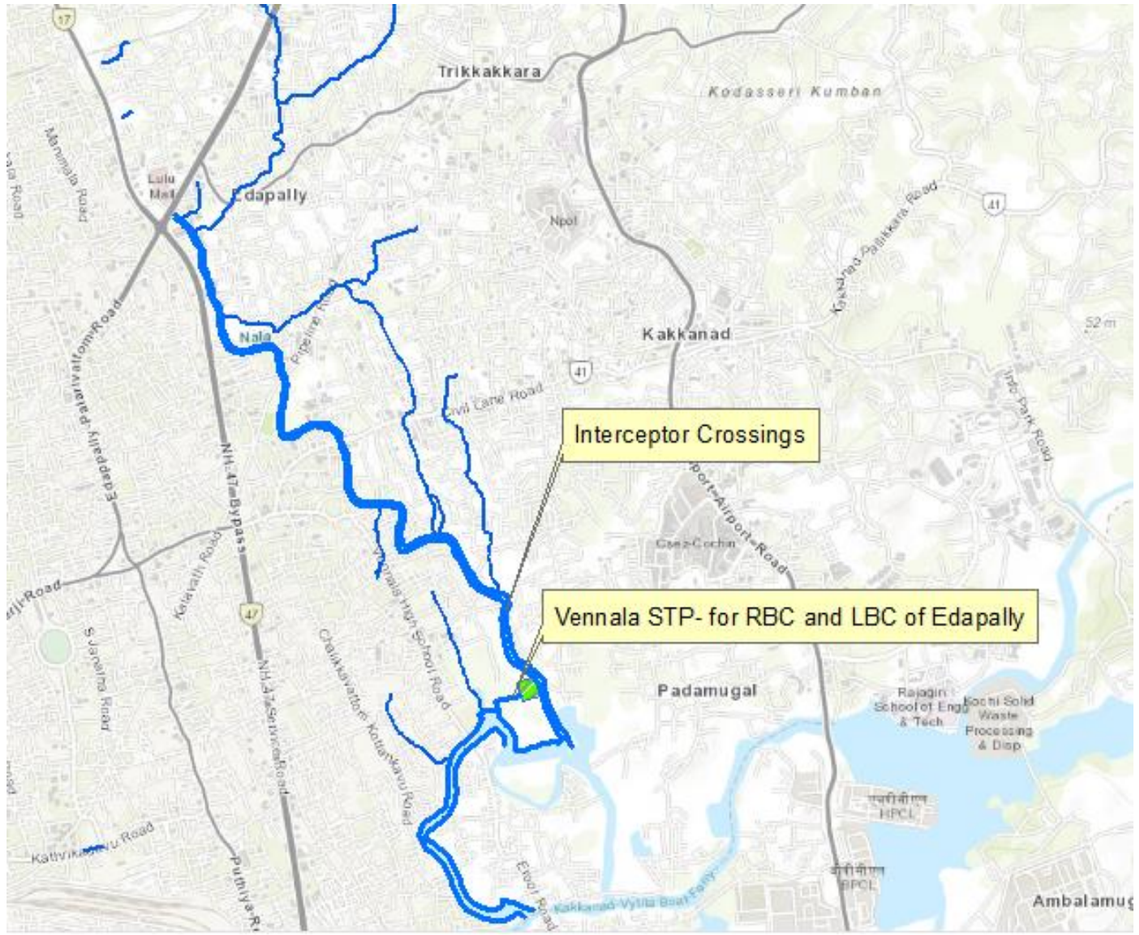
Elamkulam STP Catchment area

TP-Catchment							
FID	Shape *	ward_no	SHAPE_Leng	Shape_Le_1	ward_name	Shape_Le_2	Shape_Area in Ha
0	Polygon ZM	65	0	5620.489555	Ernakulam North	5620.489555	1.178607
1	Polygon ZM	64	0	5810.649979	Ernakulam Central	5810.649979	52.023949
2	Polygon ZM	60	0	5172.966136	Ernakulam South	5172.966136	48.095045
3	Polygon ZM	59	0	5362.0379	Ravipuram	5362.0379	38.523848
4	Polygon ZM	57	0	5654.235809	Thevara	5654.235809	9.722975
5	Polygon ZM	63	0	5755.792658	Kaloor South	5755.792658	60.301728
6	Polygon ZM	62	0	4961.404598	Kathrukadavu	4961.404598	49.259824
7	Polygon ZM	61	0	5568.523684	Gandinagar	5568.523684	133.816282
8	Polygon ZM	52	0	5189.992096	Elamkulam	5189.992096	10.608697
9	Polygon ZM	56	0	3772.929645	Konthuruthy	3772.929645	11.956207
10	Polygon ZM	58	0	4910.610148	Perumanoor	4910.610148	78.522842
11	Polygon ZM	55	0	6747.488893	Kadavanthra	6747.488893	3.66432
12	Polygon ZM	53	0	6558.104723	Giri Nagar	6558.104723	47.605892
13	Polygon ZM	54	0	4883.968956	Panampally Nagar	4883.968956	78.229368
						Total Catchment of Elamkulam Catchment from TP	623.509584
Chilavanoor-Catchment							
FID	Shape *	ward_no	SHAPE_Leng	Shape_Le_1	ward_name	Shape_Le_2	Shape_Area in Ha
0	Polygon ZM	63	0	5755.792658	kaloor South	5755.792658	1.052447
1	Polygon ZM	62	0	4961.404598	Kathrukadavu	4961.404598	68.638844
2	Polygon ZM	43	0	5582.492956	Karanakodam	5582.492956	131.564991
3	Polygon ZM	42	0	5026.446949	Palarivattom	5026.446949	49.93302
4	Polygon ZM	47	0	4766.988905	Ponnurunny East	4766.988905	14.408534
5	Polygon ZM	44	0	6651.591673	Thammanam	6651.591673	113.424077
6	Polygon ZM	61	0	5568.523684	Gandinagar	5568.523684	24.226301
7	Polygon ZM	52	0	5189.992096	Elamkulam	5189.992096	119.676089
8	Polygon ZM	51	0	4649.224669	Ponnurnny	4649.224669	107.624822
9	Polygon ZM	48	0	13876.76715	Vyttila	13876.76715	1.559531
10	Polygon ZM	49	0	9518.800235	Poonithura	9518.800235	2.516361
11	Polygon ZM	50	0	5665.177146	Vyttila Janatha	5665.177146	116.661897
12	Polygon ZM	55	0	6747.488893	Kadavanthra	6747.488893	38.710759
13	Polygon ZM	53	0	6558.104723	Giri Nagar	6558.104723	27.570923
14	Polygon ZM	63	0	0	Kaloor South	0	49.299177
						Total Catchment of Elamkulam Catchment from Chilavanoor	866.867773
						Total catchment of Elamkulam Plant in Ha	**1490.377357**


Elamkulam STP- for RBC and LBC of Chilavanoor and TP Canal and Wards
Kaloor
Kaloor South
Palarivattom
Padamugal
Ernakulam North
Kathrukadavu
Karanakodam
Thammanam
Ernakulam Central
Gandinagar
Elamkulam
Ernakulam South
Ponnurnny
Vyttila
Poonithura
Eroor
Giri Nagar
Ravipuram
Kadavanthra
Vyttila Janatha
Panampally Nagar
Perumanoor
Thevara
Korthuruthy
Willingdon Island
Thipunithura Road
NH 47-Bypass

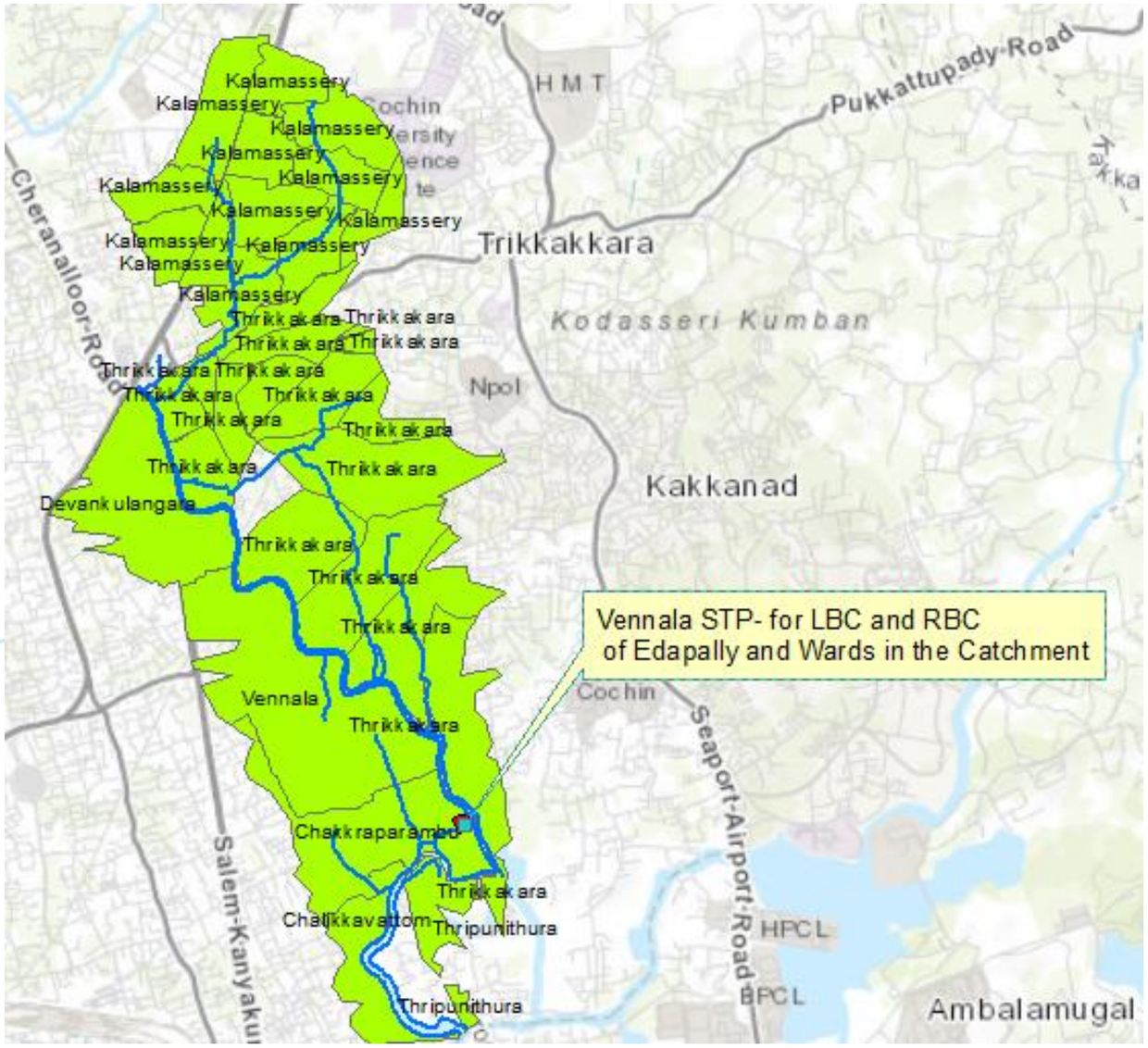
2. Vennala STP network (RBC and LBC of Edappally canal and Wards)

FID	Shape *	OID_	Name	SymbolID	AltMode	Shape_Leng	Length
0	Polyline ZM	0	Untitled Path	5	-1	0.002352	0.26
1	Polyline ZM	0	Placemark	3	-1	0.053344	5.88
2	Polyline ZM	0	Placemark	3	-1	0.001907	0.21
3	Polyline ZM	0	Placemark	3	-1	0.009791	1.08
4	Polyline ZM	0	Placemark	3	-1	0.058256	6.42
5	Polyline ZM	0	Placemark	3	-1	0.005719	0.63
6	Polyline ZM	0	Placemark	3	-1	0.011989	1.32
7	Polyline ZM	0	Placemark	3	-1	0.009252	1.02
8	Polyline ZM	0	Placemark	3	-1	0.000543	0.06
9	Polyline ZM	0	Placemark	6	-1	0.000273	0.03
10	Polyline ZM	0	Placemark	3	-1	0.001366	0.15
11	Polyline ZM	0	Placemark	3	-1	0.001364	0.15
						Total Network Length	17.21



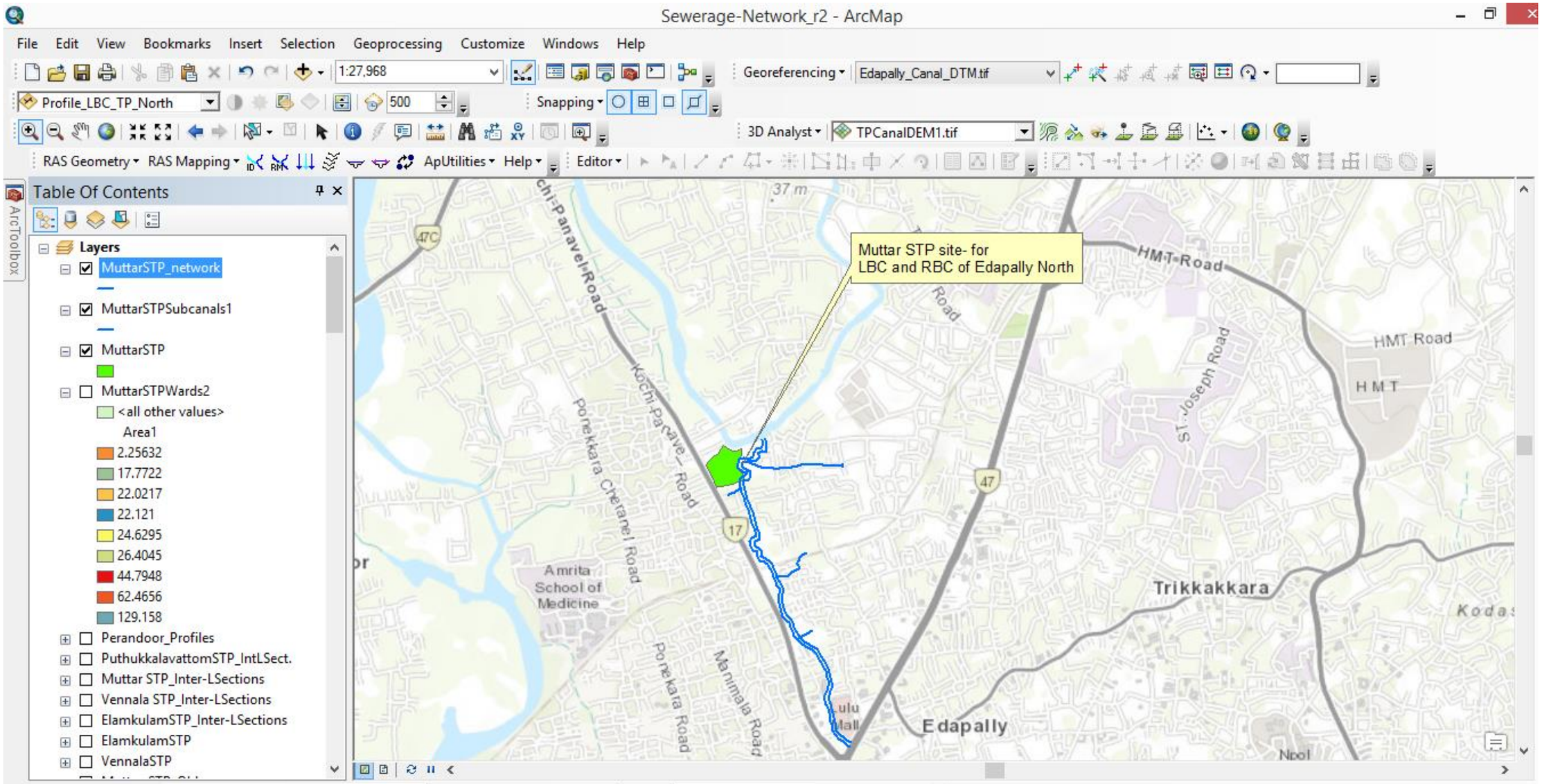
Vennala STP Catchment area

FID	Shape *	OBJECTID	FID_Thripu	Id	WardName	WardNo1	Area in Ha
0	Polygon ZM	2	1	0	Thripunithura	2	31.6071
1	Polygon ZM	7	-1	0	Kalamassery	32	29.7417
2	Polygon ZM	8	-1	0	Kalamassery	31	19.5813
3	Polygon ZM	9	-1	0	Kalamassery	35	21.9008
4	Polygon ZM	10	-1	0	Kalamassery	36	23.6615
5	Polygon ZM	12	-1	0	Kalamassery	37	41.2286
6	Polygon ZM	13	-1	0	Kalamassery	25	23.6914
7	Polygon ZM	14	-1	0	Kalamassery	24	24.5096
8	Polygon ZM	15	-1	0	Kalamassery	26	35.2201
9	Polygon ZM	16	-1	0	Kalamassery	28	23.5568
10	Polygon ZM	17	-1	0	Kalamassery	29	27.676
11	Polygon ZM	18	-1	0	Kalamassery	27	17.7191
12	Polygon ZM	21	-1	0	Kalamassery	30	32.2396
13	Polygon ZM	25	-1	0	Devankulangara	38	109.163
14	Polygon ZM	27	-1	0	Vennala	41	190.832
15	Polygon ZM	28	-1	0	Chakkraparambu	45	107.601
16	Polygon ZM	29	-1	0	Chalikkavattom	46	46.6342
17	Polygon ZM	30	-1	0	Thrikkakkara	2	15.4892
18	Polygon ZM	31	-1	0	Thrikkakkara	3	9.55725
19	Polygon ZM	32	-1	0	Thrikkakkara	41	18.2365
20	Polygon ZM	33	-1	0	Thrikkakkara	1	25.9019
21	Polygon ZM	35	-1	0	Thrikkakkara	33	55.4606
22	Polygon ZM	36	-1	0	Thrikkakkara	31	67.0045
23	Polygon ZM	37	-1	0	Thrikkakkara	29	64.0103
24	Polygon ZM	38	-1	0	Thrikkakkara	30	67.8908
25	Polygon ZM	39	-1	0	Thrikkakkara	22	6.84117
26	Polygon ZM	40	-1	0	Thrikkakkara	4	21.014
27	Polygon ZM	41	-1	0	Thrikkakkara	40	19.1245
28	Polygon ZM	42	-1	0	Thrikkakkara	39	20.3401
29	Polygon ZM	43	-1	0	Thrikkakkara	36	4.62371
30	Polygon ZM	44	-1	0	Thrikkakkara	38	1.19944
31	Polygon ZM	45	-1	0	Thrikkakkara	34	35.6601
32	Polygon ZM	46	-1	0	Thrikkakkara	35	20.2516
33	Polygon ZM	48	-1	0	Thrikkakkara	32	79.0395
Total Catchment of Vennala Catchment from Edappally in Ha							1338.20897



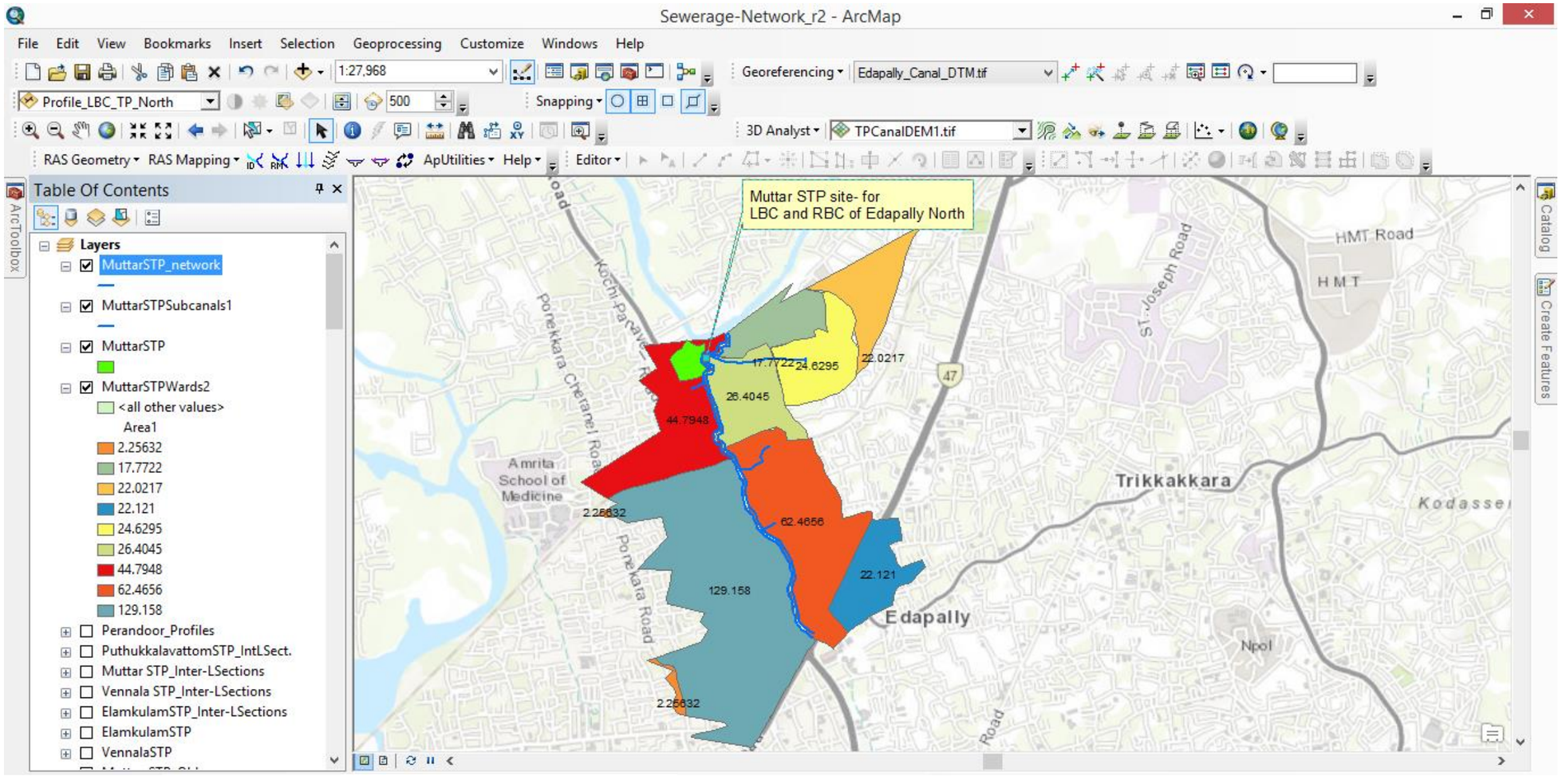
3. Muttar STP network (LBC And RBC of Edappally north)

FID	Shape *	OID_	Name	SymbolID	AltMode	Base	Clamped	Extruded	Snippet	popup Info	Shape_Leng
0	Polyline ZM	0	Placemark	2	-1	0	0	0			2.459998
1	Polyline ZM	0	Placemark	2	-1	0	0	0			2.463002
										Total Network Length	4.923



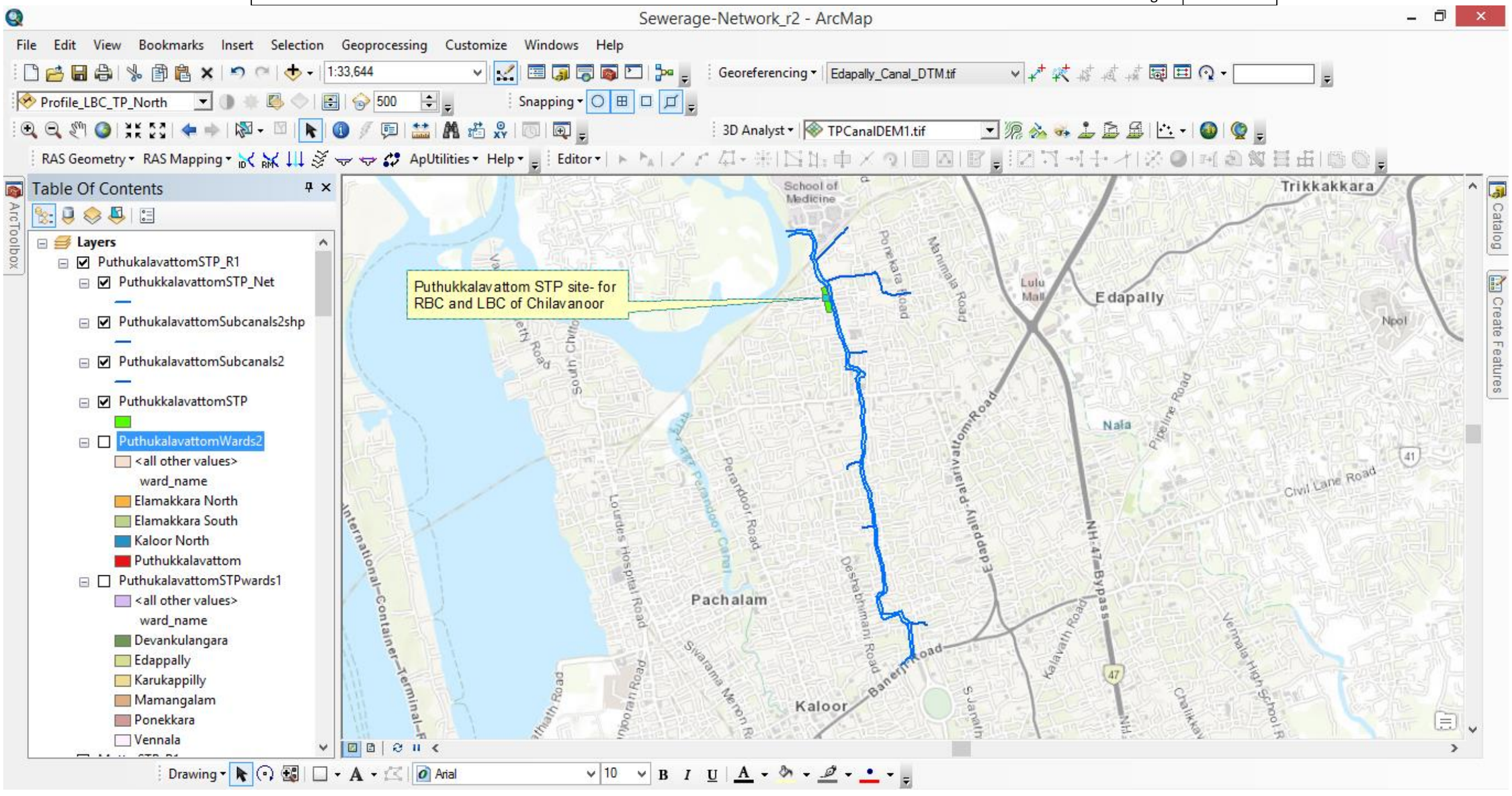
Muttar STP Catchment area

Edappally Catchment							
FID	Shape *	OBJECTID	FID_Thripu	Id	Ward Name	WardNo1	Area1
0	Polygon ZM	3	-1	0	Kalamassery	39	26.4045
1	Polygon ZM	4	-1	0	Kalamassery	38	24.6295
2	Polygon ZM	5	-1	0	Kalamassery	34	62.4656
3	Polygon ZM	6	-1	0	Kalamassery	33	22.121
4	Polygon ZM	11	-1	0	Kalamassery	41	22.0217
5	Polygon ZM	19	-1	0	Kalamassery	40	17.7722
6	Polygon ZM	22	-1	0	Kunnumpuarm	36	44.7948
7	Polygon ZM	23	-1	0	Ponekkara	35	2.25632
8	Polygon ZM	24	-1	0	Edappally	37	129.158
						Total Muttar Catchment from Edappally in Ha	351.62362



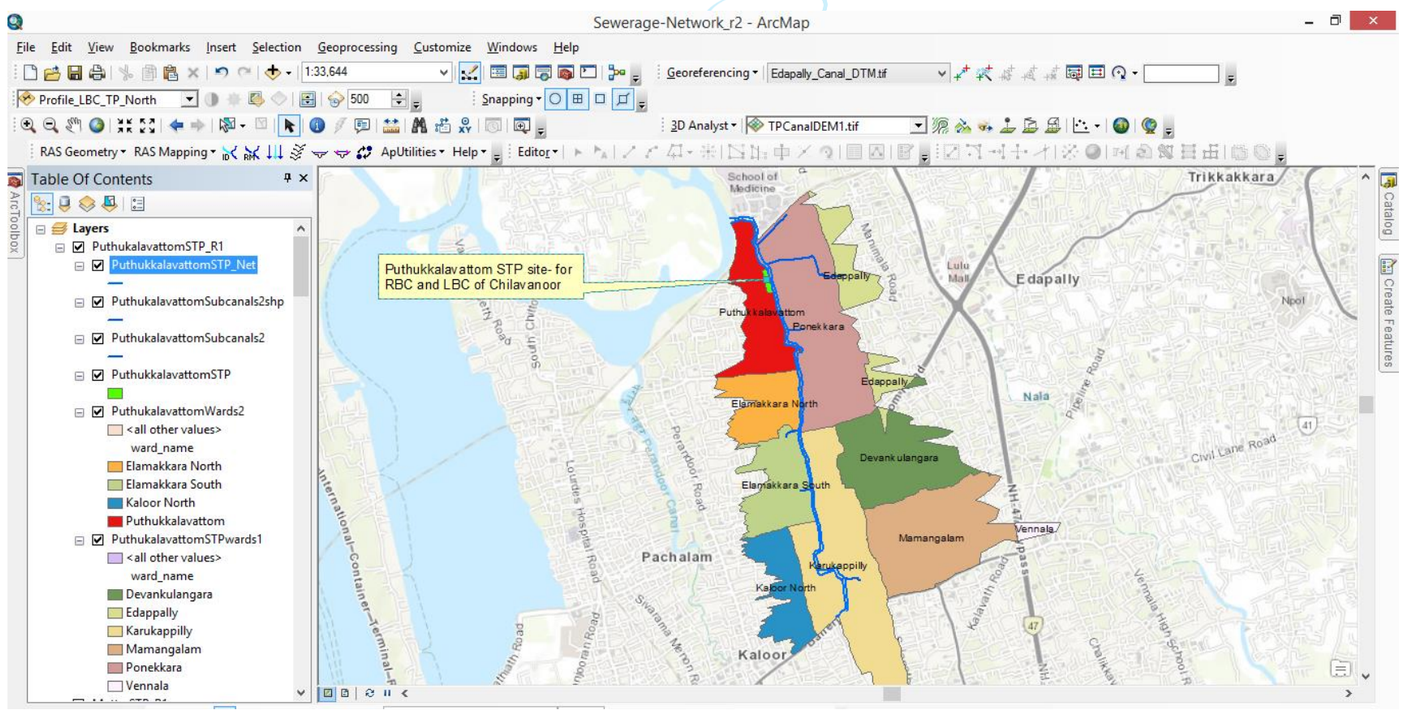
4. Puthukkalavattom STP network (RBC and LBC of Chilavanoor)

FID	Shape *	OID_	Name	SymbolID	AltMode	Base	Clamped	Extruded	Snippet	PopupInfo	Shape_Leng
0	Polyline ZM	0	Chilavanoor LBC	2	-1	0	0	0			4.169999
1	Polyline ZM	0	Chilavanoor RBC	0	0	0	0	0			4.127648
									Total Network Length		8.3



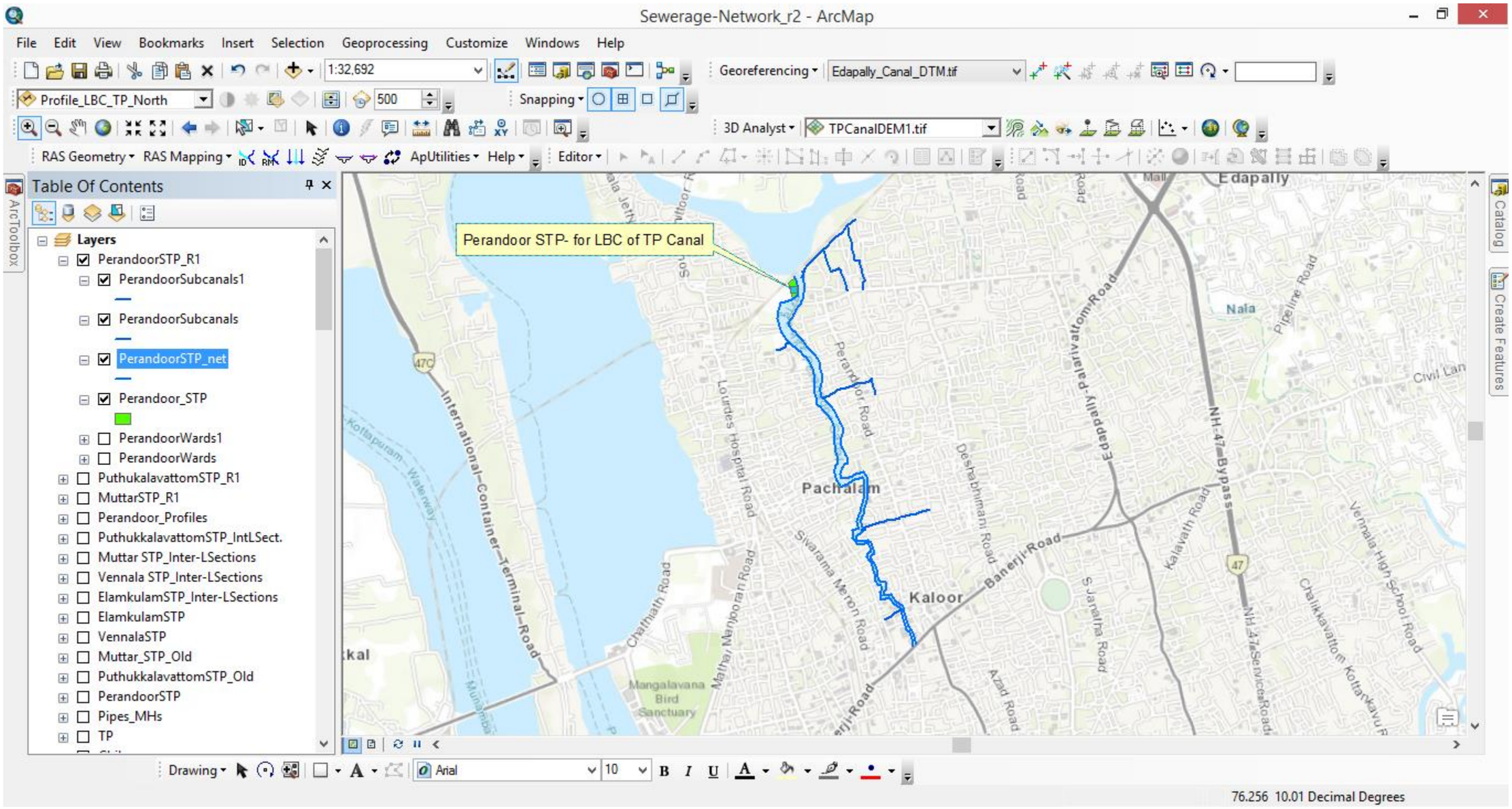
Puthukkalavattom STP Catchment area

LBC Chilavanoor							
FID	Shape *	ward_no	SHAPE_Leng	Shape_Le_1	ward_name	Shape_Le_2	Shape_Area
0	Polygon ZM	68	0	4379.908879	Kaloor North	4379.908879	34.195398
1	Polygon ZM	33	0	4632.24736	Elamakkara North	4632.24736	34.508174
2	Polygon ZM	34	0	5277.590292	Puthukkalavattom	5277.590292	42.710362
3	Polygon ZM	69	0	4461.547413	Elamakkara South	4461.547413	42.225179
					Area of catchment in LBC Chilavanoor		153.639113
RBC Chilavanoor							
FID	Shape *	ward_no	SHAPE_Leng	Shape_Le_1	ward_name	Shape_Le_2	Shape_Area
0	Polygon ZM	35	0	5366.583282	Ponekkara	5366.583282	110.328846
1	Polygon ZM	37	0	6105.54958	Edappally	6105.54958	31.838724
2	Polygon ZM	39	0	6462.199063	Karukappilly	6462.199063	113.876188
3	Polygon ZM	38	0	6926.441102	Devankulangara	6926.441102	68.111583
4	Polygon ZM	40	0	4266.894123	Mamangalam	4266.894123	86.953318
5	Polygon ZM	41	0	7257.010177	Vennala	7257.010177	4.407652
					Area of catchment in RBC Chilavanoor		415.516311
					Total Puthukkalavattom Catchment in Ha		569.155424



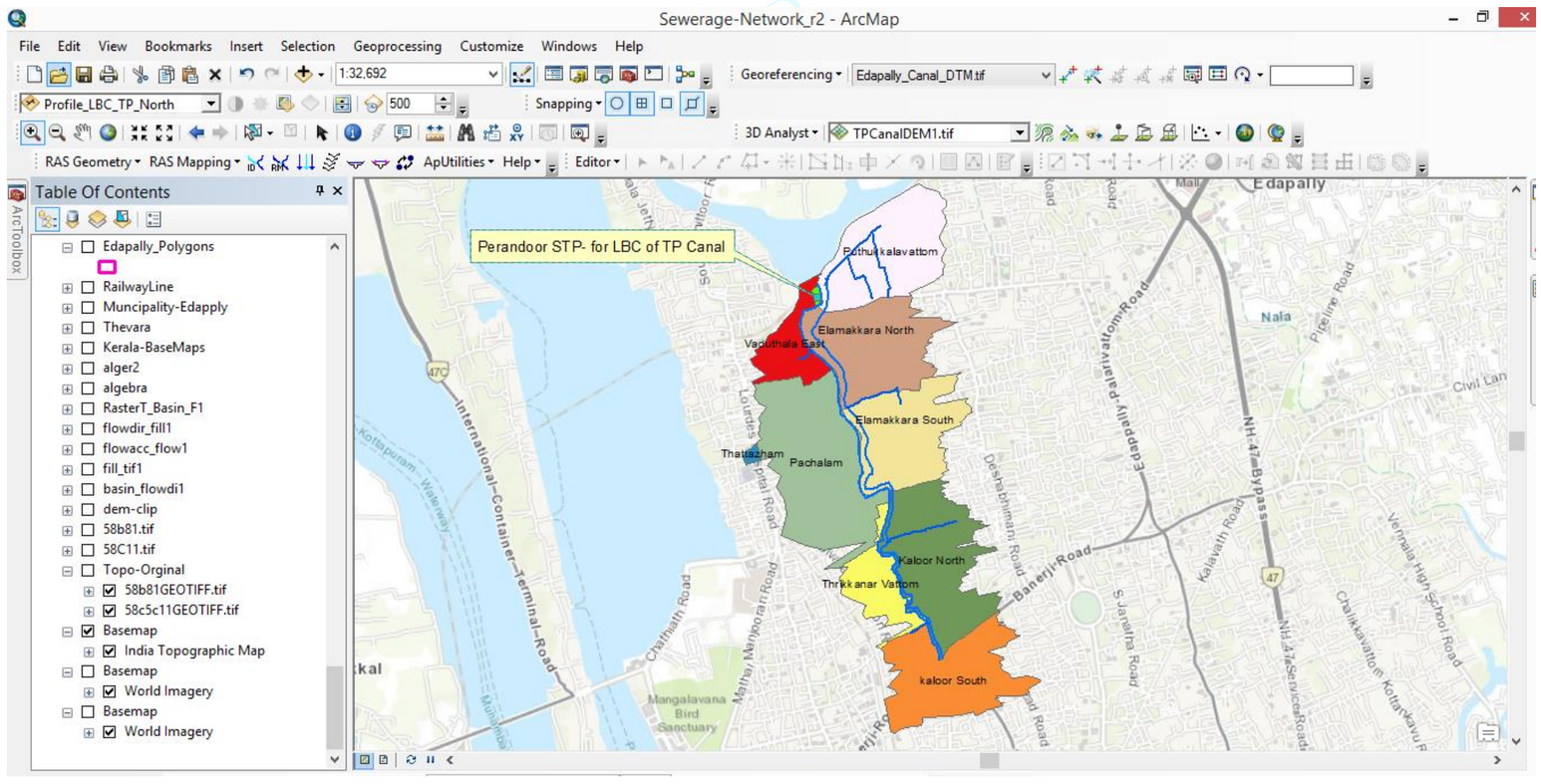
5. Perandoor STP network (for LBC of TP canal)

FID	Shape *	OID_	Name	SymbolID	AltMode	Base	Clamped	Extruded	Snippet	PopupInfo	Shape_Leng
0	Polyline ZM	0	TP LBC	2	-1	0	0	0			3.810001
1	Polyline ZM	0	TP RBC	0	0	0	0	0			3.779575
										Total Network Length	7.589576



Perandoor Catchment area

RBC of TP canal							
FID	Shape *	ward_no	SHAPE_Leng	Shape_Le_1	ward_name	Shape_Le_2	Shape_Area
0	Polygon ZM	68	0	4379.908879	Kaloor North	4379.908879	69.077897
1	Polygon ZM	33	0	4632.24736	Elamakkara North	4632.24736	59.500272
2	Polygon ZM	34	0	5277.590292	Puthukkalavattom	5277.590292	62.448684
3	Polygon ZM	69	0	4461.547413	Elamakkara South	4461.547413	54.507063
						RBC TP Area in Ha	245.533916
LBC of TP canal							
FID	Shape *	ward_no	SHAPE_Leng	Shape_Le_1	ward_name	Shape_Le_2	Shape_Area
0	Polygon ZM	71	4958.349489	9117.684944	Thattazham	9117.684944	1.32453
1	Polygon ZM	32	0	4506.388917	Vaduthala East	4506.388917	22.479252
2	Polygon ZM	70	0	5055.421647	Pachalam	5055.421647	91.311892
3	Polygon ZM	67	0	4400.698988	Thrikkanar Vattom	4400.698988	24.446686
4	Polygon ZM	63	0	5755.792658	kaloor South	5755.792658	60.301728
						LBC TP Area in Ha	199.864088
						Total Area of Catchment in Ha	445.398004



Projected Sewerage Generation for 2041 and 2051

1. Projected Sewerage Generation for 2041 and 2051 for Thevara-Perandoor catchment

Sl. No	Ward Number	Ward Name	Shape Area (Ha)	Total Area (Ha)	% Area in Catchment	Projected Population Density				Projected Population				Projected Sewage Generation (MLD)			
						2021	2031	2041	2051	2021	2031	2041	2051	2021	2031	2041	2051
1	32	Vaduthala East	22.5	83.02	27.1	100.1	102.8	109.9	101.58	2250	2310	2470	2283	0.234	0.240	0.257	0.237
2	33	Elamakkara North	59.5	94	63.3	109.3	112.2	102.2	110.95	6503	6679	6080	6601	0.676	0.694	0.632	0.686
3	34	Puthukkalavattom	62.4	116.43	53.6	77.8	79.9	111.6	78.96	4858	4989	6969	4931	0.505	0.518	0.724	0.512
4	52	Elamkulam	10.6	130.33	8.1	78.0	80.1	79.6	79.15	827	849	845	840	0.086	0.088	0.088	0.087
5	53	Giri Nagar	47.6	93.49	50.9	91.0	93.4	92.9	92.33	4330	4446	4421	4395	0.450	0.462	0.459	0.457
6	54	Panampally Nagar	78.2	81.83	95.6	82.7	84.9	84.4	83.91	6466	6640	6602	6564	0.672	0.690	0.686	0.682
7	55	Kadavanthara	3.7	185.82	2	57.3	58.9	58.5	58.19	210	216	214	213	0.022	0.022	0.022	0.022
8	56	Konthuruthy	12	73.05	16.4	115.2	118.3	117.6	116.92	1377	1414	1406	1398	0.143	0.147	0.146	0.145
9	57	Thevara	9.7	92.54	10.5	58.8	60.4	60.1	59.73	572	587	584	581	0.059	0.061	0.061	0.060
10	58	Perumanoor	78.5	103.5	75.9	94.7	97.2	96.7	96.13	7434	7635	7591	7548	0.772	0.793	0.789	0.784
11	59	Ravipuram	38.5	147.55	26.1	47.5	48.7	48.5	48.17	1828	1878	1867	1856	0.190	0.195	0.194	0.193
12	60	Ernakulam South	48.1	155.92	30.8	57.7	59.2	58.9	58.52	2773	2847	2831	2815	0.288	0.296	0.294	0.292
13	61	Gandhi Nagar	133.8	158.08	84.6	72.1	74.0	73.6	73.18	9647	9907	9850	9793	1.002	1.029	1.023	1.017
14	62	Kathrukadavu	49.3	118.92	41.4	87.7	90.1	89.6	89.04	4321	4438	4412	4386	0.449	0.461	0.458	0.456
15	63	Kaloor South	60.3	113.44	53.2	77.3	79.3	78.9	78.42	4659	4784	4757	4729	0.484	0.497	0.494	0.491
16	64	Ernakulam Central	52	159.71	32.6	86.4	88.7	88.2	87.68	4493	4614	4588	4562	0.467	0.479	0.477	0.474
17	65	Ernakulam North	1.2	82.41	1.4	70.0	71.9	71.4	71.04	82	85	84	84	0.009	0.009	0.009	0.009
18	67	Thrikkanar Vattom	24.4	68.4	35.7	157.0	161.3	160.3	159.42	3839	3942	3920	3897	0.399	0.409	0.407	0.405
19	68	Kaloor North	69.1	103.29	66.9	93.7	96.3	95.7	95.16	6475	6650	6612	6573	0.673	0.691	0.687	0.683
20	69	Elamakkara South	54.5	96.72	56.4	155.2	159.3	158.4	157.51	8457	8686	8635	8585	0.878	0.902	0.897	0.892
21	70	Pachalam	91.3	109.07	83.7	84.8	87.1	86.5	86.05	7740	7949	7903	7857	0.804	0.826	0.821	0.816
22	71	Thattazham	1.3	111.52	1.2	84.0	86.3	85.8	85.29	111	114	114	113	0.012	0.012	0.012	0.012
									Total	**89254**	**91659**	**92754**	**90605**	**9.271**	**9.521**	**9.635**	**9.412**

2. Projected Sewerage Generation for 2041 and 2051 for Chilavanoor catchment

Sl. No	Ward Number	Ward Name	Shape Area in Ha	Total Area in Ha	% Area in Catchment	Projected Population Density				Projected Population				Projected Sewage Generation in MLD			
						2021	2031	2041	2051	2021	2031	2041	2051	2021	2031	2041	2051
1	33	Elamakkara North	34.5	94	36.7	109.3	112.2	111.6	110.9	3771.7	3873.4	3851.0	3828.6	0.392	0.402	0.400	0.398
2	34	Puthukkalavattom	42.7	116.43	36.7	77.8	79.9	79.4	79.0	3322.4	3411.9	3392.1	3372.3	0.345	0.354	0.352	0.350
3	35	Ponekkara	110.3	112.59	98	82.3	84.5	84.0	83.5	9078.0	9321.9	9269.0	9216.1	0.943	0.968	0.963	0.957
4	37	Edappally	31.8	161.08	19.8	58.4	60.0	59.6	59.3	1859.4	1909.6	1898.5	1887.4	0.193	0.198	0.197	0.196
5	38	Devankulangara	68.1	177.59	38.4	60.3	62.0	61.6	61.3	4109.6	4220.4	4196.2	4172.1	0.427	0.438	0.436	0.433
6	39	Karukappilly	113.9	113.88	100	82.6	84.8	84.3	83.9	9406.7	9660.7	9604.7	9548.7	0.977	1.004	0.998	0.992
7	40	Mamangalam	87	98.31	88.4	70.2	72.1	71.7	71.3	6102.0	6266.5	6231.2	6195.8	0.634	0.651	0.647	0.644
8	41	Vennala	4.4	201.59	2.2	59.7	61.3	60.9	60.6	263.0	270.1	268.5	267.0	0.027	0.028	0.028	0.028

Sl. No	Ward Number	Ward Name	Shape Area in Ha	Total Area in Ha	% Area in Catchment	Projected Population Density				Projected Population				Projected Sewage Generation in MLD			
						2021	2031	2041	2051	2021	2031	2041	2051	2021	2031	2041	2051
9	42	Palarivattom	49.9	123.02	40.6	112.9	116.0	115.3	114.6	5638.7	5790.9	5757.2	5723.5	0.586	0.602	0.598	0.595
10	43	Karanakodam	131.6	131.56	100	84.5	86.8	86.3	85.8	11116.4	11416.4	11350.4	11284.4	1.155	1.186	1.179	1.172
11	44	Thammanam	113.4	129.53	87.6	69.4	71.3	70.9	70.4	7871.3	8083.2	8036.8	7990.4	0.818	0.840	0.835	0.830
12	47	Ponnurunny East	14.4	200.4	7.2	45.8	47.1	46.8	46.5	660.3	678.2	674.3	670.4	0.069	0.070	0.070	0.070
13	48	Vyttila	1.6	82.39	1.9	71.4	73.3	72.9	72.5	111.4	114.4	113.7	113.1	0.012	0.012	0.012	0.012
14	49	Poonithura	2.5	111.14	2.3	55.9	57.4	57.1	56.8	140.7	144.5	143.7	142.8	0.015	0.015	0.015	0.015
15	50	Vyttila Janatha	116.7	174.98	66.7	51.6	53.0	52.7	52.4	6019.1	6181.1	6145.8	6110.4	0.625	0.642	0.638	0.635
16	51	Ponnurnny	107.6	127.75	84.2	64.1	65.8	65.4	65.0	6896.4	7081.8	7041.3	7000.9	0.716	0.736	0.731	0.727
17	52	Elamkulam	119.7	136.7	87.5	66.5	68.3	67.9	67.5	7962.4	8176.8	8129.6	8082.3	0.827	0.849	0.844	0.840
18	53	Giri Nagar	27.6	117.91	23.4	81.6	83.8	83.4	82.9	2251.1	2311.6	2298.3	2285.0	0.234	0.240	0.239	0.237
19	55	Kadavanthra	38.7	185.82	20.8	57.3	58.9	58.5	58.2	2219.1	2278.9	2265.7	2252.6	0.231	0.237	0.235	0.234
20	61	Gandhi Nagar	24.2	158.08	15.3	72.1	74.0	73.6	73.2	1746.5	1793.5	1783.3	1773.0	0.181	0.186	0.185	0.184
21	62	Kathrukadavu	68.6	118.92	57.7	87.7	90.1	89.6	89.0	6021.2	6183.4	6147.6	6111.8	0.625	0.642	0.639	0.635
22	63	Kaloor South	1.1	113.44	0.9	77.3	79.3	78.9	78.4	81.3	83.5	83.0	82.5	0.008	0.009	0.009	0.009
23	68	Kaloor North	34.2	103.29	33.1	93.7	96.3	95.7	95.2	3205.3	3291.7	3272.9	3254.0	0.333	0.342	0.340	0.338
24	69	Elamakkara South	42.2	96.72	43.7	155.2	159.3	158.4	157.5	6551.6	6728.4	6689.6	6650.7	0.681	0.699	0.695	0.691
									Total	**106405**	**109273**	**108644**	**108016**	**11.053**	**11.351**	**11.285**	**11.220**

3. Projected Sewerage Generation for 2041 and 2051 for Edappally catchment

Sl. No	Ward No:	Ward Name	Shape Area in Ha	Total Area in Ha	%Area in Catchment	Population Density in 2011	Projected Population Density				Population in 2011	Projected Population				Sewage Generation in MLD (2011)	Projected Sewage Generation in MLD			
							2021	2031	2041	2051		2021	2031	2041	2051		2021	2031	2041	2051
Corporation- Boundary - Left Bank Canal																				
1	35	Ponekkara	2.3	112.59	2	78.0	82.3	84.5	84.0	83.5	176	186	191	190	188	0.018	0.019	0.020	0.020	0.020
2	36	Kunnumpuarm	45	206.58	21.8	42.4	44.7	45.9	45.7	45.4	1910	2015	2069	2057	2045	0.198	0.209	0.215	0.214	0.212
3	37	Edappally	129.2	161.08	80.2	55.4	58.4	60.0	59.6	59.3	7155	7545	7749	7704	7659	0.743	0.784	0.805	0.800	0.796
4	38	Devankulangara	109.5	177.59	61.6	57.2	60.3	62.0	61.6	61.3	6264	6605	6783	6744	6705	0.651	0.686	0.705	0.701	0.697
5	40	Mamangalam	7.5	98.31	7.6	66.6	70.2	72.1	71.7	71.3	498	525	539	536	533	0.052	0.055	0.056	0.056	0.055
6	41	Vennala	191.4	201.59	94.9	56.6	59.7	61.3	60.9	60.6	10829	11420	11727	11660	11592	1.125	1.186	1.218	1.211	1.204
7	45	Chakkraparambu	108.6	200.4	54.2	43.5	45.8	47.1	46.8	46.5	4719	4976	5110	5081	5051	0.490	0.517	0.531	0.528	0.525
8	46	Chalikkavattom	46.6	82.39	56.6	67.7	71.4	73.3	72.9	72.5	3159	3331	3420	3401	3381	0.328	0.346	0.355	0.353	0.351
					Total	**58.4**	**61.6**	**63.3**	**62.9**	**62.5**	**34710**	**36601**	**37588**	**37372**	**37155**	**3.606**	**3.802**	**3.904**	**3.882**	**3.859**
Right Bank Canal - Municipality- Boundary																				
Kalamassery Municipality																				
9	23	NA	6.96	NA	NA	NA	61.6	63.3	62.9	62.5	1546	429	441	438	436	0.161	0.045	0.046	0.046	0.045
10	24	NA	24.58	NA	NA	NA	61.6	63.3	62.9	62.5	1334	1515	1555	1546	1538	0.139	0.157	0.162	0.161	0.160
11	25	NA	24.15	NA	NA	NA	61.6	63.3	62.9	62.5	1420	1488	1528	1519	1510	0.148	0.155	0.159	0.158	0.157
12	26	NA	35.25	NA	NA	NA	61.6	63.3	62.9	62.5	1599	2171	2230	2217	2204	0.166	0.226	0.232	0.230	0.229
13	27	NA	17.81	NA	NA	NA	61.6	63.3	62.9	62.5	789	1097	1127	1120	1114	0.082	0.114	0.117	0.116	0.116
14	28	NA	23.58	NA	NA	NA	61.6	63.3	62.9	62.5	1558	1453	1492	1483	1475	0.162	0.151	0.155	0.154	0.153

Sl. No	Ward No:	Ward Name	Shape Area in Ha	Total Area in Ha	%Area in Catchment	Population Density in 2011	Projected Population Density				Population in 2011	Projected Population				Sewage Generation in MLD (2011)	Projected Sewage Generation in MLD			
							2021	2031	2041	2051		2021	2031	2041	2051		2021	2031	2041	2051
15	29	NA	27.90	NA	NA	NA	61.6	63.3	62.9	62.5	1606	1719	1765	1755	1745	0.167	0.179	0.183	0.182	0.181
16	30	NA	32.29	NA	NA	NA	61.6	63.3	62.9	62.5	2199	1989	2043	2031	2019	0.228	0.207	0.212	0.211	0.210
17	31	NA	19.68	NA	NA	NA	61.6	63.3	62.9	62.5	1899	1213	1245	1238	1231	0.197	0.126	0.129	0.129	0.128
18	32	NA	29.87	NA	NA	NA	61.6	63.3	62.9	62.5	1695	1840	1890	1879	1868	0.176	0.191	0.196	0.195	0.194
19	33	NA	22.27	NA	NA	NA	61.6	63.3	62.9	62.5	2200	1372	1409	1401	1393	0.229	0.143	0.146	0.146	0.145
20	34	NA	62.66	NA	NA	NA	61.6	63.3	62.9	62.5	1948	3860	3964	3941	3919	0.202	0.401	0.412	0.409	0.407
21	35	NA	22.06	NA	NA	NA	61.6	63.3	62.9	62.5	1708	1359	1396	1388	1380	0.177	0.141	0.145	0.144	0.143
22	36	NA	23.84	NA	NA	NA	61.6	63.3	62.9	62.5	2073	1469	1508	1500	1491	0.215	0.153	0.157	0.156	0.155
23	37	NA	41.79	NA	NA	NA	61.6	63.3	62.9	62.5	1666	2575	2644	2629	2614	0.173	0.267	0.275	0.273	0.272
24	38	NA	24.68	NA	NA	NA	61.6	63.3	62.9	62.5	2136	1521	1561	1553	1544	0.222	0.158	0.162	0.161	0.160
25	39	NA	26.71	NA	NA	NA	61.6	63.3	62.9	62.5	1731	1646	1690	1680	1671	0.180	0.171	0.176	0.175	0.174
26	40	NA	17.92	NA	NA	NA	61.6	63.3	62.9	62.5	1049	1104	1134	1127	1121	0.109	0.115	0.118	0.117	0.116
27	41	NA	22.05	NA	NA	NA	61.6	63.3	62.9	62.5	1291	1358	1395	1387	1379	0.134	0.141	0.145	0.144	0.143
										Total	**31446**	**31177**	**32016**	**31833**	**31649**	**3.266**	**3.238**	**3.326**	**3.307**	**3.288**
Thrikkakkara Municipality																				
28	1	NA	26.36	NA	NA	NA	61.6	63.3	62.9	62.5	1965	1624	1668	1658	1649	0.204	0.169	0.173	0.172	0.171
29	2	NA	15.76	NA	NA	NA	61.6	63.3	62.9	62.5	1877	971	997	991	986	0.195	0.101	0.104	0.103	0.102
30	3	NA	9.71	NA	NA	NA	61.6	63.3	62.9	62.5	1729	598	614	611	607	0.180	0.062	0.064	0.063	0.063
31	4	NA	21.26	NA	NA	NA	61.6	63.3	62.9	62.5	430	1310	1345	1338	1330	0.045	0.136	0.140	0.139	0.138
32	22	NA	7.02	NA	NA	NA	61.6	63.3	62.9	62.5	76	433	444	442	439	0.008	0.045	0.046	0.046	0.046
33	28	NA	6.47	NA	NA	NA	61.6	63.3	62.9	62.5	1669	399	410	407	405	0.173	0.041	0.043	0.042	0.042
34	29	NA	65.74	NA	NA	NA	61.6	63.3	62.9	62.5	2220	4050	4159	4135	4112	0.231	0.421	0.432	0.430	0.427
35	30	NA	70.05	NA	NA	NA	61.6	63.3	62.9	62.5	1994	4316	4432	4407	4381	0.207	0.448	0.460	0.458	0.455
36	31	NA	67.02	NA	NA	NA	61.6	63.3	62.9	62.5	1487	4129	4240	4216	4192	0.154	0.429	0.440	0.438	0.435
37	32	NA	79.13	NA	NA	NA	61.6	63.3	62.9	62.5	2118	4875	5006	4977	4949	0.220	0.506	0.520	0.517	0.514
38	33	NA	55.75	NA	NA	NA	61.6	63.3	62.9	62.5	207	3435	3527	3507	3487	0.021	0.357	0.366	0.364	0.362
39	34	NA	35.81	NA	NA	NA	61.6	63.3	62.9	62.5	2032	2206	2265	2252	2239	0.211	0.229	0.235	0.234	0.233
40	35	NA	20.28	NA	NA	NA	61.6	63.3	62.9	62.5	2189	1249	1283	1276	1268	0.227	0.130	0.133	0.133	0.132
41	36	NA	4.64	NA	NA	NA	61.6	63.3	62.9	62.5	2659	286	293	292	290	0.276	0.030	0.030	0.030	0.030
42	38	NA	1.20	NA	NA	NA	61.6	63.3	62.9	62.5	2085	74	76	76	75	0.217	0.008	0.008	0.008	0.008
43	39	NA	20.47	NA	NA	NA	61.6	63.3	62.9	62.5	1198	1261	1295	1287	1280	0.124	0.131	0.134	0.134	0.133
44	40	NA	19.20	NA	NA	NA	61.6	63.3	62.9	62.5	1124	1183	1215	1208	1201	0.117	0.123	0.126	0.125	0.125
45	41	NA	18.35	NA	NA	NA	61.6	63.3	62.9	62.5	1074	1131	1161	1154	1148	0.112	0.117	0.121	0.120	0.119
46	43	NA	21.93	NA	NA	NA	61.6	63.3	62.9	62.5	1284	1351	1388	1380	1372	0.133	0.140	0.144	0.143	0.142
										Total	**29416**	**34880**	**35819**	**35614**	**35409**	**3.056**	**3.623**	**3.721**	**3.699**	**3.678**
Thripunithura Municipality																				
28	1	NA	36.21	NA	NA		61.6	63.3	62.9	62.5	2119	2230.6	2290.6	2277.5	2264.4	0.220	0.232	0.238	0.237	0.235
29	2	NA	31.70	NA	NA		61.6	63.3	62.9	62.5	1855	1952.9	2005.5	1994.0	1982.5	0.193	0.203	0.208	0.207	0.206
										Total	**3974**	**4183**	**4296**	**4271**	**4247**	**0.413**	**0.435**	**0.446**	**0.444**	**0.441**
															Total MLD	**10.340**	**11.098**	**11.397**	**11.332**	**11.266**

ANNEXURE 5.1

Catalogue of Canal bank development

Source: https://nurserynisarga.in/product/saptaparni-dita-alstonia-scholaris-plant/

Alstonia scholaris

Source: https://www.greensouq.ae/pdt/ficus-religiosa-sacred-fig/

Ficus religiosa

Source: https://www.flickr.com/photos/mercadanteweb/8177162843

Syzygium jambos

Source: https://www.fast-growing-trees.com/products/illinois-everbearing-mulberry-tree

Morus

Source: https://www.greensouq.ae/pdt/mimusops-elengi/

Mimusops elengi

Source: https://evermotion.org/shop/show_product/ficus-benjamina-tree-27-am210-archmodels/15207

Ficus Benjamina

Source: https://dekochi.com/anjili-tree-artocarpus-hirsutus.html | De Kochi - Photographic Journal

Artocarpus Hirsutus

Source: https://indiabiodiversity.org/species/show/31820

Syzygium cumini (L.) Skeels

Source: https://www.fast-growing-trees.com/products/illinois-everbearing-mulberry-tree

Chandrakaran Mangifera indica

Source: https://horomidis.gr/en/product/bauhinia-purpurea-%CE%B-C%CF%80%CE%BF%CF%87%CE%B9%CE%BD%CE%B9%CE%B1/

BAUHINIA PURPUREA

Source:https://warehouse-13-artifact-database.fandom.com/wiki/Vietnamese_Starfruit_Tree

L. Averrhoa carambola

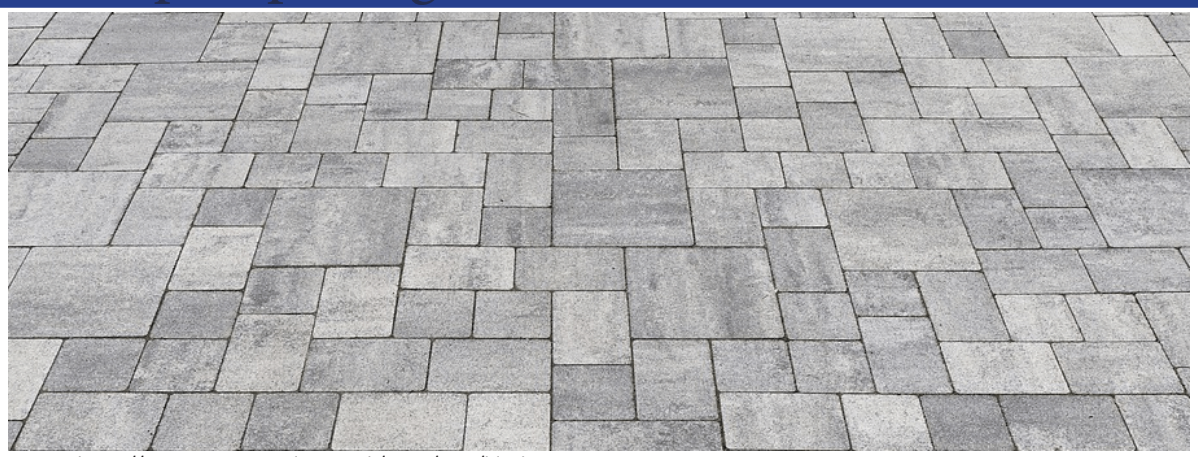
Source: https://www.amazon.in/LushGreen-Tropical-Glomerata-Ornamental-Healthy/dp/B07W5R29F1

Ficus glomerata

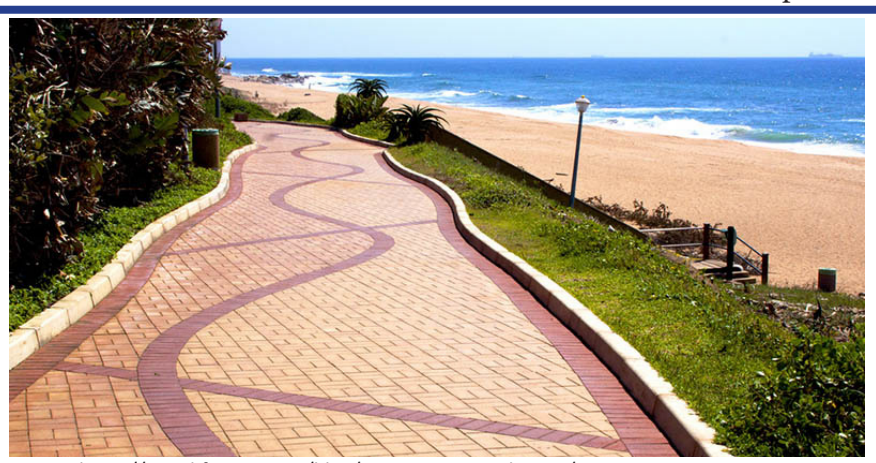
Source: colourbox.com/image/cassia-fistula-or-golden-shower-tree-in-the-park-image-7434558

Casia fistula

Hard scape - paving



Source: https://www.primaporcelain.co.uk/news/post/block-paving-patterns



Source: https://searchfrog.com.au/blog/paving-patterns-designs/

Porcelain paving

Source: https://searchfrog.com.au/blog/paving-patterns-designs/

Cement block pavers

Source: ixabay.com/photos/patch-paving-stones-cobble-

Source: https://onestoppavers.com/clay-brick-pavers/

Concrete Lattice paving

Source: http://www.greenscape.co/grass_grid_paver.html

Recycled plastic grass paving

stone paving

Source:https://www.amazon.com/Marshalltown-REDRR130-Roller-Ashlar-16-Inch/dp/B00FK-8P7V4

Pressed concrete paving

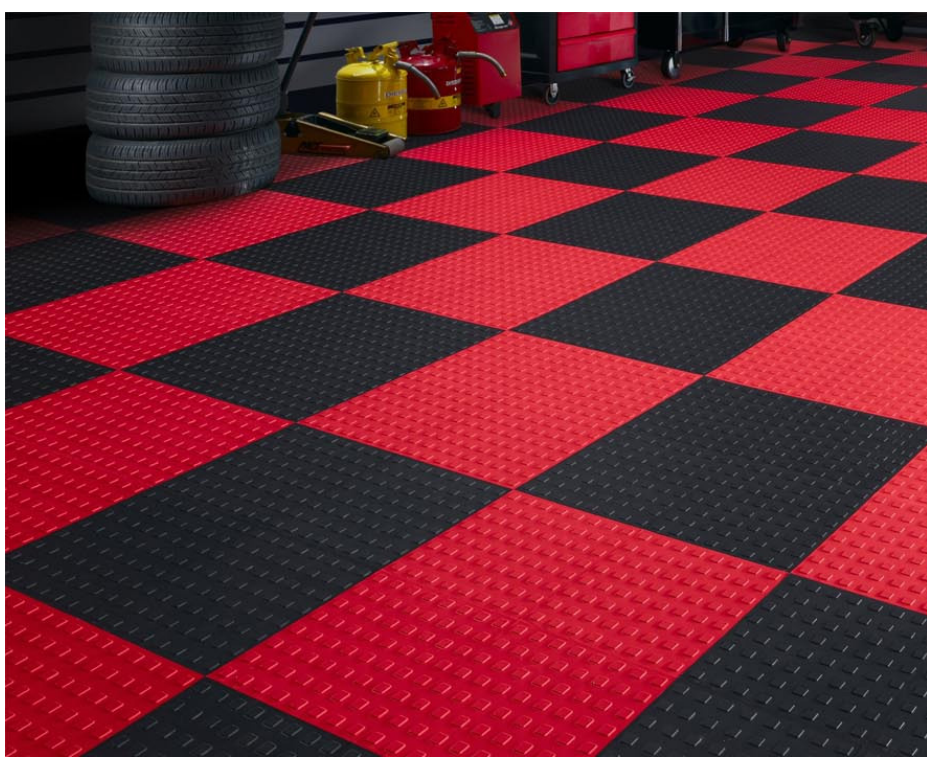
Clay brick paving

Source:https://www.amazon.com/Marshalltown-REDRR130-Roller-Ashlar-16-Inch/dp/B00FK8P7V4

Concrete mold paving

Source: https://www.dreamstime.com/stock-photo-old-laterite-ground-tiled-pavement-picture-image41364696

Literate stone



Source:http://www.infoclub.co/Product_View/8455/interlock-and-paving-tiles---vijaya-bricks

Paving tile

Source: https://www.durbanis.com/portfolio-item/catalunya-union-square/

Concrete bench

Source:https://www.architonic.com/en/product/ete-concrete-bench-2/20006157

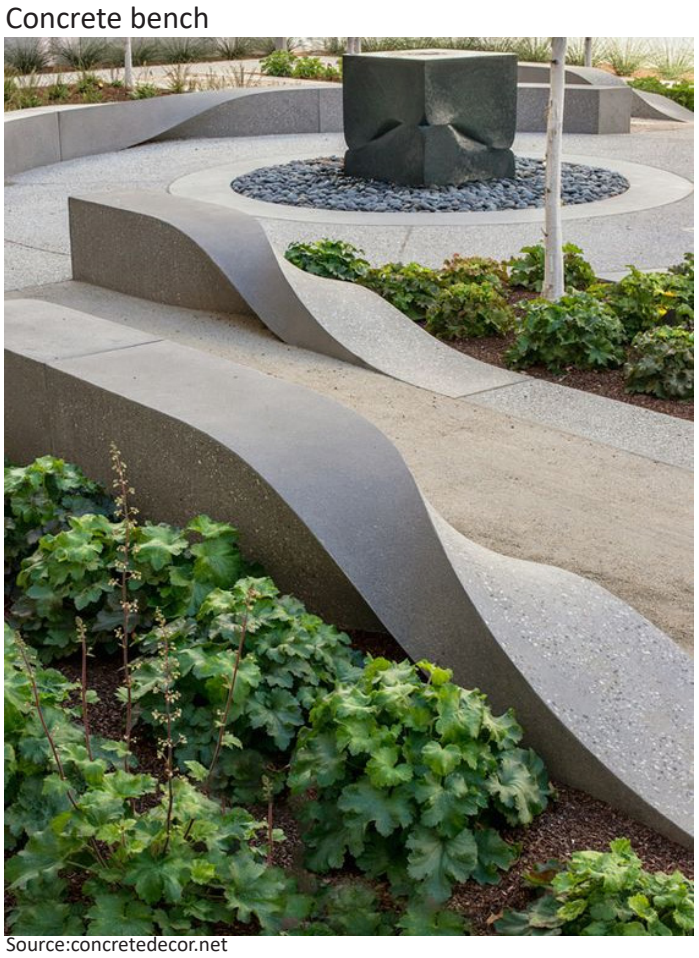
Concrete bench

Source:archiexpo.com

Concrete bench

Source: https://www.guyon-mobilier-urbain.com/wp-content/uploads/2017/02/guyon-mobilier-urbain-banc-exterieur-beton-la-reunion-centre-commercial-2.jpg

Concrete bench

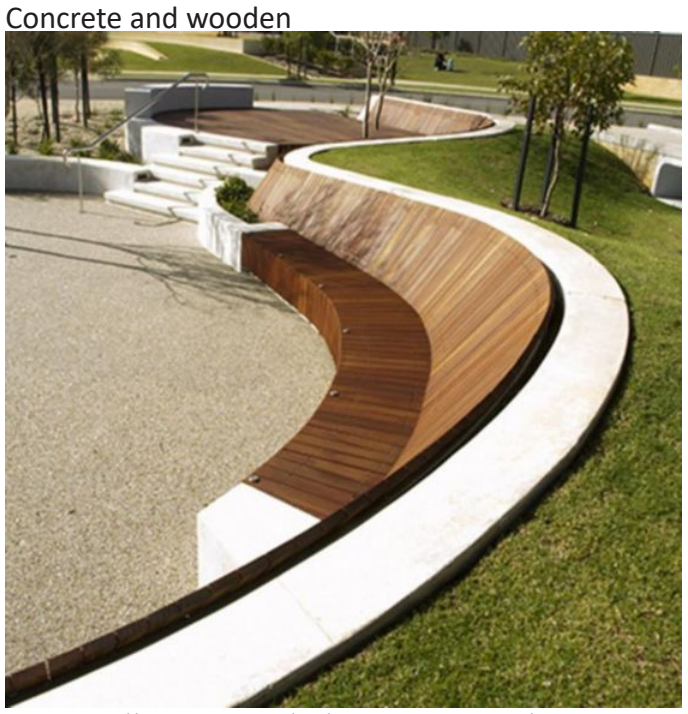


Source:concretedecor.net

Concrete bench

Source: https://www.pinterest.ie/pin/737605245203381892/

Concrete and wooden



Source:https://www.pinterest.ie/pin/637963103442159258/

Concrete and wooden

Source:https://www.externalworksindex.co.uk/entry/145921/Marshalls-land-

Concrete

Source:https://www.scancord.net/parkbankar-och-parksoffor/4423-parksoffa-versio-juno.html

Metal bench with wooden seat

Source:https://www.guyon-mobilier-urbain.com/en/savoir-faire/projects-and-custom-designs/concrete-bench-with-wooden-seat-residential-area-givors/

Concrete bench with wooden seat

Source:https://www.durbanis.com/

Concrete bench with wooden seat

Source: https://pxhere.com/en/photo/617655

Source: https://www.area-streetfurniture.com/street-furniture/litter-receptacle/45l-and-75l-litter-bin-narcisse

Source: https://inhabitat.com/custom-made-designer-trash-bins-pop-up-in-nyc-parks/

Source: https://www.fixturescloseup.com/2015/10/05/contemporary-cubist-recycling-center/

Source:https://www.urbaneffects.co.nz/products/west-iron-litter-bin/

Source:http://www.scandinaviandesign.com/nola/0802/800/Elbin.jpg

Source:https://www.ziegler-metall.de/

Source:https://www.baileystreetscene.co.uk/multiplicity-litter-bin

Source:https://specifierreview.com/

Source:https://sanfrom.en.made-in-china.com/

Source:http://www.springfurniture.co.uk/

Source:hhttps://www.artformurban.co.uk/

Street furniture- tree grate

Source:https://www.scancord.net/parkbankar-och-parksof-for/4423-parksoffa-versio-juno.html

Source:ironagegrates.com

Source:https://conceptlandscape.tumblr.com/

Source:https://www.ironagegrates.com/

Source:https://www.streetlife.nl/

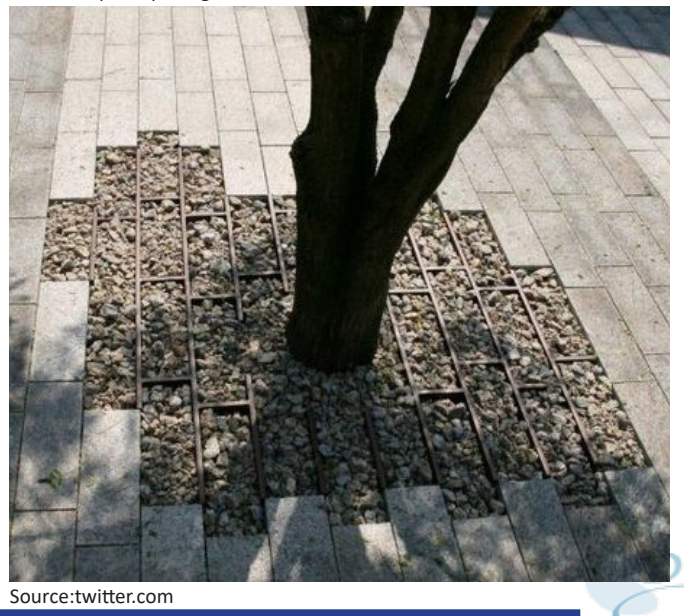
Source:https://www.streetlife.nl/

Source:https://landscapearchitect.com/

Source:vergoti.livejournal.com

Source:https://landscapearchitect.com/

Source:https://i.pinimg.com/



Source:twitter.com

Street furnitures- kiosk

Source:beyman.net

russian.alibaba.com

Source: futuristarchitecture.com

Source: flickr.com

Source: arch daily

Source: carriageworks.com

Source: https://www.flickr.com/

Source: https://uniquekiosk.com/

Source: messnerarchitects.com

Source: bellagroupdesign.com

Source: https://inhabitat.com/

Source: flickr.com

Source: https://www.archiexpo.com/

Source: http://www .upload.wikimedia-org

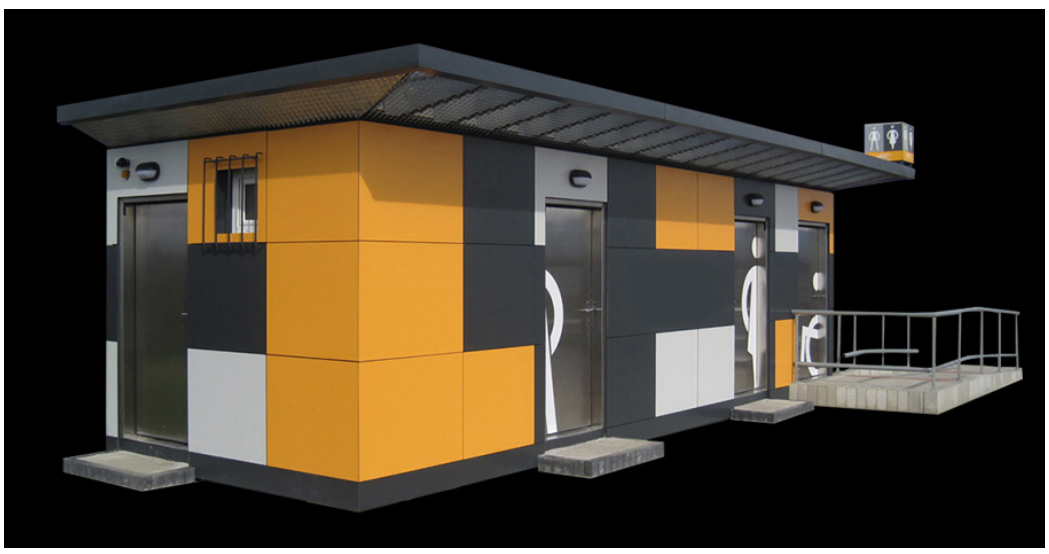
Source: http://www.archiexpo.com

Source:www.archiexpo.com

Source: http://www.accesswa.com

Source:: http://www.hansenyuncken.com

Source:http://www.archiexpo.com



Source:https://landscapearchitect.com/

Source:https://gkindiatoday.com/

Street furniture -Pathway lighting

Source: http://t3.gstatic.com/images

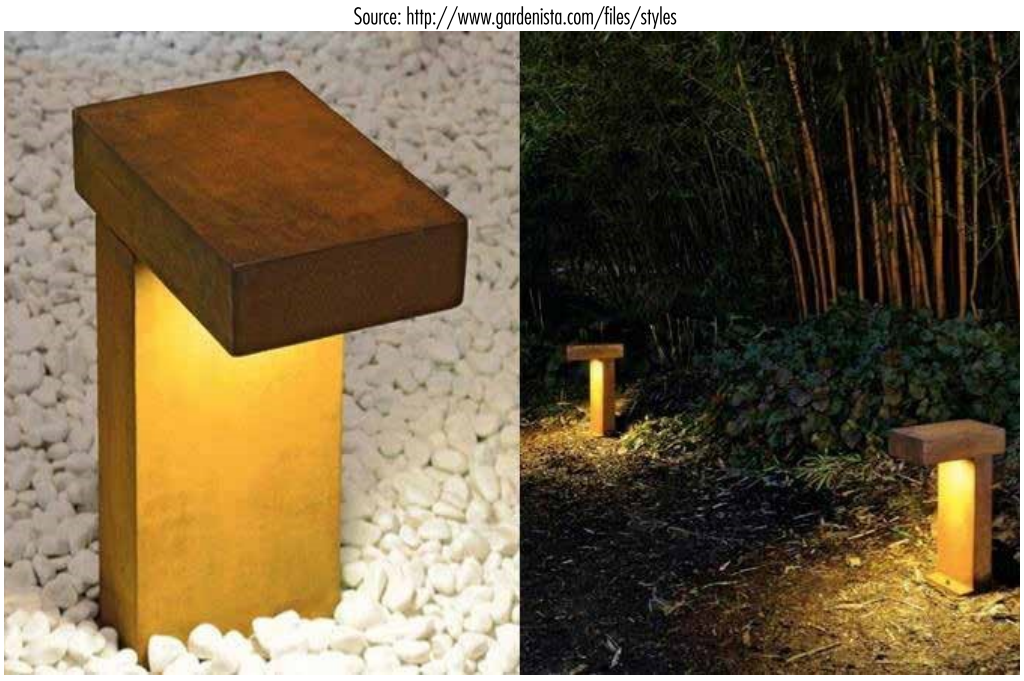
Source: http://www.qvsdirect.com

Source: http://t0.gstatic.com/images

Source: http://www.gardenista.com/files/styles

Source: http://t1.gstatic.com

Source: http://t3.gstatic.com/images



Source: http://www.gardenista.com/files/img/sub/700_rust-pathway-light.jpg

Source: http://www.smartesolarsystems.com/_images/bollard-light-trail.jpg

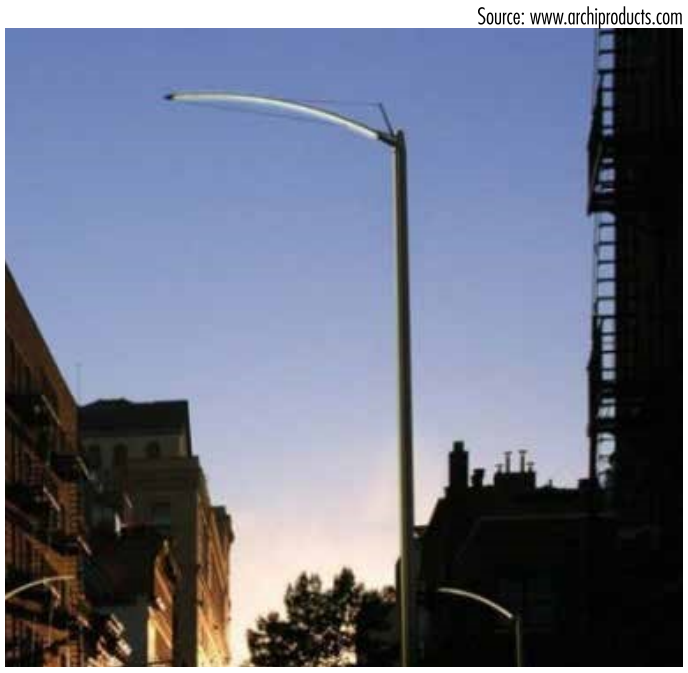
source: google.ca

source: https://www.gardenista.com/

Source: www.archiproducts.com

Source: www.archiproducts.com

Source: www.gettyimage.in



Source: http://memo.ryecroft.net

Source: http://gettyimages.in

Source: http://discovermagazine.com/

Source: http://designsenselighting.com

Source: http://turbosquid.com

source:dunriteplaygrounds.com

source:buildindia.co.in

source:buildindia.co.in

source:wayfair.com

source:magiccabin.com

source:amazon.com

source:https://grabcad.com/

Street furniture - Gym

Mild Steel Outdoor Gym Sitting Cycle
source: https://www.indiamart.com/

surf borad
source: https://www.indiamart.com/

horse rider
source: https://www.indiamart.com/

shoulder builder
source: https://www.indiamart.com/

shoulder builder
source: https://sc01.alicdn.com/

body builder
source: https://www.alibaba.com/

source: https://playfitness.co.uk/

IURWTS Kochi.WT-2024 Integrate Urban Rejuvenation and Water Transport System Kochi Abstract						
Sl No	**Description**	**Quantity**	**Units**	**Rate (Rs)**	**Amount (Rs)**	**Remarks**
A.1	**Canal cleaning, deepening and widening**					
A.1.1	Cleaning and water hyacinth removal with preparatory and final phase					
	Cleaning and removal of water hyacinth including weeds,thick and thorny floating jungles, plastics by means of suitable excavator mounted on pontoon specially made to suit the site condition and disposal of the same including cost and conveyance of all materials , Labour charge, lead, lift etc within a lead of 5 km , as directed by Engineer- In -Charge at all levels					
	Edappally Canal	130784.16	sqm	25.96	3395283.86	
	Chilavanoor Canal	202795.70	sqm	25.96	5264773.19	
	Thevara Perandoor Canal	65638.31	sqm	25.96	1704034.14	
	Thevara Canal	3859.52	sqm	25.96	100196.95	
	Market Canal	1250.31	sqm	25.96	32459.29	
	Total Amount				**1,04,96,747.43**	
	Start of the Project				1,04,96,747.43	
	Completion of the project				1,04,96,747.43	
	Grand total				**2,09,93,494.86**	

Note: Is to be done in two phases

IURWTS Kochi.WT-2024 Integrate Urban Rejuvenation and Water Transport System Kochi						
DETAILED ESTIMATE						
Sl No		**Unit**	**Qty**	**Rate (Rs)**	**Amount**	**Remark**
A.1.1	Cleaning and removal of water hyacinth including weeds,thick and thorny floating jungles, plastics by means of suitable excavator mounted on pontoon specially made to suit the site condition and disposal of the same including cost and conveyance of all materials , Labour charge, lead, lift etc within a lead of 5 km , as directed by Engineer- In -Charge at all levels					OD
	Edappally Canal		1,30,784.16			
	Chilavanoor Canal		2,02,795.70			
	Thevara Perandoor Canal		65,638.31			
	Thevara Canal		3,859.52			
	Market Canal		1,250.31			
		m2	**404328.00**	**25.96**	**1,04,96,747.43**	
	TOTAL				**1,04,96,747.43**	

Edapally Canal							
Sl.No	Chainage	DETAILS					Remarks
		W (m)	Based on the concentration (W1)	L (m)	Area (L*W1)	Total Area (Sqm)	
1	CH 000 : CH 15	13.23	1.59	15.00	23.81	23.81	
2	CH 15 : CH 30	11.77	1.41	15.00	21.18	21.18	
3	CH 30 : CH 45	9.03	0.45	15.00	6.77	6.77	
4	CH 45 : CH 60	7.05	0.35	15.00	5.29	5.29	
5	CH 60 : CH 75	7.48	0.37	15.00	5.61	5.61	
6	CH 75 : CH 90	6.53	0.33	15.00	4.89	4.89	
7	CH 90 : CH 105	7.00	0.35	15.00	5.25	5.25	
8	CH 105 : CH 120	7.45	0.37	15.00	5.59	5.59	
9	CH 120 : CH 135	7.10	0.36	15.00	5.33	5.33	
10	CH 135 : CH 150	7.70	0.38	15.00	5.77	5.77	
11	CH 150 : CH 165	9.37	0.47	15.00	7.03	7.03	
12	CH 165 : CH 180	10.35	1.24	15.00	18.63	18.63	
13	CH 180 : CH 195	7.66	0.38	15.00	5.75	5.75	
14	CH 195 : CH 210	7.09	0.35	15.00	5.31	5.31	
15	CH 210 : CH 225	7.60	0.38	15.00	5.70	5.70	
16	CH 225 : CH 240	7.16	0.36	15.00	5.37	5.37	
17	CH 240 : CH 255	10.36	1.24	15.00	18.64	18.64	
18	CH 255 : CH 270	15.50	1.86	15.00	27.90	27.90	
19	CH 270 : CH 285	11.10	1.33	15.00	19.98	19.98	
20	CH 285 : CH 300	6.23	0.31	15.00	4.67	4.67	
21	CH 300 : CH 315	5.99	0.30	15.00	4.49	4.49	
22	CH 315 : CH 330	6.34	0.32	15.00	4.75	4.75	
23	CH 330 : CH 345	6.13	0.31	15.00	4.59	4.59	
24	CH 345 : CH 360	6.33	0.32	15.00	4.75	4.75	
25	CH 360 : CH 375	6.18	0.31	15.00	4.63	4.63	
26	CH 375 : CH 390	6.15	0.31	15.00	4.61	4.61	
27	CH 390 : CH 405	7.20	0.36	15.00	5.40	5.40	
28	CH 405 : CH 420	8.22	0.41	15.00	6.16	6.16	
29	CH 420 : CH 435	8.50	0.43	15.00	6.38	6.38	
30	CH 435 : CH 450	10.90	1.31	15.00	19.61	19.61	
31	CH 450 : CH 465	12.14	1.46	15.00	21.84	21.84	
32	CH 465 : CH 480	11.42	1.37	15.00	20.56	20.56	
33	CH 480 : CH 495	11.09	1.33	15.00	19.95	19.95	
34	CH 495 : CH 510	11.19	1.34	15.00	20.15	20.15	
35	CH 510 : CH 525	10.05	1.21	15.00	18.09	18.09	
36	CH 525 : CH 540	9.34	0.47	15.00	7.01	7.01	
37	CH 540 : CH 555	9.59	0.48	15.00	7.19	7.19	
38	CH 555 : CH 570	10.22	1.23	15.00	18.40	18.40	
39	CH 570 : CH 585	10.95	1.31	15.00	19.70	19.70	
40	CH 585 : CH 600	11.08	1.33	15.00	19.94	19.94	
41	CH 600 : CH 615	11.85	1.42	15.00	21.33	21.33	
42	CH 615 : CH 630	12.96	1.55	15.00	23.32	23.32	
43	CH 630 : CH 645	13.09	1.57	15.00	23.55	23.55	
44	CH 645 : CH 660	12.91	1.55	15.00	23.24	23.24	
45	CH 660 : CH 675	13.17	1.58	15.00	23.70	23.70	
46	CH 675 : CH 690	12.87	1.54	15.00	23.17	23.17	
47	CH 690 : CH 705	11.70	1.40	15.00	21.06	21.06	
48	CH 705 : CH 720	9.48	0.47	15.00	7.11	7.11	
49	CH 720 : CH 735	8.01	0.40	15.00	6.00	6.00	

Sl.No	Chainage	DETAILS					Remarks
		W (m)	Based on the concentration (W1)	L (m)	Area (L*W1)	Total Area (Sqm)	
50	CH 735 : CH 750	7.84	0.39	15.00	5.88	5.88	
51	CH 750 : CH 765	7.40	0.37	15.00	5.55	5.55	
52	CH 765 : CH 780	7.52	0.38	15.00	5.64	5.64	
53	CH 780 : CH 795	8.07	0.40	15.00	6.05	6.05	
54	CH 795 : CH 810	7.85	0.39	15.00	5.88	5.88	
55	CH 810 : CH 825	8.02	0.40	15.00	6.02	6.02	
56	CH 825 : CH 840	8.67	0.43	15.00	6.50	6.50	
57	CH 840 : CH 855	10.20	1.22	15.00	18.35	18.35	
58	CH 855 : CH 870	10.98	1.32	15.00	19.76	19.76	
59	CH 870 : CH 885	10.03	1.20	15.00	18.05	18.05	
60	CH 885 : CH 900	9.30	0.46	15.00	6.97	6.97	
61	CH 900 : CH 915	9.51	0.48	15.00	7.14	7.14	
62	CH 915 : CH 930	8.28	0.41	15.00	6.21	6.21	
63	CH 930 : CH 945	8.61	0.43	15.00	6.46	6.46	
64	CH 945 : CH 960	8.59	0.43	15.00	6.44	6.44	
65	CH 960 : CH 975	8.02	0.40	15.00	6.01	6.01	
66	CH 975 : CH 990	8.52	0.43	15.00	6.39	6.39	
67	CH 990 : CH 1005	7.90	0.40	15.00	5.93	5.93	
68	CH 1005 : CH 1020	7.89	0.39	15.00	5.92	5.92	
69	CH 1020 : CH 1035	8.88	0.44	15.00	6.66	6.66	
70	CH 1035 : CH 1050	9.49	0.47	15.00	7.11	7.11	
71	CH 1050 : CH 1065	9.94	0.50	15.00	7.46	7.46	
72	CH 1065 : CH 1080	10.33	1.24	15.00	18.59	18.59	
73	CH 1080 : CH 1095	11.34	1.36	15.00	20.40	20.40	
74	CH 1095 : CH 1110	15.86	1.90	15.00	28.55	28.55	
75	CH 1110 : CH 1125	17.77	2.13	15.00	31.99	31.99	
76	CH 1125 : CH 1140	17.54	2.10	15.00	31.56	31.56	
77	CH 1140 : CH 1155	15.42	1.85	15.00	27.76	27.76	
78	CH 1155 : CH 1170	13.81	1.66	15.00	24.85	24.85	
79	CH 1170 : CH 1185	13.28	1.59	15.00	23.90	23.90	
80	CH 1185 : CH 1200	13.41	1.61	15.00	24.13	24.13	
81	CH 1200 : CH 1215	12.93	1.55	15.00	23.27	23.27	
82	CH 1215 : CH 1230	11.16	1.34	15.00	20.08	20.08	
83	CH 1230 : CH 1245	10.45	1.25	15.00	18.80	18.80	
84	CH 1245 : CH 1260	11.16	1.34	15.00	20.09	20.09	
85	CH 1260 : CH 1275	11.61	1.39	15.00	20.89	20.89	
86	CH 1275 : CH 1290	10.93	1.31	15.00	19.67	19.67	
87	CH 1290 : CH 1305	10.02	1.20	15.00	18.04	18.04	
88	CH 1305 : CH 1320	10.29	1.23	15.00	18.52	18.52	
89	CH 1320 : CH 1335	10.70	1.28	15.00	19.27	19.27	
90	CH 1335 : CH 1350	10.21	1.22	15.00	18.37	18.37	
91	CH 1350 : CH 1365	10.37	1.24	15.00	18.66	18.66	
92	CH 1365 : CH 1380	10.53	1.26	15.00	18.95	18.95	
93	CH 1380 : CH 1395	10.78	1.29	15.00	19.40	19.40	
94	CH 1395 : CH 1410	11.38	1.37	15.00	20.48	20.48	
95	CH 1410 : CH 1425	11.66	1.40	15.00	20.99	20.99	
96	CH 1425 : CH 1440	10.70	1.28	15.00	19.25	19.25	
97	CH 1440 : CH 1455	10.47	1.26	15.00	18.85	18.85	
98	CH 1455 : CH 1470	10.51	1.26	15.00	18.92	18.92	
99	CH 1470 : CH 1485	9.81	0.49	15.00	7.35	7.35	
100	CH 1485 : CH 1500	11.20	1.34	15.00	20.15	20.15	

Sl.No	Chainage	DETAILS					Remarks
		W (m)	Based on the concentration (W1)	L (m)	Area (L*W1)	Total Area (Sqm)	
101	CH 1500 : CH 1515	12.11	1.45	15.00	21.79	21.79	
102	CH 1515 : CH 1530	9.78	0.49	15.00	7.34	7.34	
103	CH 1530 : CH 1545	8.09	0.40	15.00	6.06	6.06	
104	CH 1545 : CH 1560	8.93	0.45	15.00	6.70	6.70	
105	CH 1560 : CH 1575	9.06	0.45	15.00	6.80	6.80	
106	CH 1575 : CH 1590	8.52	0.43	15.00	6.39	6.39	
107	CH 1590 : CH 1605	8.64	0.43	15.00	6.48	6.48	
108	CH 1605 : CH 1620	8.82	0.44	15.00	6.62	6.62	
109	CH 1620 : CH 1635	8.80	0.44	15.00	6.60	6.60	
110	CH 1635 : CH 1650	9.73	0.49	15.00	7.29	7.29	
111	CH 1650 : CH 1665	10.85	1.30	15.00	19.52	19.52	
112	CH 1665 : CH 1680	11.92	1.43	15.00	21.46	21.46	
113	CH 1680 : CH 1695	12.03	1.44	15.00	21.65	21.65	
114	CH 1695 : CH 1710	10.11	1.21	15.00	18.19	18.19	
115	CH 1710 : CH 1725	9.90	0.50	15.00	7.43	7.43	
116	CH 1725 : CH 1740	10.28	1.23	15.00	18.50	18.50	
117	CH 1740 : CH 1755	11.46	1.37	15.00	20.62	20.62	
118	CH 1755 : CH 1770	12.49	1.50	15.00	22.48	22.48	
119	CH 1770 : CH 1785	12.31	1.48	15.00	22.16	22.16	
120	CH 1785 : CH 1800	10.82	1.30	15.00	19.48	19.48	
121	CH 1800 : CH 1815	9.97	0.50	15.00	7.48	7.48	
122	CH 1815 : CH 1830	10.55	1.27	15.00	18.98	18.98	
123	CH 1830 : CH 1845	11.51	1.38	15.00	20.72	20.72	
124	CH 1845 : CH 1860	12.45	1.49	15.00	22.40	22.40	
125	CH 1860 : CH 1875	13.00	1.56	15.00	23.39	23.39	
126	CH 1875 : CH 1890	12.24	1.47	15.00	22.03	22.03	
127	CH 1890 : CH 1905	12.64	1.52	15.00	22.74	22.74	
128	CH 1905 : CH 1920	13.14	1.58	15.00	23.66	23.66	
129	CH 1920 : CH 1935	11.43	1.37	15.00	20.57	20.57	
130	CH 1935 : CH 1950	10.81	1.30	15.00	19.46	19.46	
131	CH 1950 : CH 1965	10.95	1.31	15.00	19.71	19.71	
132	CH 1965 : CH 1980	11.11	1.33	15.00	19.99	19.99	
133	CH 1980 : CH 1995	10.90	1.31	15.00	19.61	19.61	
134	CH 1995 : CH 2010	10.81	1.30	15.00	19.46	19.46	
135	CH 2010 : CH 2025	11.08	1.33	15.00	19.94	19.94	
136	CH 2025 : CH 2040	12.10	1.45	15.00	21.79	21.79	
137	CH 2040 : CH 2055	12.90	1.55	15.00	23.21	23.21	
138	CH 2055 : CH 2070	14.67	1.76	15.00	26.40	26.40	
139	CH 2070 : CH 2085	15.97	1.92	15.00	28.75	28.75	
140	CH 2085 : CH 2100	17.78	2.13	15.00	32.00	32.00	
141	CH 2100 : CH 2115	20.81	6.24	15.00	93.62	93.62	
142	CH 2115 : CH 2130	22.87	6.86	15.00	102.93	102.93	
143	CH 2130 : CH 2145	19.57	2.35	15.00	35.22	35.22	
144	CH 2145 : CH 2160	18.09	2.17	15.00	32.55	32.55	
145	CH 2160 : CH 2175	19.51	2.34	15.00	35.12	35.12	
146	CH 2175 : CH 2190	18.27	2.19	15.00	32.88	32.88	
147	CH 2190 : CH 2205	15.24	1.83	15.00	27.43	27.43	
148	CH 2205 : CH 2220	14.93	1.79	15.00	26.87	26.87	
149	CH 2220 : CH 2235	17.56	2.11	15.00	31.60	31.60	
150	CH 2235 : CH 2250	19.12	2.29	15.00	34.41	34.41	
151	CH 2250 : CH 2265	19.14	2.30	15.00	34.45	34.45	

Sl.No	Chainage	DETAILS					Remarks
		W (m)	Based on the concentration (W1)	L (m)	Area (L*W1)	Total Area (Sqm)	
152	CH 2265 : CH 2280	18.58	2.23	15.00	33.44	33.44	
153	CH 2280 : CH 2295	17.33	2.08	15.00	31.19	31.19	
154	CH 2295 : CH 2310	16.48	1.98	15.00	29.66	29.66	
155	CH 2310 : CH 2325	16.09	1.93	15.00	28.95	28.95	
156	CH 2325 : CH 2340	15.56	1.87	15.00	28.01	28.01	
157	CH 2340 : CH 2355	14.61	1.75	15.00	26.29	26.29	
158	CH 2355 : CH 2370	14.45	1.73	15.00	26.00	26.00	
159	CH 2370 : CH 2385	17.04	2.04	15.00	30.66	30.66	
160	CH 2385 : CH 2400	18.02	2.16	15.00	32.44	32.44	
161	CH 2400 : CH 2415	16.43	1.97	15.00	29.57	29.57	
162	CH 2415 : CH 2430	17.03	2.04	15.00	30.65	30.65	
163	CH 2430 : CH 2445	18.88	2.27	15.00	33.98	33.98	
164	CH 2445 : CH 2460	20.09	6.03	15.00	90.38	90.38	
165	CH 2460 : CH 2475	22.07	6.62	15.00	99.29	99.29	
166	CH 2475 : CH 2490	23.83	7.15	15.00	107.24	107.24	
167	CH 2490 : CH 2505	21.91	6.57	15.00	98.60	98.60	
168	CH 2505 : CH 2520	17.51	2.10	15.00	31.52	31.52	
169	CH 2520 : CH 2535	14.88	1.79	15.00	26.78	26.78	
170	CH 2535 : CH 2550	15.12	1.81	15.00	27.22	27.22	
171	CH 2550 : CH 2565	16.16	1.94	15.00	29.09	29.09	
172	CH 2565 : CH 2580	16.15	1.94	15.00	29.06	29.06	
173	CH 2580 : CH 2595	16.19	1.94	15.00	29.14	29.14	
174	CH 2595 : CH 2610	16.63	2.00	15.00	29.93	29.93	
175	CH 2610 : CH 2625	16.39	1.97	15.00	29.50	29.50	
176	CH 2625 : CH 2640	15.49	1.86	15.00	27.87	27.87	
177	CH 2640 : CH 2655	14.30	1.72	15.00	25.73	25.73	
178	CH 2655 : CH 2670	13.43	1.61	15.00	24.17	24.17	
179	CH 2670 : CH 2685	13.02	1.56	15.00	23.43	23.43	
180	CH 2685 : CH 2700	13.88	1.67	15.00	24.98	24.98	
181	CH 2700 : CH 2715	15.69	1.88	15.00	28.24	28.24	
182	CH 2715 : CH 2730	14.14	1.70	15.00	25.45	25.45	
183	CH 2730 : CH 2745	15.03	1.80	15.00	27.05	27.05	
184	CH 2745 : CH 2760	15.31	1.84	15.00	27.56	27.56	
185	CH 2760 : CH 2775	15.21	1.83	15.00	27.38	27.38	
186	CH 2775 : CH 2790	14.04	1.68	15.00	25.27	25.27	
187	CH 2790 : CH 2805	12.42	1.49	15.00	22.36	22.36	
188	CH 2805 : CH 2820	10.88	1.31	15.00	19.58	19.58	
189	CH 2820 : CH 2835	10.10	1.21	15.00	18.17	18.17	
190	CH 2835 : CH 2850	10.33	1.24	15.00	18.59	18.59	
191	CH 2850 : CH 2865	12.26	1.47	15.00	22.06	22.06	
192	CH 2865 : CH 2880	14.00	1.68	15.00	25.20	25.20	
193	CH 2880 : CH 2895	14.48	1.74	15.00	26.06	26.06	
194	CH 2895 : CH 2910	13.57	1.63	15.00	24.42	24.42	
195	CH 2910 : CH 2925	11.74	1.41	15.00	21.13	21.13	
196	CH 2925 : CH 2940	11.56	1.39	15.00	20.81	20.81	
197	CH 2940 : CH 2955	11.94	1.43	15.00	21.48	21.48	
198	CH 2955 : CH 2970	11.76	1.41	15.00	21.16	21.16	
199	CH 2970 : CH 2985	12.58	1.51	15.00	22.64	22.64	
200	CH 2985 : CH 3000	14.59	1.75	15.00	26.26	26.26	
201	CH 3000 : CH 3015	16.45	1.97	15.00	29.60	29.60	
202	CH 3015 : CH 3030	16.85	2.02	15.00	30.33	30.33	

Sl.No	Chainage	DETAILS					Remarks
		W (m)	Based on the concentration (W1)	L (m)	Area (L*W1)	Total Area (Sqm)	
203	CH 3030 : CH 3045	14.84	1.78	15.00	26.70	26.70	
204	CH 3045 : CH 3060	12.84	1.54	15.00	23.10	23.10	
205	CH 3060 : CH 3075	12.22	1.47	15.00	21.99	21.99	
206	CH 3075 : CH 3090	11.99	1.44	15.00	21.57	21.57	
207	CH 3090 : CH 3105	12.13	1.46	15.00	21.83	21.83	
208	CH 3105 : CH 3120	12.55	1.51	15.00	22.59	22.59	
209	CH 3120 : CH 3135	12.58	1.51	15.00	22.64	22.64	
210	CH 3135 : CH 3150	12.59	1.51	15.00	22.65	22.65	
211	CH 3150 : CH 3165	13.15	1.58	15.00	23.67	23.67	
212	CH 3165 : CH 3180	13.51	1.62	15.00	24.32	24.32	
213	CH 3180 : CH 3195	12.72	1.53	15.00	22.89	22.89	
214	CH 3195 : CH 3210	11.55	1.39	15.00	20.79	20.79	
215	CH 3210 : CH 3225	10.43	1.25	15.00	18.77	18.77	
216	CH 3225 : CH 3240	9.67	0.48	15.00	7.25	7.25	
217	CH 3240 : CH 3255	10.30	1.24	15.00	18.54	18.54	
218	CH 3255 : CH 3270	11.37	1.36	15.00	20.47	20.47	
219	CH 3270 : CH 3285	11.84	1.42	15.00	21.30	21.30	
220	CH 3285 : CH 3300	13.00	1.56	15.00	23.39	23.39	
221	CH 3300 : CH 3315	15.11	1.81	15.00	27.19	27.19	
222	CH 3315 : CH 3330	16.70	2.00	15.00	30.05	30.05	
223	CH 3330 : CH 3345	17.48	2.10	15.00	31.46	31.46	
224	CH 3345 : CH 3360	17.48	2.10	15.00	31.46	31.46	
225	CH 3360 : CH 3375	17.61	2.11	15.00	31.69	31.69	
226	CH 3375 : CH 3390	17.83	2.14	15.00	32.09	32.09	
227	CH 3390 : CH 3405	17.41	2.09	15.00	31.34	31.34	
228	CH 3405 : CH 3420	16.78	2.01	15.00	30.20	30.20	
229	CH 3420 : CH 3435	16.43	1.97	15.00	29.57	29.57	
230	CH 3435 : CH 3450	16.14	1.94	15.00	29.05	29.05	
231	CH 3450 : CH 3465	15.82	1.90	15.00	28.48	28.48	
232	CH 3465 : CH 3480	15.48	1.86	15.00	27.86	27.86	
233	CH 3480 : CH 3495	16.36	1.96	15.00	29.45	29.45	
234	CH 3495 : CH 3510	17.95	2.15	15.00	32.30	32.30	
235	CH 3510 : CH 3525	16.15	1.94	15.00	29.06	29.06	
236	CH 3525 : CH 3540	12.70	1.52	15.00	22.87	22.87	
237	CH 3540 : CH 3555	12.96	1.55	15.00	23.32	23.32	
238	CH 3555 : CH 3570	13.25	1.59	15.00	23.84	23.84	
239	CH 3570 : CH 3585	13.11	1.57	15.00	23.60	23.60	
240	CH 3585 : CH 3600	12.96	1.55	15.00	23.32	23.32	
241	CH 3600 : CH 3615	12.06	1.45	15.00	21.71	21.71	
242	CH 3615 : CH 3630	10.60	1.27	15.00	19.07	19.07	
243	CH 3630 : CH 3645	10.15	1.22	15.00	18.27	18.27	
244	CH 3645 : CH 3660	10.47	1.26	15.00	18.84	18.84	
245	CH 3660 : CH 3675	10.49	1.26	15.00	18.88	18.88	
246	CH 3675 : CH 3690	10.51	1.26	15.00	18.92	18.92	
247	CH 3690 : CH 3705	10.79	1.29	15.00	19.42	19.42	
248	CH 3705 : CH 3720	10.80	1.30	15.00	19.43	19.43	
249	CH 3720 : CH 3735	10.66	1.28	15.00	19.18	19.18	
250	CH 3735 : CH 3750	11.16	1.34	15.00	20.08	20.08	
251	CH 3750 : CH 3765	12.29	1.47	15.00	22.11	22.11	
252	CH 3765 : CH 3780	13.55	1.63	15.00	24.39	24.39	
253	CH 3780 : CH 3795	14.78	1.77	15.00	26.60	26.60	

Sl.No	Chainage	DETAILS					Remarks
		W (m)	Based on the concentration (W1)	L (m)	Area (L*W1)	Total Area (Sqm)	
254	CH 3795 : CH 3810	15.25	1.83	15.00	27.44	27.44	
255	CH 3810 : CH 3825	15.28	1.83	15.00	27.50	27.50	
256	CH 3825 : CH 3840	16.19	1.94	15.00	29.14	29.14	
257	CH 3840 : CH 3855	16.21	1.94	15.00	29.17	29.17	
258	CH 3855 : CH 3870	15.55	1.87	15.00	27.98	27.98	
259	CH 3870 : CH 3885	16.23	1.95	15.00	29.21	29.21	
260	CH 3885 : CH 3900	18.01	2.16	15.00	32.41	32.41	
261	CH 3900 : CH 3915	18.96	2.28	15.00	34.13	34.13	
262	CH 3915 : CH 3930	17.60	2.11	15.00	31.68	31.68	
263	CH 3930 : CH 3945	15.32	1.84	15.00	27.58	27.58	
264	CH 3945 : CH 3960	12.50	1.50	15.00	22.49	22.49	
265	CH 3960 : CH 3975	11.19	1.34	15.00	20.14	20.14	
266	CH 3975 : CH 3990	12.06	1.45	15.00	21.71	21.71	
267	CH 3990 : CH 4005	12.14	1.46	15.00	21.85	21.85	
268	CH 4005 : CH 4020	11.43	1.37	15.00	20.57	20.57	
269	CH 4020 : CH 4035	12.75	1.53	15.00	22.94	22.94	
270	CH 4035 : CH 4050	14.87	1.78	15.00	26.76	26.76	
271	CH 4050 : CH 4065	13.54	1.62	15.00	24.36	24.36	
272	CH 4065 : CH 4080	11.47	1.38	15.00	20.65	20.65	
273	CH 4080 : CH 4095	11.10	1.33	15.00	19.98	19.98	
274	CH 4095 : CH 4110	11.08	1.33	15.00	19.94	19.94	
275	CH 4110 : CH 4125	11.90	1.43	15.00	21.42	21.42	
276	CH 4125 : CH 4140	13.29	1.60	15.00	23.93	23.93	
277	CH 4140 : CH 4155	13.21	1.58	15.00	23.77	23.77	
278	CH 4155 : CH 4170	13.47	1.62	15.00	24.25	24.25	
279	CH 4170 : CH 4185	15.62	1.87	15.00	28.11	28.11	
280	CH 4185 : CH 4200	16.55	1.99	15.00	29.78	29.78	
281	CH 4200 : CH 4215	15.38	1.85	15.00	27.68	27.68	
282	CH 4215 : CH 4230	14.59	1.75	15.00	26.26	26.26	
283	CH 4230 : CH 4245	15.63	1.88	15.00	28.13	28.13	
284	CH 4245 : CH 4260	15.79	1.89	15.00	28.41	28.41	
285	CH 4260 : CH 4275	14.36	1.72	15.00	25.85	25.85	
286	CH 4275 : CH 4290	14.04	1.68	15.00	25.27	25.27	
287	CH 4290 : CH 4305	15.22	1.83	15.00	27.40	27.40	
288	CH 4305 : CH 4320	15.99	1.92	15.00	28.77	28.77	
289	CH 4320 : CH 4335	16.46	1.97	15.00	29.62	29.62	
290	CH 4335 : CH 4350	16.61	1.99	15.00	29.90	29.90	
291	CH 4350 : CH 4365	16.24	1.95	15.00	29.23	29.23	
292	CH 4365 : CH 4380	15.61	1.87	15.00	28.09	28.09	
293	CH 4380 : CH 4395	15.51	1.86	15.00	27.91	27.91	
294	CH 4395 : CH 4410	15.94	1.91	15.00	28.68	28.68	
295	CH 4410 : CH 4425	16.59	1.99	15.00	29.86	29.86	
296	CH 4425 : CH 4440	17.44	2.09	15.00	31.38	31.38	
297	CH 4440 : CH 4455	17.54	2.10	15.00	31.56	31.56	
298	CH 4455 : CH 4470	17.14	2.06	15.00	30.85	30.85	
299	CH 4470 : CH 4485	16.41	1.97	15.00	29.53	29.53	
300	CH 4485 : CH 4500	14.86	1.78	15.00	26.74	26.74	
301	CH 4500 : CH 4515	13.95	1.67	15.00	25.10	25.10	
302	CH 4515 : CH 4530	14.84	1.78	15.00	26.70	26.70	
303	CH 4530 : CH 4545	16.83	2.02	15.00	30.29	30.29	
304	CH 4545 : CH 4560	17.80	2.14	15.00	32.04	32.04	

Sl.No	Chainage	DETAILS					Remarks
		W (m)	Based on the concentration (W1)	L (m)	Area (L*W1)	Total Area (Sqm)	
305	CH 4560 : CH 4575	18.79	2.25	15.00	33.82	33.82	
306	CH 4575 : CH 4590	20.27	6.08	15.00	91.19	91.19	
307	CH 4590 : CH 4605	20.30	6.09	15.00	91.35	91.35	
308	CH 4605 : CH 4620	18.32	2.20	15.00	32.97	32.97	
309	CH 4620 : CH 4635	16.56	1.99	15.00	29.81	29.81	
310	CH 4635 : CH 4650	16.27	1.95	15.00	29.29	29.29	
311	CH 4650 : CH 4665	16.08	1.93	15.00	28.94	28.94	
312	CH 4665 : CH 4680	15.60	1.87	15.00	28.08	28.08	
313	CH 4680 : CH 4695	15.84	1.90	15.00	28.51	28.51	
314	CH 4695 : CH 4710	16.23	1.95	15.00	29.21	29.21	
315	CH 4710 : CH 4725	14.75	1.77	15.00	26.54	26.54	
316	CH 4725 : CH 4740	13.93	1.67	15.00	25.07	25.07	
317	CH 4740 : CH 4755	14.79	1.77	15.00	26.61	26.61	
318	CH 4755 : CH 4770	16.01	1.92	15.00	28.82	28.82	
319	CH 4770 : CH 4785	17.51	2.10	15.00	31.52	31.52	
320	CH 4785 : CH 4800	18.52	2.22	15.00	33.34	33.34	
321	CH 4800 : CH 4815	18.23	2.19	15.00	32.81	32.81	
322	CH 4815 : CH 4830	17.31	2.08	15.00	31.16	31.16	
323	CH 4830 : CH 4845	16.87	2.02	15.00	30.37	30.37	
324	CH 4845 : CH 4860	17.34	2.08	15.00	31.20	31.20	
325	CH 4860 : CH 4875	18.09	2.17	15.00	32.56	32.56	
326	CH 4875 : CH 4890	18.39	2.21	15.00	33.10	33.10	
327	CH 4890 : CH 4905	18.77	2.25	15.00	33.78	33.78	
328	CH 4905 : CH 4920	20.20	2.42	15.00	36.35	36.35	
329	CH 4920 : CH 4935	21.75	2.61	15.00	39.15	39.15	
330	CH 4935 : CH 4950	22.27	2.67	15.00	40.08	40.08	
331	CH 4950 : CH 4965	22.30	2.68	15.00	40.13	40.13	
332	CH 4965 : CH 4980	20.87	2.50	15.00	37.57	37.57	
333	CH 4980 : CH 4995	18.84	2.26	15.00	33.91	33.91	
334	CH 4995 : CH 5010	17.98	2.16	15.00	32.36	32.36	
335	CH 5010 : CH 5025	17.67	2.12	15.00	31.81	31.81	
336	CH 5025 : CH 5040	17.17	2.06	15.00	30.90	30.90	
337	CH 5040 : CH 5055	16.63	2.00	15.00	29.93	29.93	
338	CH 5055 : CH 5070	16.90	2.03	15.00	30.42	30.42	
339	CH 5070 : CH 5085	17.59	2.11	15.00	31.65	31.65	
340	CH 5085 : CH 5100	16.83	2.02	15.00	30.29	30.29	
341	CH 5100 : CH 5115	15.15	1.82	15.00	27.26	27.26	
342	CH 5115 : CH 5130	14.79	1.77	15.00	26.61	26.61	
343	CH 5130 : CH 5145	16.74	2.01	15.00	30.12	30.12	
344	CH 5145 : CH 5160	18.01	2.16	15.00	32.42	32.42	
345	CH 5160 : CH 5175	16.69	2.00	15.00	30.04	30.04	
346	CH 5175 : CH 5190	15.60	1.87	15.00	28.07	28.07	
347	CH 5190 : CH 5205	16.85	2.02	15.00	30.33	30.33	
348	CH 5205 : CH 5220	19.46	2.33	15.00	35.02	35.02	
349	CH 5220 : CH 5235	21.14	6.34	15.00	95.13	95.13	
350	CH 5235 : CH 5250	21.47	6.44	15.00	96.59	96.59	
351	CH 5250 : CH 5265	21.01	6.30	15.00	94.52	94.52	
352	CH 5265 : CH 5280	21.10	6.33	15.00	94.95	94.95	
353	CH 5280 : CH 5295	21.56	6.47	15.00	97.02	97.02	
354	CH 5295 : CH 5310	21.95	6.58	15.00	98.75	98.75	
355	CH 5310 : CH 5325	22.46	6.74	15.00	101.07	101.07	

Sl.No	Chainage	DETAILS					Remarks
		W (m)	Based on the concentration (W1)	L (m)	Area (L*W1)	Total Area (Sqm)	
356	CH 5325 : CH 5340	22.89	6.87	15.00	102.98	102.98	
357	CH 5340 : CH 5355	23.02	6.90	15.00	103.57	103.57	
358	CH 5355 : CH 5370	22.53	6.76	15.00	101.39	101.39	
359	CH 5370 : CH 5385	21.61	6.48	15.00	97.25	97.25	
360	CH 5385 : CH 5400	20.63	6.19	15.00	92.81	92.81	
361	CH 5400 : CH 5415	19.51	2.34	15.00	35.11	35.11	
362	CH 5415 : CH 5430	19.63	2.36	15.00	35.33	35.33	
363	CH 5430 : CH 5445	20.56	6.17	15.00	92.52	92.52	
364	CH 5445 : CH 5460	22.15	6.65	15.00	99.68	99.68	
365	CH 5460 : CH 5475	23.23	6.97	15.00	104.51	104.51	
366	CH 5475 : CH 5490	24.26	7.28	15.00	109.15	109.15	
367	CH 5490 : CH 5505	25.36	7.61	15.00	114.12	114.12	
368	CH 5505 : CH 5520	24.80	7.44	15.00	111.60	111.60	
369	CH 5520 : CH 5535	24.03	7.21	15.00	108.11	108.11	
370	CH 5535 : CH 5550	22.43	6.73	15.00	100.94	100.94	
371	CH 5550 : CH 5565	21.20	6.36	15.00	95.38	95.38	
372	CH 5565 : CH 5580	19.71	2.37	15.00	35.48	35.48	
373	CH 5580 : CH 5595	17.97	2.16	15.00	32.35	32.35	
374	CH 5595 : CH 5610	18.82	2.26	15.00	33.88	33.88	
375	CH 5610 : CH 5625	19.44	2.33	15.00	34.99	34.99	
376	CH 5625 : CH 5640	19.72	2.37	15.00	35.49	35.49	
377	CH 5640 : CH 5655	20.09	6.03	15.00	90.38	90.38	
378	CH 5655 : CH 5670	19.79	2.37	15.00	35.62	35.62	
379	CH 5670 : CH 5685	20.42	6.13	15.00	91.89	91.89	
380	CH 5685 : CH 5700	22.00	6.60	15.00	98.98	98.98	
381	CH 5700 : CH 5715	22.98	6.89	15.00	103.41	103.41	
382	CH 5715 : CH 5730	22.80	6.84	15.00	102.60	102.60	
383	CH 5730 : CH 5745	22.42	6.73	15.00	100.89	100.89	
384	CH 5745 : CH 5760	21.82	6.54	15.00	98.17	98.17	
385	CH 5760 : CH 5775	21.64	6.49	15.00	97.38	97.38	
386	CH 5775 : CH 5790	22.17	6.65	15.00	99.77	99.77	
387	CH 5790 : CH 5805	23.21	6.96	15.00	104.45	104.45	
388	CH 5805 : CH 5820	24.07	7.22	15.00	108.29	108.29	
389	CH 5820 : CH 5835	23.64	7.09	15.00	106.38	106.38	
390	CH 5835 : CH 5850	22.26	6.68	15.00	100.15	100.15	
391	CH 5850 : CH 5865	21.71	6.51	15.00	97.67	97.67	
392	CH 5865 : CH 5880	21.52	6.45	15.00	96.82	96.82	
393	CH 5880 : CH 5895	19.64	2.36	15.00	35.34	35.34	
394	CH 5895 : CH 5910	16.91	2.03	15.00	30.43	30.43	
395	CH 5910 : CH 5925	15.24	1.83	15.00	27.43	27.43	
396	CH 5925 : CH 5940	16.85	2.02	15.00	30.32	30.32	
397	CH 5940 : CH 5955	21.03	6.31	15.00	94.61	94.61	
398	CH 5955 : CH 5970	22.96	6.89	15.00	103.32	103.32	
399	CH 5970 : CH 5985	24.13	7.24	15.00	108.59	108.59	
400	CH 5985 : CH 6000	25.55	7.66	15.00	114.95	114.95	
401	CH 6000 : CH 6015	25.51	7.65	15.00	114.80	114.80	
402	CH 6015 : CH 6030	26.13	7.84	15.00	117.59	117.59	
403	CH 6030 : CH 6045	27.31	8.19	15.00	122.87	122.87	
404	CH 6045 : CH 6060	27.38	8.21	15.00	123.19	123.19	
405	CH 6060 : CH 6075	26.16	7.85	15.00	117.70	117.70	
406	CH 6075 : CH 6090	25.36	7.61	15.00	114.10	114.10	

Sl.No	Chainage	DETAILS					Remarks
		W (m)	Based on the concentration (W1)	L (m)	Area (L*W1)	Total Area (Sqm)	
407	CH 6090 : CH 6105	26.30	7.89	15.00	118.35	118.35	
408	CH 6105 : CH 6120	28.11	8.43	15.00	126.50	126.50	
409	CH 6120 : CH 6135	31.04	15.52	15.00	232.80	232.80	
410	CH 6135 : CH 6150	33.51	16.76	15.00	251.33	251.33	
411	CH 6150 : CH 6165	32.16	16.08	15.00	241.20	241.20	
412	CH 6165 : CH 6180	28.96	8.69	15.00	130.30	130.30	
413	CH 6180 : CH 6195	27.98	8.39	15.00	125.91	125.91	
414	CH 6195 : CH 6210	27.60	8.28	15.00	124.18	124.18	
415	CH 6210 : CH 6225	25.18	7.55	15.00	113.31	113.31	
416	CH 6225 : CH 6240	22.73	6.82	15.00	102.29	102.29	
417	CH 6240 : CH 6255	21.03	6.31	15.00	94.61	94.61	
418	CH 6255 : CH 6270	20.45	6.14	15.00	92.03	92.03	
419	CH 6270 : CH 6285	21.39	6.42	15.00	96.26	96.26	
420	CH 6285 : CH 6300	22.92	6.88	15.00	103.14	103.14	
421	CH 6300 : CH 6315	25.16	7.55	15.00	113.20	113.20	
422	CH 6315 : CH 6330	26.96	8.09	15.00	121.30	121.30	
423	CH 6330 : CH 6345	26.18	7.85	15.00	117.81	117.81	
424	CH 6345 : CH 6360	25.20	7.56	15.00	113.38	113.38	
425	CH 6360 : CH 6375	25.44	7.63	15.00	114.46	114.46	
426	CH 6375 : CH 6390	25.64	7.69	15.00	115.36	115.36	
427	CH 6390 : CH 6405	26.70	8.01	15.00	120.13	120.13	
428	CH 6405 : CH 6420	28.20	8.46	15.00	126.88	126.88	
429	CH 6420 : CH 6435	29.18	8.75	15.00	131.31	131.31	
430	CH 6435 : CH 6450	27.85	8.35	15.00	125.30	125.30	
431	CH 6450 : CH 6465	25.68	7.70	15.00	115.54	115.54	
432	CH 6465 : CH 6480	27.81	8.34	15.00	125.15	125.15	
433	CH 6480 : CH 6495	30.65	15.32	15.00	229.84	229.84	
434	CH 6495 : CH 6510	31.33	15.66	15.00	234.94	234.94	
435	CH 6510 : CH 6525	30.77	15.38	15.00	230.74	230.74	
436	CH 6525 : CH 6540	25.96	7.79	15.00	116.80	116.80	
437	CH 6540 : CH 6555	20.33	6.10	15.00	91.46	91.46	
438	CH 6555 : CH 6570	17.77	2.13	15.00	31.98	31.98	
439	CH 6570 : CH 6585	17.22	2.07	15.00	31.00	31.00	
440	CH 6585 : CH 6600	18.54	2.22	15.00	33.37	33.37	
441	CH 6600 : CH 6615	21.38	6.41	15.00	96.19	96.19	
442	CH 6615 : CH 6630	23.41	7.02	15.00	105.32	105.32	
443	CH 6630 : CH 6645	24.06	7.22	15.00	108.27	108.27	
444	CH 6645 : CH 6660	24.69	7.41	15.00	111.08	111.08	
445	CH 6660 : CH 6675	24.29	7.29	15.00	109.31	109.31	
446	CH 6675 : CH 6690	22.91	6.87	15.00	103.07	103.07	
447	CH 6690 : CH 6705	22.32	6.69	15.00	100.42	100.42	
448	CH 6705 : CH 6720	22.58	6.77	15.00	101.61	101.61	
449	CH 6720 : CH 6735	22.88	6.86	15.00	102.96	102.96	
450	CH 6735 : CH 6750	24.92	7.48	15.00	112.14	112.14	
451	CH 6750 : CH 6765	27.08	8.12	15.00	121.86	121.86	
452	CH 6765 : CH 6780	27.70	8.31	15.00	124.65	124.65	
453	CH 6780 : CH 6795	25.98	7.79	15.00	116.91	116.91	
454	CH 6795 : CH 6810	25.43	7.63	15.00	114.41	114.41	
455	CH 6810 : CH 6825	28.13	8.44	15.00	126.56	126.56	
456	CH 6825 : CH 6840	30.28	15.14	15.00	227.06	227.06	
457	CH 6840 : CH 6855	31.35	15.67	15.00	235.09	235.09	

Sl.No	Chainage	DETAILS					Remarks
		W (m)	Based on the concentration (W1)	L (m)	Area (L*W1)	Total Area (Sqm)	
458	CH 6855 : CH 6870	30.16	15.08	15.00	226.16	226.16	
459	CH 6870 : CH 6885	29.32	8.80	15.00	131.94	131.94	
460	CH 6885 : CH 6900	30.99	15.50	15.00	232.43	232.43	
461	CH 6900 : CH 6915	33.40	16.70	15.00	250.46	250.46	
462	CH 6915 : CH 6930	34.06	17.03	15.00	255.45	255.45	
463	CH 6930 : CH 6945	32.19	16.09	15.00	241.39	241.39	
464	CH 6945 : CH 6960	29.79	8.94	15.00	134.03	134.03	
465	CH 6960 : CH 6975	28.41	8.52	15.00	127.85	127.85	
466	CH 6975 : CH 6990	27.25	8.17	15.00	122.60	122.60	
467	CH 6990 : CH 7005	26.02	7.80	15.00	117.07	117.07	
468	CH 7005 : CH 7020	26.37	7.91	15.00	118.64	118.64	
469	CH 7020 : CH 7035	26.18	7.85	15.00	117.81	117.81	
470	CH 7035 : CH 7050	25.02	7.50	15.00	112.57	112.57	
471	CH 7050 : CH 7065	24.90	7.47	15.00	112.05	112.05	
472	CH 7065 : CH 7080	24.07	7.22	15.00	108.32	108.32	
473	CH 7080 : CH 7095	22.65	6.80	15.00	101.93	101.93	
474	CH 7095 : CH 7110	21.07	6.32	15.00	94.82	94.82	
475	CH 7110 : CH 7125	24.43	7.33	15.00	109.91	109.91	
476	CH 7125 : CH 7140	31.75	15.87	15.00	238.09	238.09	
477	CH 7140 : CH 7155	36.44	18.22	15.00	273.30	273.30	
478	CH 7155 : CH 7170	40.43	20.22	15.00	303.23	303.23	
479	CH 7170 : CH 7185	38.78	19.39	15.00	290.81	290.81	
480	CH 7185 : CH 7200	35.19	17.59	15.00	263.89	263.89	
481	CH 7200 : CH 7215	33.31	16.65	15.00	249.79	249.79	
482	CH 7215 : CH 7230	30.07	15.03	15.00	225.49	225.49	
483	CH 7230 : CH 7245	28.86	8.66	15.00	129.85	129.85	
484	CH 7245 : CH 7260	25.38	7.61	15.00	114.19	114.19	
485	CH 7260 : CH 7275	23.07	6.92	15.00	103.82	103.82	
486	CH 7275 : CH 7290	25.23	7.57	15.00	113.51	113.51	
487	CH 7290 : CH 7305	27.32	8.20	15.00	122.94	122.94	
488	CH 7305 : CH 7320	29.60	8.88	15.00	133.18	133.18	
489	CH 7320 : CH 7335	31.18	15.59	15.00	233.85	233.85	
490	CH 7335 : CH 7350	31.90	15.95	15.00	239.25	239.25	
491	CH 7350 : CH 7365	32.63	16.31	15.00	244.69	244.69	
492	CH 7365 : CH 7380	33.60	16.80	15.00	251.96	251.96	
493	CH 7380 : CH 7395	33.81	16.90	15.00	253.54	253.54	
494	CH 7395 : CH 7410	32.98	16.49	15.00	247.31	247.31	
495	CH 7410 : CH 7425	32.10	16.05	15.00	240.75	240.75	
496	CH 7425 : CH 7440	31.62	15.81	15.00	237.15	237.15	
497	CH 7440 : CH 7455	31.66	15.83	15.00	237.41	237.41	
498	CH 7455 : CH 7470	31.95	15.97	15.00	239.59	239.59	
499	CH 7470 : CH 7485	32.38	16.19	15.00	242.81	242.81	
500	CH 7485 : CH 7500	32.82	16.41	15.00	246.15	246.15	
501	CH 7500 : CH 7515	33.93	16.96	15.00	254.44	254.44	
502	CH 7515 : CH 7530	36.05	18.02	15.00	270.34	270.34	
503	CH 7530 : CH 7545	37.49	18.74	15.00	281.14	281.14	
504	CH 7545 : CH 7560	37.40	18.70	15.00	280.50	280.50	
505	CH 7560 : CH 7575	37.17	18.58	15.00	278.74	278.74	
506	CH 7575 : CH 7590	36.05	18.02	15.00	270.34	270.34	
507	CH 7590 : CH 7605	34.35	17.18	15.00	257.63	257.63	
508	CH 7605 : CH 7620	33.28	16.64	15.00	249.60	249.60	

Sl.No	Chainage	DETAILS					Remarks
		W (m)	Based on the concentration (W1)	L (m)	Area (L*W1)	Total Area (Sqm)	
509	CH 7620 : CH 7635	32.58	16.29	15.00	244.35	244.35	
510	CH 7635 : CH 7650	30.59	15.29	15.00	229.39	229.39	
511	CH 7650 : CH 7665	28.09	8.43	15.00	126.41	126.41	
512	CH 7665 : CH 7680	27.23	8.17	15.00	122.54	122.54	
513	CH 7680 : CH 7695	29.32	8.80	15.00	131.94	131.94	
514	CH 7695 : CH 7710	34.59	17.30	15.00	259.43	259.43	
515	CH 7710 : CH 7725	39.65	19.82	15.00	297.34	297.34	
516	CH 7725 : CH 7740	40.30	20.15	15.00	302.21	302.21	
517	CH 7740 : CH 7755	35.88	17.94	15.00	269.06	269.06	
518	CH 7755 : CH 7770	31.74	15.87	15.00	238.01	238.01	
519	CH 7770 : CH 7785	30.17	15.08	15.00	226.24	226.24	
520	CH 7785 : CH 7800	28.29	8.49	15.00	127.31	127.31	
521	CH 7800 : CH 7815	26.49	7.95	15.00	119.21	119.21	
522	CH 7815 : CH 7830	27.25	8.18	15.00	122.63	122.63	
523	CH 7830 : CH 7845	30.46	15.23	15.00	228.41	228.41	
524	CH 7845 : CH 7860	33.49	16.75	15.00	251.18	251.18	
525	CH 7860 : CH 7875	34.32	17.16	15.00	257.40	257.40	
526	CH 7875 : CH 7890	35.31	17.66	15.00	264.83	264.83	
527	CH 7890 : CH 7905	37.48	18.74	15.00	281.06	281.06	
528	CH 7905 : CH 7920	37.60	18.80	15.00	282.00	282.00	
529	CH 7920 : CH 7935	35.09	17.55	15.00	263.18	263.18	
530	CH 7935 : CH 7950	31.74	15.87	15.00	238.01	238.01	
531	CH 7950 : CH 7965	29.69	8.91	15.00	133.61	133.61	
532	CH 7965 : CH 7980	28.84	8.65	15.00	129.76	129.76	
533	CH 7980 : CH 7995	27.60	8.28	15.00	124.18	124.18	
534	CH 7995 : CH 8010	26.35	7.90	15.00	118.55	118.55	
535	CH 8010 : CH 8025	26.52	7.96	15.00	119.34	119.34	
536	CH 8025 : CH 8040	28.13	8.44	15.00	126.56	126.56	
537	CH 8040 : CH 8055	28.86	8.66	15.00	129.85	129.85	
538	CH 8055 : CH 8070	28.56	8.57	15.00	128.50	128.50	
539	CH 8070 : CH 8085	27.95	8.39	15.00	125.78	125.78	
540	CH 8085 : CH 8100	27.15	8.14	15.00	122.15	122.15	
541	CH 8100 : CH 8115	26.84	8.05	15.00	120.76	120.76	
542	CH 8115 : CH 8130	27.19	8.16	15.00	122.33	122.33	
543	CH 8130 : CH 8145	28.29	8.49	15.00	127.28	127.28	
544	CH 8145 : CH 8160	30.64	15.32	15.00	229.76	229.76	
545	CH 8160 : CH 8175	32.75	16.38	15.00	245.63	245.63	
546	CH 8175 : CH 8190	32.74	16.37	15.00	245.55	245.55	
547	CH 8190 : CH 8205	31.49	15.74	15.00	236.14	236.14	
548	CH 8205 : CH 8220	30.26	15.13	15.00	226.91	226.91	
549	CH 8220 : CH 8235	29.95	8.99	15.00	134.78	134.78	
550	CH 8235 : CH 8250	32.06	16.03	15.00	240.45	240.45	
551	CH 8250 : CH 8265	33.65	16.82	15.00	252.34	252.34	
552	CH 8265 : CH 8280	33.13	16.57	15.00	248.48	248.48	
553	CH 8280 : CH 8295	33.43	16.71	15.00	250.69	250.69	
554	CH 8295 : CH 8310	33.12	16.56	15.00	248.40	248.40	
555	CH 8310 : CH 8325	31.11	15.56	15.00	233.33	233.33	
556	CH 8325 : CH 8340	30.83	15.41	15.00	231.19	231.19	
557	CH 8340 : CH 8355	35.54	17.77	15.00	266.55	266.55	
558	CH 8355 : CH 8370	43.52	21.76	15.00	326.36	326.36	
559	CH 8370 : CH 8385	54.40	27.20	15.00	408.00	408.00	

Sl.No	Chainage	DETAILS					Remarks
		W (m)	Based on the concentration (W1)	L (m)	Area (L*W1)	Total Area (Sqm)	
560	CH 8385 : CH 8400	59.05	29.53	15.00	442.88	442.88	
561	CH 8400 : CH 8415	54.58	27.29	15.00	409.31	409.31	
562	CH 8415 : CH 8430	53.32	26.66	15.00	399.86	399.86	
563	CH 8430 : CH 8445	55.61	27.80	15.00	417.04	417.04	
564	CH 8445 : CH 8460	55.62	27.81	15.00	417.11	417.11	
565	CH 8460 : CH 8475	55.62	27.81	15.00	417.15	417.15	
566	CH 8475 : CH 8490	58.77	29.38	15.00	440.74	440.74	
567	CH 8490 : CH 8505	62.18	31.09	15.00	466.35	466.35	
568	CH 8505 : CH 8520	62.69	31.34	15.00	470.14	470.14	
569	CH 8520 : CH 8535	59.54	29.77	15.00	446.55	446.55	
570	CH 8535 : CH 8550	56.89	28.45	15.00	426.68	426.68	
571	CH 8550 : CH 8565	55.98	27.99	15.00	419.81	419.81	
572	CH 8565 : CH 8580	54.77	27.39	15.00	410.78	410.78	
573	CH 8580 : CH 8595	54.40	27.20	15.00	407.96	407.96	
574	CH 8595 : CH 8610	55.37	27.68	15.00	415.24	415.24	
575	CH 8610 : CH 8625	56.34	28.17	15.00	422.51	422.51	
576	CH 8625 : CH 8640	57.13	28.57	15.00	428.48	428.48	
577	CH 8640 : CH 8655	55.99	27.99	15.00	419.89	419.89	
578	CH 8655 : CH 8670	52.77	26.38	15.00	395.74	395.74	
579	CH 8670 : CH 8685	52.29	26.14	15.00	392.14	392.14	
580	CH 8685 : CH 8700	54.38	27.19	15.00	407.85	407.85	
581	CH 8700 : CH 8715	56.59	28.29	15.00	424.39	424.39	
582	CH 8715 : CH 8730	57.65	28.83	15.00	432.38	432.38	
583	CH 8730 : CH 8745	60.41	30.20	15.00	453.04	453.04	
584	CH 8745 : CH 8760	72.49	36.25	15.00	543.68	543.68	
585	CH 8760 : CH 8775	104.23	52.12	15.00	781.73	781.73	
586	CH 8775 : CH 8790	151.67	75.84	15.00	1137.53	1137.53	
587	CH 8790 : CH 8805	170.85	85.43	15.00	1281.38	1281.38	
588	CH 8805 : CH 8820	123.65	61.83	15.00	927.38	927.38	
589	CH 8820 : CH 8835	85.75	42.87	15.00	643.09	643.09	
590	CH 8835 : CH 8850	77.10	38.55	15.00	578.25	578.25	
591	CH 8850 : CH 8865	75.48	37.74	15.00	566.10	566.10	
592	CH 8865 : CH 8880	76.00	38.00	15.00	570.00	570.00	
593	CH 8880 : CH 8895	76.90	38.45	15.00	576.75	576.75	
594	CH 8895 : CH 8910	75.81	37.91	15.00	568.58	568.58	
595	CH 8910 : CH 8925	73.30	36.65	15.00	549.71	549.71	
596	CH 8925 : CH 8940	71.93	35.96	15.00	539.44	539.44	
597	CH 8940 : CH 8955	69.95	34.98	15.00	524.63	524.63	
598	CH 8955 : CH 8970	66.09	33.04	15.00	495.64	495.64	
599	CH 8970 : CH 8985	59.97	29.99	15.00	449.78	449.78	
600	CH 8985 : CH 9000	54.43	27.21	15.00	408.19	408.19	
601	CH 9000 : CH 9015	57.70	28.85	15.00	432.71	432.71	
602	CH 9015 : CH 9030	67.51	33.76	15.00	506.33	506.33	
603	CH 9030 : CH 9045	81.22	40.61	15.00	609.15	609.15	
604	CH 9045 : CH 9060	109.44	54.72	15.00	820.80	820.80	
605	CH 9060 : CH 9075	130.75	65.38	15.00	980.63	980.63	
606	CH 9075 : CH 9090	134.15	67.08	15.00	1006.13	1006.13	
607	CH 9090 : CH 9105	135.61	67.81	15.00	1017.08	1017.08	
608	CH 9105 : CH 9120	137.19	68.60	15.00	1028.93	1028.93	
609	CH 9120 : CH 9135	119.75	59.88	15.00	898.13	898.13	
610	CH 9135 : CH 9150	90.99	45.49	15.00	682.39	682.39	

Sl.No	Chainage	DETAILS					Remarks
		W (m)	Based on the concentration (W1)	L (m)	Area (L*W1)	Total Area (Sqm)	
611	CH 9150 : CH 9165	76.87	38.43	15.00	576.49	576.49	
612	CH 9165 : CH 9180	69.45	34.73	15.00	520.88	520.88	
613	CH 9180 : CH 9195	65.55	32.77	15.00	491.59	491.59	
614	CH 9195 : CH 9210	63.63	31.82	15.00	477.23	477.23	
615	CH 9210 : CH 9225	61.47	30.74	15.00	461.03	461.03	
616	CH 9225 : CH 9240	58.99	29.50	15.00	442.44	442.44	
617	CH 9240 : CH 9255	57.22	28.61	15.00	429.12	429.12	
618	CH 9255 : CH 9270	57.36	28.68	15.00	430.16	430.16	
619	CH 9270 : CH 9285	54.06	27.03	15.00	405.41	405.41	
620	CH 9285 : CH 9300	50.88	25.44	15.00	381.56	381.56	
621	CH 9300 : CH 9315	52.38	26.19	15.00	392.85	392.85	
622	CH 9315 : CH 9330	53.14	26.57	15.00	398.55	398.55	
623	CH 9330 : CH 9345	53.63	26.82	15.00	402.23	402.23	
624	CH 9345 : CH 9360	53.80	26.90	15.00	403.46	403.46	
625	CH 9360 : CH 9375	53.55	26.77	15.00	401.59	401.59	
626	CH 9375 : CH 9390	52.78	26.39	15.00	395.85	395.85	
627	CH 9390 : CH 9405	51.34	25.67	15.00	385.05	385.05	
628	CH 9405 : CH 9420	51.09	25.54	15.00	383.14	383.14	
629	CH 9420 : CH 9435	53.12	26.56	15.00	398.40	398.40	
630	CH 9435 : CH 9450	56.15	28.07	15.00	421.09	421.09	
631	CH 9450 : CH 9465	57.10	28.55	15.00	428.21	428.21	
632	CH 9465 : CH 9480	55.42	27.71	15.00	415.61	415.61	
633	CH 9480 : CH 9495	51.78	25.89	15.00	388.35	388.35	
634	CH 9495 : CH 9510	48.21	24.11	15.00	361.58	361.58	
635	CH 9510 : CH 9525	46.71	23.35	15.00	350.29	350.29	
636	CH 9525 : CH 9540	47.83	23.92	15.00	358.73	358.73	
637	CH 9540 : CH 9555	49.60	24.80	15.00	371.96	371.96	
638	CH 9555 : CH 9570	49.72	24.86	15.00	372.86	372.86	
639	CH 9570 : CH 9585	49.51	24.75	15.00	371.29	371.29	
640	CH 9585 : CH 9600	50.16	25.08	15.00	376.20	376.20	
641	CH 9600 : CH 9615	51.15	25.58	15.00	383.63	383.63	
642	CH 9615 : CH 9630	51.80	25.90	15.00	388.46	388.46	
643	CH 9630 : CH 9645	52.38	26.19	15.00	392.85	392.85	
644	CH 9645 : CH 9660	52.92	26.46	15.00	396.86	396.86	
645	CH 9660 : CH 9675	53.42	26.71	15.00	400.61	400.61	
646	CH 9675 : CH 9690	53.90	26.95	15.00	404.21	404.21	
647	CH 9690 : CH 9705	54.16	27.08	15.00	406.20	406.20	
648	CH 9705 : CH 9720	53.65	26.82	15.00	402.34	402.34	
649	CH 9720 : CH 9735	52.49	26.24	15.00	393.64	393.64	
650	CH 9735 : CH 9750	51.68	25.84	15.00	387.60	387.60	
651	CH 9750 : CH 9765	51.52	25.76	15.00	386.40	386.40	
652	CH 9765 : CH 9780	52.07	26.03	15.00	390.49	390.49	
653	CH 9780 : CH 9795	52.24	26.12	15.00	391.80	391.80	
654	CH 9795 : CH 9810	50.76	25.38	15.00	380.70	380.70	
655	CH 9810 : CH 9825	48.37	24.18	15.00	362.74	362.74	
656	CH 9825 : CH 9840	47.51	23.75	15.00	356.29	356.29	
657	CH 9840 : CH 9855	49.73	24.87	15.00	372.98	372.98	
658	CH 9855 : CH 9870	53.46	26.73	15.00	400.91	400.91	
659	CH 9870 : CH 9885	56.92	28.46	15.00	426.86	426.86	
660	CH 9885 : CH 9900	58.96	29.48	15.00	442.20	442.20	
661	CH 9900 : CH 9915	57.04	28.52	15.00	427.76	427.76	

Sl.No	Chainage	DETAILS					Remarks
		W (m)	Based on the concentration (W1)	L (m)	Area (L*W1)	Total Area (Sqm)	
662	CH 9915 : CH 9930	56.69	28.34	15.00	425.14	425.14	
663	CH 9930 : CH 9945	56.62	28.31	15.00	424.61	424.61	
664	CH 9945 : CH 9960	53.61	26.80	15.00	402.04	402.04	
665	CH 9960 : CH 9975	53.16	26.58	15.00	398.70	398.70	
666	CH 9975 : CH 9990	57.48	28.74	15.00	431.10	431.10	
667	CH 9990 : CH 10005	60.38	30.19	15.00	452.85	452.85	
668	CH 10005 : CH 10020	61.92	30.96	15.00	464.36	464.36	
669	CH 10020 : CH 10035	64.26	32.13	15.00	481.95	481.95	
670	CH 10035 : CH 10050	65.02	32.51	15.00	487.61	487.61	
671	CH 10050 : CH 10065	62.78	31.39	15.00	470.81	470.81	
672	CH 10065 : CH 10080	60.81	30.40	15.00	456.04	456.04	
673	CH 10080 : CH 10095	57.15	28.58	15.00	428.63	428.63	
674	CH 10095 : CH 10110	51.61	25.81	15.00	387.08	387.08	
675	CH 10110 : CH 10125	47.21	23.61	15.00	354.08	354.08	
676	CH 10125 : CH 10140	45.93	22.96	15.00	344.44	344.44	
677	CH 10140 : CH 10155	46.08	23.04	15.00	345.56	345.56	
678	CH 10155 : CH 10170	46.44	23.22	15.00	348.26	348.26	
679	CH 10170 : CH 10185	48.74	24.37	15.00	365.55	365.55	
680	CH 10185 : CH 10200	51.79	25.89	15.00	388.39	388.39	
681	CH 10200 : CH 10215	54.59	27.29	15.00	409.39	409.39	
682	CH 10215 : CH 10230	56.04	28.02	15.00	420.30	420.30	
683	CH 10230 : CH 10245	56.17	28.08	15.00	421.24	421.24	
684	CH 10245 : CH 10260	57.95	28.98	15.00	434.63	434.63	
685	CH 10260 : CH 10275	55.06	27.53	15.00	412.91	412.91	
686	CH 10275 : CH 10290	52.91	26.46	15.00	396.83	396.83	
687	CH 10290 : CH 10305	54.13	27.07	15.00	405.98	405.98	
688	CH 10305 : CH 10320	52.86	26.43	15.00	396.45	396.45	
689	CH 10320 : CH 10335	52.69	26.35	15.00	395.18	395.18	
690	CH 10335 : CH 10350	51.89	25.95	15.00	389.18	389.18	
691	CH 10350 : CH 10365	52.13	26.06	15.00	390.94	390.94	
692	CH 10365 : CH 10380	53.94	26.97	15.00	404.51	404.51	
693	CH 10380 : CH 10395	54.60	27.30	15.00	409.46	409.46	
694	CH 10395 : CH 10410	54.10	27.05	15.00	405.71	405.71	
695	CH 10410 : CH 10425	51.91	25.95	15.00	389.29	389.29	
696	CH 10425 : CH 10440	51.34	25.67	15.00	385.05	385.05	
697	CH 10440 : CH 10455	52.68	26.34	15.00	395.06	395.06	
698	CH 10455 : CH 10470	53.79	26.90	15.00	403.43	403.43	
699	CH 10470 : CH 10485	55.46	27.73	15.00	415.91	415.91	
700	CH 10485 : CH 10500	55.82	27.91	15.00	418.61	418.61	
701	CH 10500 : CH 10515	55.04	27.52	15.00	412.80	412.80	
702	CH 10515 : CH 10530	55.55	27.78	15.00	416.63	416.63	
703	CH 10530 : CH 10545	55.62	27.81	15.00	417.15	417.15	
704	CH 10545 : CH 10560	55.13	27.57	15.00	413.48	413.48	
705	CH 10560 : CH 10575	59.01	29.50	15.00	442.54	442.54	
706	CH 10575 : CH 10590	59.79	29.90	15.00	448.43	448.43	
707	CH 10590 : CH 10605	55.46	27.73	15.00	415.91	415.91	
708	CH 10605 : CH 10620	55.63	27.82	15.00	417.23	417.23	
709	CH 10620 : CH 10635	57.68	28.84	15.00	432.60	432.60	
710	CH 10635 : CH 10650	57.25	28.63	15.00	429.38	429.38	
711	CH 10650 : CH 10665	56.52	28.26	15.00	423.86	423.86	
712	CH 10665 : CH 10680	56.77	28.38	15.00	425.74	425.74	

Sl.No	Chainage	DETAILS					Remarks
		W (m)	Based on the concentration (W1)	L (m)	Area (L*W1)	Total Area (Sqm)	
713	CH 10680 : CH 10695	58.15	29.07	15.00	436.09	436.09	
714	CH 10695 : CH 10710	60.01	30.01	15.00	450.08	450.08	
715	CH 10710 : CH 10725	60.64	30.32	15.00	454.80	454.80	
716	CH 10725 : CH 10740	61.17	30.58	15.00	458.74	458.74	
717	CH 10740 : CH 10755	62.15	31.08	15.00	466.13	466.13	
718	CH 10755 : CH 10770	59.80	29.90	15.00	448.46	448.46	
719	CH 10770 : CH 10785	58.50	29.25	15.00	438.71	438.71	
720	CH 10785 : CH 10800	60.70	30.35	15.00	455.21	455.21	
721	CH 10800 : CH 10815	62.81	31.41	15.00	471.08	471.08	
722	CH 10815 : CH 10830	66.72	33.36	15.00	500.36	500.36	
723	CH 10830 : CH 10845	68.60	34.30	15.00	514.46	514.46	
724	CH 10845 : CH 10860	66.62	33.31	15.00	499.61	499.61	
725	CH 10860 : CH 10875	65.68	32.84	15.00	492.60	492.60	
726	CH 10875 : CH 10890	64.89	32.45	15.00	486.68	486.68	
727	CH 10890 : CH 10905	63.02	31.51	15.00	472.65	472.65	
728	CH 10905 : CH 10920	62.80	31.40	15.00	471.00	471.00	
729	CH 10920 : CH 10935	63.22	31.61	15.00	474.11	474.11	
730	CH 10935 : CH 10950	64.11	32.06	15.00	480.83	480.83	
731	CH 10950 : CH 10965	68.17	34.09	15.00	511.28	511.28	
732	CH 10965 : CH 10980	76.45	38.22	15.00	573.34	573.34	
733	CH 10980 : CH 10995	88.04	44.02	15.00	660.26	660.26	
734	CH 10995 : CH 11010	94.56	47.28	15.00	709.20	709.20	
735	CH 11010 : CH 11025	95.31	47.66	15.00	714.83	714.83	
736	CH 11025 : CH 11040	99.38	49.69	15.00	745.31	745.31	
737	CH 11040 : CH 11055	106.00	53.00	15.00	794.96	794.96	
738	CH 11055 : CH 11070	112.14	56.07	15.00	841.05	841.05	
739	CH 11070 : CH 11085	99.65	49.83	15.00	747.38	747.38	
740	CH 11085 : CH 11100	77.99	38.99	15.00	584.89	584.89	
741	CH 11100 : CH 11115	65.67	32.84	15.00	492.53	492.53	
742	CH 11115 : CH 11130	51.92	25.96	15.00	389.36	389.36	
743	CH 11130 : CH 11145	43.00	21.50	15.00	322.46	322.46	
744	CH 11145 : CH 11160	40.66	20.33	15.00	304.95	304.95	
745	CH 11160 : CH 11175	41.17	20.59	15.00	308.78	308.78	
746	CH 11175 : CH 11190	47.27	23.64	15.00	354.53	354.53	
747	CH 11190 : CH 11205	55.83	27.92	15.00	418.73	418.73	
748	CH 11205 : CH 11220	64.05	32.02	15.00	480.34	480.34	
749	CH 11220 : CH 11231	80.60	40.30	11.00	443.30	443.30	
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Chilavanoor Canal							
Sl.No	Chainage	DETAILS					Remarks
		W (m)	Based on the concentration (W1)	L (m)	Area (L*W1)	Total Area (Sqm)	
1	CH 0 : CH 15	51.29	25.64	15.00	384.64	384.64	
2	CH 15 : CH 30	42.05	21.02	15.00	315.35	315.35	
3	CH 30 : CH 45	29.99	9.00	15.00	134.97	134.97	
4	CH 45 : CH 60	22.39	6.72	15.00	100.76	100.76	
5	CH 60 : CH 75	20.58	6.17	15.00	92.59	92.59	
6	CH 75 : CH 90	21.77	6.53	15.00	97.98	97.98	
7	CH 90 : CH 105	23.82	7.15	15.00	107.21	107.21	
8	CH 105 : CH 120	25.31	7.59	15.00	113.89	113.89	
9	CH 120 : CH 135	27.15	8.15	15.00	122.19	122.19	
10	CH 135 : CH 150	29.08	8.72	15.00	130.84	130.84	
11	CH 150 : CH 165	30.42	15.21	15.00	228.13	228.13	
12	CH 165 : CH 180	29.31	8.79	15.00	131.89	131.89	
13	CH 180 : CH 195	24.12	7.24	15.00	108.55	108.55	
14	CH 195 : CH 210	18.15	2.18	15.00	32.67	32.67	
15	CH 210 : CH 225	16.50	1.98	15.00	29.70	29.70	
16	CH 225 : CH 240	16.93	2.03	15.00	30.48	30.48	
17	CH 240 : CH 255	17.00	2.04	15.00	30.59	30.59	
18	CH 255 : CH 270	17.07	2.05	15.00	30.73	30.73	
19	CH 270 : CH 285	18.97	2.28	15.00	34.15	34.15	
20	CH 285 : CH 300	20.54	6.16	15.00	92.42	92.42	
21	CH 300 : CH 315	19.79	2.37	15.00	35.62	35.62	
22	CH 315 : CH 330	19.15	2.30	15.00	34.48	34.48	
23	CH 330 : CH 345	20.83	6.25	15.00	93.72	93.72	
24	CH 345 : CH 360	22.09	6.63	15.00	99.39	99.39	
25	CH 360 : CH 375	17.48	2.10	15.00	31.46	31.46	
26	CH 375 : CH 390	13.66	1.64	15.00	24.58	24.58	
27	CH 390 : CH 405	11.85	1.42	15.00	21.34	21.34	
28	CH 405 : CH 420	17.18	2.06	15.00	30.92	30.92	
29	CH 420 : CH 435	18.56	2.23	15.00	33.41	33.41	
30	CH 435 : CH 450	18.85	2.26	15.00	33.94	33.94	
31	CH 450 : CH 465	19.43	2.33	15.00	34.97	34.97	
32	CH 465 : CH 480	20.37	6.11	15.00	91.68	91.68	
33	CH 480 : CH 495	20.83	6.25	15.00	93.71	93.71	
34	CH 495 : CH 510	18.48	2.22	15.00	33.26	33.26	
35	CH 510 : CH 525	19.74	2.37	15.00	35.54	35.54	
36	CH 525 : CH 540	26.37	7.91	15.00	118.65	118.65	
37	CH 540 : CH 555	29.15	8.75	15.00	131.20	131.20	
38	CH 555 : CH 570	28.47	8.54	15.00	128.11	128.11	
39	CH 570 : CH 585	27.46	8.24	15.00	123.55	123.55	
40	CH 585 : CH 600	26.20	7.86	15.00	117.88	117.88	
41	CH 600 : CH 615	24.68	7.40	15.00	111.06	111.06	
42	CH 615 : CH 630	24.59	7.38	15.00	110.66	110.66	
43	CH 630 : CH 645	24.35	7.31	15.00	109.59	109.59	
44	CH 645 : CH 660	22.08	6.62	15.00	99.36	99.36	
45	CH 660 : CH 675	18.79	2.25	15.00	33.82	33.82	
46	CH 675 : CH 690	16.30	1.96	15.00	29.34	29.34	
47	CH 690 : CH 705	15.60	1.87	15.00	28.09	28.09	
48	CH 705 : CH 720	14.02	1.68	15.00	25.23	25.23	
49	CH 720 : CH 735	13.23	1.59	15.00	23.81	23.81	
50	CH 735 : CH 750	14.39	1.73	15.00	25.90	25.90	

Sl.No	Chainage	DETAILS					Remarks
		W (m)	Based on the concentration (W1)	L (m)	Area (L*W1)	Total Area (Sqm)	
51	CH 750 : CH 765	15.36	1.84	15.00	27.64	27.64	
52	CH 765 : CH 780	15.37	1.84	15.00	27.66	27.66	
53	CH 780 : CH 795	15.51	1.86	15.00	27.92	27.92	
54	CH 795 : CH 810	15.68	1.88	15.00	28.22	28.22	
55	CH 810 : CH 825	15.58	1.87	15.00	28.05	28.05	
56	CH 825 : CH 840	15.47	1.86	15.00	27.85	27.85	
57	CH 840 : CH 855	15.38	1.85	15.00	27.68	27.68	
58	CH 855 : CH 870	15.73	1.89	15.00	28.31	28.31	
59	CH 870 : CH 885	16.75	2.01	15.00	30.15	30.15	
60	CH 885 : CH 900	17.08	2.05	15.00	30.74	30.74	
61	CH 900 : CH 915	16.25	1.95	15.00	29.25	29.25	
62	CH 915 : CH 930	15.66	1.88	15.00	28.19	28.19	
63	CH 930 : CH 945	15.54	1.86	15.00	27.97	27.97	
64	CH 945 : CH 960	17.53	2.10	15.00	31.56	31.56	
65	CH 960 : CH 975	19.95	2.39	15.00	35.91	35.91	
66	CH 975 : CH 990	18.49	2.22	15.00	33.28	33.28	
67	CH 990 : CH 1005	15.62	1.87	15.00	28.12	28.12	
68	CH 1005 : CH 1020	13.86	1.66	15.00	24.95	24.95	
69	CH 1020 : CH 1035	13.52	1.62	15.00	24.33	24.33	
70	CH 1035 : CH 1050	14.22	1.71	15.00	25.60	25.60	
71	CH 1050 : CH 1065	14.35	1.72	15.00	25.82	25.82	
72	CH 1065 : CH 1080	13.77	1.65	15.00	24.79	24.79	
73	CH 1080 : CH 1095	13.04	1.56	15.00	23.47	23.47	
74	CH 1095 : CH 1110	12.50	1.50	15.00	22.50	22.50	
75	CH 1110 : CH 1125	12.02	1.44	15.00	21.64	21.64	
76	CH 1125 : CH 1140	11.41	1.37	15.00	20.54	20.54	
77	CH 1140 : CH 1155	11.46	1.37	15.00	20.62	20.62	
78	CH 1155 : CH 1170	12.60	1.51	15.00	22.67	22.67	
79	CH 1170 : CH 1185	14.03	1.68	15.00	25.26	25.26	
80	CH 1185 : CH 1200	15.37	1.84	15.00	27.67	27.67	
81	CH 1200 : CH 1215	16.89	2.03	15.00	30.40	30.40	
82	CH 1215 : CH 1230	17.82	2.14	15.00	32.08	32.08	
83	CH 1230 : CH 1245	16.72	2.01	15.00	30.10	30.10	
84	CH 1245 : CH 1260	15.29	1.84	15.00	27.53	27.53	
85	CH 1260 : CH 1275	14.23	1.71	15.00	25.61	25.61	
86	CH 1275 : CH 1290	13.40	1.61	15.00	24.12	24.12	
87	CH 1290 : CH 1305	13.59	1.63	15.00	24.46	24.46	
88	CH 1305 : CH 1320	14.40	1.73	15.00	25.92	25.92	
89	CH 1320 : CH 1335	16.36	1.96	15.00	29.44	29.44	
90	CH 1335 : CH 1350	20.22	7.08	15.00	106.16	106.16	
91	CH 1350 : CH 1365	18.57	2.23	15.00	33.43	33.43	
92	CH 1365 : CH 1380	12.24	1.47	15.00	22.03	22.03	
93	CH 1380 : CH 1395	9.83	0.49	15.00	7.37	7.37	
94	CH 1395 : CH 1410	9.42	0.47	15.00	7.06	7.06	
95	CH 1410 : CH 1425	9.92	0.50	15.00	7.44	7.44	
96	CH 1425 : CH 1440	11.30	1.36	15.00	20.33	20.33	
97	CH 1440 : CH 1455	11.56	1.39	15.00	20.81	20.81	
98	CH 1455 : CH 1470	10.54	1.26	15.00	18.97	18.97	
99	CH 1470 : CH 1485	9.35	0.47	15.00	7.01	7.01	
100	CH 1485 : CH 1500	8.96	0.45	15.00	6.72	6.72	
101	CH 1500 : CH 1515	8.98	0.45	15.00	6.74	6.74	

Sl.No	Chainage	DETAILS					Remarks
		W (m)	Based on the concentration (W1)	L (m)	Area (L*W1)	Total Area (Sqm)	
102	CH 1515 : CH 1530	9.77	0.49	15.00	7.33	7.33	
103	CH 1530 : CH 1545	10.74	1.29	15.00	19.34	19.34	
104	CH 1545 : CH 1560	11.20	1.34	15.00	20.16	20.16	
105	CH 1560 : CH 1575	12.88	1.55	15.00	23.18	23.18	
106	CH 1575 : CH 1590	14.52	1.74	15.00	26.14	26.14	
107	CH 1590 : CH 1605	15.35	1.84	15.00	27.63	27.63	
108	CH 1605 : CH 1620	16.03	1.92	15.00	28.86	28.86	
109	CH 1620 : CH 1635	16.47	1.98	15.00	29.65	29.65	
110	CH 1635 : CH 1650	16.31	1.96	15.00	29.36	29.36	
111	CH 1650 : CH 1665	15.26	1.83	15.00	27.46	27.46	
112	CH 1665 : CH 1680	13.84	1.66	15.00	24.91	24.91	
113	CH 1680 : CH 1695	12.98	1.56	15.00	23.37	23.37	
114	CH 1695 : CH 1710	12.51	1.50	15.00	22.52	22.52	
115	CH 1710 : CH 1725	11.53	1.38	15.00	20.75	20.75	
116	CH 1725 : CH 1740	11.12	1.33	15.00	20.02	20.02	
117	CH 1740 : CH 1755	11.51	1.38	15.00	20.71	20.71	
118	CH 1755 : CH 1770	11.41	1.37	15.00	20.53	20.53	
119	CH 1770 : CH 1785	11.59	1.39	15.00	20.86	20.86	
120	CH 1785 : CH 1800	12.29	1.47	15.00	22.11	22.11	
121	CH 1800 : CH 1815	12.42	1.49	15.00	22.35	22.35	
122	CH 1815 : CH 1830	12.06	1.45	15.00	21.71	21.71	
123	CH 1830 : CH 1845	11.43	1.37	15.00	20.58	20.58	
124	CH 1845 : CH 1860	10.59	1.27	15.00	19.07	19.07	
125	CH 1860 : CH 1875	10.04	1.20	15.00	18.07	18.07	
126	CH 1875 : CH 1890	9.13	0.46	15.00	6.85	6.85	
127	CH 1890 : CH 1905	8.62	0.43	15.00	6.46	6.46	
128	CH 1905 : CH 1920	8.70	0.43	15.00	6.52	6.52	
129	CH 1920 : CH 1935	8.62	0.43	15.00	6.46	6.46	
130	CH 1935 : CH 1950	8.78	0.44	15.00	6.58	6.58	
131	CH 1950 : CH 1965	8.96	0.45	15.00	6.72	6.72	
132	CH 1965 : CH 1980	8.99	0.45	15.00	6.74	6.74	
133	CH 1980 : CH 1995	8.47	0.42	15.00	6.36	6.36	
134	CH 1995 : CH 2010	7.58	0.38	15.00	5.69	5.69	
135	CH 2010 : CH 2025	6.69	0.33	15.00	5.02	5.02	
136	CH 2025 : CH 2040	5.97	0.30	15.00	4.48	4.48	
137	CH 2040 : CH 2055	6.11	0.31	15.00	4.58	4.58	
138	CH 2055 : CH 2070	6.74	0.34	15.00	5.05	5.05	
139	CH 2070 : CH 2085	6.53	0.33	15.00	4.90	4.90	
140	CH 2085 : CH 2100	6.19	0.31	15.00	4.65	4.65	
141	CH 2100 : CH 2115	6.26	0.31	15.00	4.69	4.69	
142	CH 2115 : CH 2130	6.03	0.30	15.00	4.53	4.53	
143	CH 2130 : CH 2145	5.52	0.28	15.00	4.14	4.14	
144	CH 2145 : CH 2160	5.50	0.28	15.00	4.13	4.13	
145	CH 2160 : CH 2175	5.46	0.27	15.00	4.10	4.10	
146	CH 2175 : CH 2190	5.18	0.26	15.00	3.89	3.89	
147	CH 2190 : CH 2205	5.72	0.29	15.00	4.29	4.29	
148	CH 2205 : CH 2220	6.07	0.30	15.00	4.55	4.55	
149	CH 2220 : CH 2235	6.03	0.30	15.00	4.53	4.53	
150	CH 2235 : CH 2250	5.28	0.26	15.00	3.96	3.96	
151	CH 2250 : CH 2265	5.47	0.27	15.00	4.10	4.10	
152	CH 2265 : CH 2280	6.25	0.31	15.00	4.69	4.69	

Sl.No	Chainage	DETAILS					Remarks
		W (m)	Based on the concentration (W1)	L (m)	Area (L*W1)	Total Area (Sqm)	
153	CH 2280 : CH 2295	5.53	0.28	15.00	4.15	4.15	
154	CH 2295 : CH 2310	5.72	0.29	15.00	4.29	4.29	
155	CH 2310 : CH 2325	6.14	0.31	15.00	4.61	4.61	
156	CH 2325 : CH 2340	6.11	0.31	15.00	4.58	4.58	
157	CH 2340 : CH 2355	6.42	0.32	15.00	4.81	4.81	
158	CH 2355 : CH 2370	5.67	0.28	15.00	4.25	4.25	
159	CH 2370 : CH 2385	4.56	0.23	15.00	3.42	3.42	
160	CH 2385 : CH 2400	4.53	0.23	15.00	3.40	3.40	
161	CH 2400 : CH 2415	5.10	0.26	15.00	3.83	3.83	
162	CH 2415 : CH 2430	5.10	0.26	15.00	3.83	3.83	
163	CH 2430 : CH 2445	4.43	0.22	15.00	3.32	3.32	
164	CH 2445 : CH 2460	4.71	0.24	15.00	3.53	3.53	
165	CH 2460 : CH 2475	5.03	0.25	15.00	3.77	3.77	
166	CH 2475 : CH 2490	4.51	0.23	15.00	3.38	3.38	
167	CH 2490 : CH 2505	4.42	0.22	15.00	3.31	3.31	
168	CH 2505 : CH 2520	5.17	0.26	15.00	3.88	3.88	
169	CH 2520 : CH 2535	5.41	0.27	15.00	4.06	4.06	
170	CH 2535 : CH 2550	4.82	0.24	15.00	3.61	3.61	
171	CH 2550 : CH 2565	4.82	0.24	15.00	3.61	3.61	
172	CH 2565 : CH 2580	5.28	0.26	15.00	3.96	3.96	
173	CH 2580 : CH 2595	5.48	0.27	15.00	4.11	4.11	
174	CH 2595 : CH 2610	5.36	0.27	15.00	4.02	4.02	
175	CH 2610 : CH 2625	5.28	0.26	15.00	3.96	3.96	
176	CH 2625 : CH 2640	5.00	0.25	15.00	3.75	3.75	
177	CH 2640 : CH 2655	4.92	0.25	15.00	3.69	3.69	
178	CH 2655 : CH 2670	5.44	0.27	15.00	4.08	4.08	
179	CH 2670 : CH 2685	5.44	0.27	15.00	4.08	4.08	
180	CH 2685 : CH 2700	4.51	0.23	15.00	3.38	3.38	
181	CH 2700 : CH 2715	3.92	0.20	15.00	2.94	2.94	
182	CH 2715 : CH 2730	4.12	0.21	15.00	3.09	3.09	
183	CH 2730 : CH 2745	4.24	0.21	15.00	3.18	3.18	
184	CH 2745 : CH 2760	3.92	0.20	15.00	2.94	2.94	
185	CH 2760 : CH 2775	3.55	0.18	15.00	2.66	2.66	
186	CH 2775 : CH 2790	3.50	0.17	15.00	2.62	2.62	
187	CH 2790 : CH 2805	3.77	0.19	15.00	2.83	2.83	
188	CH 2805 : CH 2820	3.86	0.19	15.00	2.90	2.90	
189	CH 2820 : CH 2835	3.72	0.19	15.00	2.79	2.79	
190	CH 2835 : CH 2850	3.66	0.18	15.00	2.74	2.74	
191	CH 2850 : CH 2865	3.73	0.19	15.00	2.79	2.79	
192	CH 2865 : CH 2880	3.82	0.19	15.00	2.86	2.86	
193	CH 2880 : CH 2895	3.57	0.18	15.00	2.68	2.68	
194	CH 2895 : CH 2910	3.40	0.17	15.00	2.55	2.55	
195	CH 2910 : CH 2925	3.30	0.16	15.00	2.47	2.47	
196	CH 2925 : CH 2940	3.42	0.17	15.00	2.57	2.57	
197	CH 2940 : CH 2955	3.72	0.19	15.00	2.79	2.79	
198	CH 2955 : CH 2970	3.70	0.19	15.00	2.78	2.78	
199	CH 2970 : CH 2985	3.65	0.18	15.00	2.73	2.73	
200	CH 2985 : CH 3000	3.62	0.18	15.00	2.71	2.71	
201	CH 3000 : CH 3015	3.57	0.18	15.00	2.68	2.68	
202	CH 3015 : CH 3030	3.40	0.17	15.00	2.55	2.55	
203	CH 3030 : CH 3045	3.12	0.16	15.00	2.34	2.34	

Sl.No	Chainage	DETAILS					Remarks
		W (m)	Based on the concentration (W1)	L (m)	Area (L*W1)	Total Area (Sqm)	
204	CH 3045 : CH 3060	3.31	0.17	15.00	2.48	2.48	
205	CH 3060 : CH 3075	3.75	0.19	15.00	2.81	2.81	
206	CH 3075 : CH 3090	3.54	0.18	15.00	2.66	2.66	
207	CH 3090 : CH 3105	3.13	0.16	15.00	2.35	2.35	
208	CH 3105 : CH 3120	3.11	0.16	15.00	2.33	2.33	
209	CH 3120 : CH 3135	3.20	0.16	15.00	2.40	2.40	
210	CH 3135 : CH 3150	3.08	0.15	15.00	2.31	2.31	
211	CH 3150 : CH 3165	3.02	0.15	15.00	2.26	2.26	
212	CH 3165 : CH 3180	3.21	0.16	15.00	2.40	2.40	
213	CH 3180 : CH 3195	3.32	0.17	15.00	2.49	2.49	
214	CH 3195 : CH 3210	3.07	0.15	15.00	2.31	2.31	
215	CH 3210 : CH 3225	3.12	0.16	15.00	2.34	2.34	
216	CH 3225 : CH 3240	3.11	0.16	15.00	2.33	2.33	
217	CH 3240 : CH 3255	3.05	0.15	15.00	2.29	2.29	
218	CH 3255 : CH 3270	3.13	0.16	15.00	2.35	2.35	
219	CH 3270 : CH 3285	3.17	0.16	15.00	2.38	2.38	
220	CH 3285 : CH 3300	3.27	0.16	15.00	2.45	2.45	
221	CH 3300 : CH 3315	3.24	0.16	15.00	2.43	2.43	
222	CH 3315 : CH 3330	3.03	0.15	15.00	2.27	2.27	
223	CH 3330 : CH 3345	3.22	0.16	15.00	2.42	2.42	
224	CH 3345 : CH 3360	3.38	0.17	15.00	2.54	2.54	
225	CH 3360 : CH 3375	2.86	0.14	15.00	2.15	2.15	
226	CH 3375 : CH 3390	2.77	0.14	15.00	2.08	2.08	
227	CH 3390 : CH 3405	3.39	0.17	15.00	2.54	2.54	
228	CH 3405 : CH 3420	3.72	0.19	15.00	2.79	2.79	
229	CH 3420 : CH 3435	2.82	0.14	15.00	2.12	2.12	
230	CH 3435 : CH 3450	2.31	0.12	15.00	1.73	1.73	
231	CH 3450 : CH 3465	2.27	0.11	15.00	1.70	1.70	
232	CH 3465 : CH 3480	2.29	0.11	15.00	1.72	1.72	
233	CH 3480 : CH 3495	2.51	0.13	15.00	1.88	1.88	
234	CH 3495 : CH 3510	2.57	0.13	15.00	1.93	1.93	
235	CH 3510 : CH 3525	2.49	0.12	15.00	1.87	1.87	
236	CH 3525 : CH 3540	2.43	0.12	15.00	1.82	1.82	
237	CH 3540 : CH 3555	2.56	0.13	15.00	1.92	1.92	
238	CH 3555 : CH 3570	2.48	0.12	15.00	1.86	1.86	
239	CH 3570 : CH 3585	2.52	0.13	15.00	1.89	1.89	
240	CH 3585 : CH 3600	2.59	0.13	15.00	1.94	1.94	
241	CH 3600 : CH 3615	2.43	0.12	15.00	1.82	1.82	
242	CH 3615 : CH 3630	2.20	0.11	15.00	1.65	1.65	
243	CH 3630 : CH 3645	2.14	0.11	15.00	1.61	1.61	
244	CH 3645 : CH 3660	2.11	0.11	15.00	1.58	1.58	
245	CH 3660 : CH 3675	2.01	0.10	15.00	1.51	1.51	
246	CH 3675 : CH 3690	2.40	0.12	15.00	1.80	1.80	
247	CH 3690 : CH 3705	2.99	0.15	15.00	2.25	2.25	
248	CH 3705 : CH 3720	3.16	0.16	15.00	2.37	2.37	
249	CH 3720 : CH 3735	2.61	0.13	15.00	1.95	1.95	
250	CH 3735 : CH 3750	2.10	0.10	15.00	1.57	1.57	
251	CH 3750 : CH 3765	2.12	0.11	15.00	1.59	1.59	
252	CH 3765 : CH 3780	2.82	0.14	15.00	2.11	2.11	
253	CH 3780 : CH 3795	3.47	0.17	15.00	2.60	2.60	
254	CH 3795 : CH 3810	3.54	0.18	15.00	2.66	2.66	

Sl.No	Chainage	DETAILS					Remarks
		W (m)	Based on the concentration (W1)	L (m)	Area (L*W1)	Total Area (Sqm)	
255	CH 3810 : CH 3825	3.46	0.17	15.00	2.59	2.59	
256	CH 3825 : CH 3840	3.10	0.15	15.00	2.32	2.32	
257	CH 3840 : CH 3855	2.78	0.14	15.00	2.09	2.09	
258	CH 3855 : CH 3870	2.76	0.14	15.00	2.07	2.07	
259	CH 3870 : CH 3885	3.39	0.17	15.00	2.54	2.54	
260	CH 3885 : CH 3900	3.27	0.16	15.00	2.45	2.45	
261	CH 3900 : CH 3915	2.63	0.13	15.00	1.97	1.97	
262	CH 3915 : CH 3930	2.63	0.13	15.00	1.98	1.98	
263	CH 3930 : CH 3945	2.60	0.13	15.00	1.95	1.95	
264	CH 3945 : CH 3960	2.65	0.13	15.00	1.99	1.99	
265	CH 3960 : CH 3975	2.70	0.13	15.00	2.02	2.02	
266	CH 3975 : CH 3990	2.64	0.13	15.00	1.98	1.98	
267	CH 3990 : CH 4005	2.63	0.13	15.00	1.97	1.97	
268	CH 4005 : CH 4020	2.62	0.13	15.00	1.97	1.97	
269	CH 4020 : CH 4035	2.60	0.13	15.00	1.95	1.95	
270	CH 4035 : CH 4050	2.67	0.13	15.00	2.00	2.00	
271	CH 4050 : CH 4065	2.73	0.14	15.00	2.05	2.05	
272	CH 4065 : CH 4080	2.68	0.13	15.00	2.01	2.01	
273	CH 4080 : CH 4095	2.68	0.13	15.00	2.01	2.01	
274	CH 4095 : CH 4110	2.74	0.14	15.00	2.05	2.05	
275	CH 4110 : CH 4125	2.64	0.13	15.00	1.98	1.98	
276	CH 4125 : CH 4140	1.27	0.06	15.00	0.95	0.95	
277	CH 4140 : CH 4155	0.00	0.00	15.00	0.00	0.00	
278	CH 4155 : CH 4170	0.00	0.00	15.00	0.00	0.00	
279	CH 4170 : CH 4185	0.00	0.00	15.00	0.00	0.00	
280	CH 4185 : CH 4200	0.00	0.00	15.00	0.00	0.00	
281	CH 4200 : CH 4215	0.00	0.00	15.00	0.00	0.00	
282	CH 4215 : CH 4230	0.00	0.00	15.00	0.00	0.00	
283	CH 4230 : CH 4245	0.00	0.00	15.00	0.00	0.00	
284	CH 4245 : CH 4260	0.00	0.00	15.00	0.00	0.00	
285	CH 4260 : CH 4275	0.00	0.00	15.00	0.00	0.00	
286	CH 4275 : CH 4290	2.01	0.10	15.00	1.51	1.51	
287	CH 4290 : CH 4305	3.96	0.20	15.00	2.97	2.97	
288	CH 4305 : CH 4320	4.02	0.20	15.00	3.01	3.01	
289	CH 4320 : CH 4335	4.17	0.21	15.00	3.13	3.13	
290	CH 4335 : CH 4350	4.14	0.21	15.00	3.10	3.10	
291	CH 4350 : CH 4365	4.34	0.22	15.00	3.25	3.25	
292	CH 4365 : CH 4380	4.49	0.22	15.00	3.37	3.37	
293	CH 4380 : CH 4395	4.46	0.22	15.00	3.35	3.35	
294	CH 4395 : CH 4410	4.55	0.23	15.00	3.41	3.41	
295	CH 4410 : CH 4425	4.33	0.22	15.00	3.25	3.25	
296	CH 4425 : CH 4440	4.15	0.21	15.00	3.11	3.11	
297	CH 4440 : CH 4455	4.24	0.21	15.00	3.18	3.18	
298	CH 4455 : CH 4470	4.19	0.21	15.00	3.15	3.15	
299	CH 4470 : CH 4485	4.24	0.21	15.00	3.18	3.18	
300	CH 4485 : CH 4500	4.24	0.21	15.00	3.18	3.18	
301	CH 4500 : CH 4515	4.39	0.22	15.00	3.30	3.30	
302	CH 4515 : CH 4530	4.51	0.23	15.00	3.38	3.38	
303	CH 4530 : CH 4545	4.21	0.21	15.00	3.16	3.16	
304	CH 4545 : CH 4560	4.17	0.21	15.00	3.13	3.13	
305	CH 4560 : CH 4575	4.26	0.21	15.00	3.19	3.19	

Sl.No	Chainage	DETAILS					Remarks
		W (m)	Based on the concentration (W1)	L (m)	Area (L*W1)	Total Area (Sqm)	
306	CH 4575 : CH 4590	4.27	0.21	15.00	3.20	3.20	
307	CH 4590 : CH 4605	4.43	0.22	15.00	3.32	3.32	
308	CH 4605 : CH 4620	4.07	0.20	15.00	3.05	3.05	
309	CH 4620 : CH 4635	4.08	0.20	15.00	3.06	3.06	
310	CH 4635 : CH 4650	4.51	0.23	15.00	3.39	3.39	
311	CH 4650 : CH 4665	4.08	0.20	15.00	3.06	3.06	
312	CH 4665 : CH 4680	3.92	0.20	15.00	2.94	2.94	
313	CH 4680 : CH 4695	4.24	0.21	15.00	3.18	3.18	
314	CH 4695 : CH 4710	4.00	0.20	15.00	3.00	3.00	
315	CH 4710 : CH 4725	3.36	0.17	15.00	2.52	2.52	
316	CH 4725 : CH 4740	3.49	0.17	15.00	2.62	2.62	
317	CH 4740 : CH 4755	3.67	0.18	15.00	2.75	2.75	
318	CH 4755 : CH 4770	3.38	0.17	15.00	2.53	2.53	
319	CH 4770 : CH 4785	3.28	0.16	15.00	2.46	2.46	
320	CH 4785 : CH 4800	3.30	0.17	15.00	2.48	2.48	
321	CH 4800 : CH 4815	3.79	0.19	15.00	2.84	2.84	
322	CH 4815 : CH 4830	4.26	0.21	15.00	3.20	3.20	
323	CH 4830 : CH 4845	4.27	0.21	15.00	3.20	3.20	
324	CH 4845 : CH 4860	4.11	0.21	15.00	3.09	3.09	
325	CH 4860 : CH 4875	3.73	0.19	15.00	2.79	2.79	
326	CH 4875 : CH 4890	3.92	0.20	15.00	2.94	2.94	
327	CH 4890 : CH 4905	4.77	0.24	15.00	3.58	3.58	
328	CH 4905 : CH 4920	4.91	0.25	15.00	3.69	3.69	
329	CH 4920 : CH 4935	4.51	0.23	15.00	3.38	3.38	
330	CH 4935 : CH 4950	4.43	0.22	15.00	3.32	3.32	
331	CH 4950 : CH 4965	4.46	0.22	15.00	3.34	3.34	
332	CH 4965 : CH 4980	4.37	0.22	15.00	3.27	3.27	
333	CH 4980 : CH 4995	4.28	0.21	15.00	3.21	3.21	
334	CH 4995 : CH 5010	4.19	0.21	15.00	3.14	3.14	
335	CH 5010 : CH 5025	4.10	0.20	15.00	3.07	3.07	
336	CH 5025 : CH 5040	4.62	0.23	15.00	3.47	3.47	
337	CH 5040 : CH 5055	5.17	0.26	15.00	3.88	3.88	
338	CH 5055 : CH 5070	5.04	0.25	15.00	3.78	3.78	
339	CH 5070 : CH 5085	5.05	0.25	15.00	3.78	3.78	
340	CH 5085 : CH 5100	5.11	0.26	15.00	3.83	3.83	
341	CH 5100 : CH 5115	4.77	0.24	15.00	3.57	3.57	
342	CH 5115 : CH 5130	4.53	0.23	15.00	3.40	3.40	
343	CH 5130 : CH 5145	4.83	0.24	15.00	3.62	3.62	
344	CH 5145 : CH 5160	4.84	0.24	15.00	3.63	3.63	
345	CH 5160 : CH 5175	4.81	0.24	15.00	3.60	3.60	
346	CH 5175 : CH 5190	5.15	0.26	15.00	3.86	3.86	
347	CH 5190 : CH 5205	5.31	0.27	15.00	3.98	3.98	
348	CH 5205 : CH 5220	5.33	0.27	15.00	4.00	4.00	
349	CH 5220 : CH 5235	5.58	0.28	15.00	4.19	4.19	
350	CH 5235 : CH 5250	5.90	0.30	15.00	4.43	4.43	
351	CH 5250 : CH 5265	6.40	0.32	15.00	4.80	4.80	
352	CH 5265 : CH 5280	5.82	0.29	15.00	4.37	4.37	
353	CH 5280 : CH 5295	4.71	0.24	15.00	3.53	3.53	
354	CH 5295 : CH 5310	4.87	0.24	15.00	3.65	3.65	
355	CH 5310 : CH 5325	5.02	0.25	15.00	3.76	3.76	
356	CH 5325 : CH 5340	5.37	0.27	15.00	4.03	4.03	

Sl.No	Chainage	DETAILS					Remarks
		W (m)	Based on the concentration (W1)	L (m)	Area (L*W1)	Total Area (Sqm)	
357	CH 5340 : CH 5355	6.16	0.31	15.00	4.62	4.62	
358	CH 5355 : CH 5370	6.89	0.34	15.00	5.17	5.17	
359	CH 5370 : CH 5385	6.65	0.33	15.00	4.98	4.98	
360	CH 5385 : CH 5400	5.71	0.29	15.00	4.28	4.28	
361	CH 5400 : CH 5415	5.99	0.30	15.00	4.49	4.49	
362	CH 5415 : CH 5430	6.23	0.31	15.00	4.67	4.67	
363	CH 5430 : CH 5445	5.06	0.25	15.00	3.80	3.80	
364	CH 5445 : CH 5460	3.86	0.19	15.00	2.90	2.90	
365	CH 5460 : CH 5475	4.80	0.24	15.00	3.60	3.60	
366	CH 5475 : CH 5490	6.06	0.30	15.00	4.55	4.55	
367	CH 5490 : CH 5505	6.03	0.30	15.00	4.52	4.52	
368	CH 5505 : CH 5520	5.75	0.29	15.00	4.31	4.31	
369	CH 5520 : CH 5535	5.34	0.27	15.00	4.00	4.00	
370	CH 5535 : CH 5550	5.30	0.26	15.00	3.97	3.97	
371	CH 5550 : CH 5565	5.57	0.28	15.00	4.18	4.18	
372	CH 5565 : CH 5580	5.93	0.30	15.00	4.45	4.45	
373	CH 5580 : CH 5595	5.93	0.30	15.00	4.45	4.45	
374	CH 5595 : CH 5610	6.02	0.30	15.00	4.52	4.52	
375	CH 5610 : CH 5625	6.51	0.33	15.00	4.88	4.88	
376	CH 5625 : CH 5640	6.72	0.34	15.00	5.04	5.04	
377	CH 5640 : CH 5655	6.82	0.34	15.00	5.12	5.12	
378	CH 5655 : CH 5670	6.60	0.33	15.00	4.95	4.95	
379	CH 5670 : CH 5685	6.37	0.32	15.00	4.78	4.78	
380	CH 5685 : CH 5700	5.72	0.29	15.00	4.29	4.29	
381	CH 5700 : CH 5715	5.23	0.26	15.00	3.92	3.92	
382	CH 5715 : CH 5730	5.96	0.30	15.00	4.47	4.47	
383	CH 5730 : CH 5745	6.72	0.34	15.00	5.04	5.04	
384	CH 5745 : CH 5760	6.33	0.32	15.00	4.75	4.75	
385	CH 5760 : CH 5775	5.68	0.28	15.00	4.26	4.26	
386	CH 5775 : CH 5790	5.64	0.28	15.00	4.23	4.23	
387	CH 5790 : CH 5805	5.58	0.28	15.00	4.18	4.18	
388	CH 5805 : CH 5820	5.33	0.27	15.00	4.00	4.00	
389	CH 5820 : CH 5835	5.35	0.27	15.00	4.01	4.01	
390	CH 5835 : CH 5850	5.76	0.29	15.00	4.32	4.32	
391	CH 5850 : CH 5865	6.10	0.31	15.00	4.58	4.58	
392	CH 5865 : CH 5880	7.29	0.36	15.00	5.47	5.47	
393	CH 5880 : CH 5895	7.98	0.40	15.00	5.99	5.99	
394	CH 5895 : CH 5910	7.35	0.37	15.00	5.51	5.51	
395	CH 5910 : CH 5925	7.23	0.36	15.00	5.42	5.42	
396	CH 5925 : CH 5940	7.58	0.38	15.00	5.68	5.68	
397	CH 5940 : CH 5955	8.04	0.40	15.00	6.03	6.03	
398	CH 5955 : CH 5970	8.36	0.42	15.00	6.27	6.27	
399	CH 5970 : CH 5985	8.42	0.42	15.00	6.32	6.32	
400	CH 5985 : CH 6000	7.52	0.38	15.00	5.64	5.64	
401	CH 6000 : CH 6015	6.15	0.31	15.00	4.61	4.61	
402	CH 6015 : CH 6030	6.36	0.32	15.00	4.77	4.77	
403	CH 6030 : CH 6045	7.24	0.36	15.00	5.43	5.43	
404	CH 6045 : CH 6060	7.99	0.40	15.00	5.99	5.99	
405	CH 6060 : CH 6075	8.48	0.42	15.00	6.36	6.36	
406	CH 6075 : CH 6090	8.75	0.44	15.00	6.56	6.56	
407	CH 6090 : CH 6105	9.16	0.46	15.00	6.87	6.87	

Sl.No	Chainage	DETAILS					Remarks
		W (m)	Based on the concentration (W1)	L (m)	Area (L*W1)	Total Area (Sqm)	
408	CH 6105 : CH 6120	9.53	0.48	15.00	7.15	7.15	
409	CH 6120 : CH 6135	9.93	0.50	15.00	7.45	7.45	
410	CH 6135 : CH 6150	12.20	1.46	15.00	21.96	21.96	
411	CH 6150 : CH 6165	13.79	1.65	15.00	24.82	24.82	
412	CH 6165 : CH 6180	11.95	1.43	15.00	21.51	21.51	
413	CH 6180 : CH 6195	10.43	1.25	15.00	18.78	18.78	
414	CH 6195 : CH 6210	10.27	1.23	15.00	18.49	18.49	
415	CH 6210 : CH 6225	10.35	1.24	15.00	18.62	18.62	
416	CH 6225 : CH 6240	10.55	1.27	15.00	19.00	19.00	
417	CH 6240 : CH 6255	10.76	1.29	15.00	19.37	19.37	
418	CH 6255 : CH 6270	10.97	1.32	15.00	19.74	19.74	
419	CH 6270 : CH 6285	10.85	1.30	15.00	19.53	19.53	
420	CH 6285 : CH 6300	11.33	1.36	15.00	20.39	20.39	
421	CH 6300 : CH 6315	12.09	1.45	15.00	21.77	21.77	
422	CH 6315 : CH 6330	12.04	1.45	15.00	21.68	21.68	
423	CH 6330 : CH 6345	10.92	1.31	15.00	19.66	19.66	
424	CH 6345 : CH 6360	9.14	0.46	15.00	6.86	6.86	
425	CH 6360 : CH 6375	8.26	0.41	15.00	6.19	6.19	
426	CH 6375 : CH 6390	8.07	0.40	15.00	6.05	6.05	
427	CH 6390 : CH 6405	7.84	0.39	15.00	5.88	5.88	
428	CH 6405 : CH 6420	7.42	0.37	15.00	5.57	5.57	
429	CH 6420 : CH 6435	7.00	0.35	15.00	5.25	5.25	
430	CH 6435 : CH 6450	7.22	0.36	15.00	5.42	5.42	
431	CH 6450 : CH 6465	7.69	0.38	15.00	5.77	5.77	
432	CH 6465 : CH 6480	8.26	0.41	15.00	6.19	6.19	
433	CH 6480 : CH 6495	8.04	0.40	15.00	6.03	6.03	
434	CH 6495 : CH 6510	7.31	0.37	15.00	5.48	5.48	
435	CH 6510 : CH 6525	7.55	0.38	15.00	5.66	5.66	
436	CH 6525 : CH 6540	8.19	0.41	15.00	6.14	6.14	
437	CH 6540 : CH 6555	8.80	0.44	15.00	6.60	6.60	
438	CH 6555 : CH 6570	10.63	1.28	15.00	19.13	19.13	
439	CH 6570 : CH 6585	14.04	1.69	15.00	25.28	25.28	
440	CH 6585 : CH 6600	15.32	1.84	15.00	27.57	27.57	
441	CH 6600 : CH 6615	14.60	1.75	15.00	26.28	26.28	
442	CH 6615 : CH 6630	14.37	1.72	15.00	25.87	25.87	
443	CH 6630 : CH 6645	14.02	1.68	15.00	25.24	25.24	
444	CH 6645 : CH 6660	13.43	1.61	15.00	24.17	24.17	
445	CH 6660 : CH 6675	13.06	1.57	15.00	23.51	23.51	
446	CH 6675 : CH 6690	12.26	1.47	15.00	22.06	22.06	
447	CH 6690 : CH 6705	11.39	1.37	15.00	20.49	20.49	
448	CH 6705 : CH 6720	12.05	1.45	15.00	21.69	21.69	
449	CH 6720 : CH 6735	13.01	1.56	15.00	23.42	23.42	
450	CH 6735 : CH 6750	13.27	1.59	15.00	23.89	23.89	
451	CH 6750 : CH 6765	13.71	1.64	15.00	24.67	24.67	
452	CH 6765 : CH 6780	14.56	1.75	15.00	26.21	26.21	
453	CH 6780 : CH 6795	15.35	1.84	15.00	27.64	27.64	
454	CH 6795 : CH 6810	15.29	1.84	15.00	27.53	27.53	
455	CH 6810 : CH 6825	14.35	1.72	15.00	25.83	25.83	
456	CH 6825 : CH 6840	13.71	1.65	15.00	24.69	24.69	
457	CH 6840 : CH 6855	13.25	1.59	15.00	23.85	23.85	
458	CH 6855 : CH 6870	12.96	1.55	15.00	23.32	23.32	

Sl.No	Chainage	DETAILS					Remarks
		W (m)	Based on the concentration (W1)	L (m)	Area (L*W1)	Total Area (Sqm)	
459	CH 6870 : CH 6885	13.44	1.61	15.00	24.19	24.19	
460	CH 6885 : CH 6900	14.33	1.72	15.00	25.79	25.79	
461	CH 6900 : CH 6915	14.54	1.74	15.00	26.17	26.17	
462	CH 6915 : CH 6930	14.41	1.73	15.00	25.93	25.93	
463	CH 6930 : CH 6945	14.75	1.77	15.00	26.55	26.55	
464	CH 6945 : CH 6960	14.74	1.77	15.00	26.53	26.53	
465	CH 6960 : CH 6975	14.15	1.70	15.00	25.46	25.46	
466	CH 6975 : CH 6990	14.71	1.77	15.00	26.48	26.48	
467	CH 6990 : CH 7005	17.66	2.12	15.00	31.79	31.79	
468	CH 7005 : CH 7020	17.44	2.09	15.00	31.40	31.40	
469	CH 7020 : CH 7035	15.87	1.90	15.00	28.56	28.56	
470	CH 7035 : CH 7050	16.37	1.96	15.00	29.46	29.46	
471	CH 7050 : CH 7065	15.60	1.87	15.00	28.09	28.09	
472	CH 7065 : CH 7080	14.94	1.79	15.00	26.88	26.88	
473	CH 7080 : CH 7095	14.79	1.77	15.00	26.62	26.62	
474	CH 7095 : CH 7110	15.29	1.84	15.00	27.53	27.53	
475	CH 7110 : CH 7125	15.47	1.86	15.00	27.84	27.84	
476	CH 7125 : CH 7140	15.45	1.85	15.00	27.81	27.81	
477	CH 7140 : CH 7155	14.89	1.79	15.00	26.81	26.81	
478	CH 7155 : CH 7170	13.73	1.65	15.00	24.72	24.72	
479	CH 7170 : CH 7185	12.85	1.54	15.00	23.14	23.14	
480	CH 7185 : CH 7200	12.79	1.53	15.00	23.02	23.02	
481	CH 7200 : CH 7215	15.01	1.80	15.00	27.02	27.02	
482	CH 7215 : CH 7230	16.75	2.01	15.00	30.15	30.15	
483	CH 7230 : CH 7245	22.85	6.86	15.00	102.83	102.83	
484	CH 7245 : CH 7260	28.11	8.43	15.00	126.49	126.49	
485	CH 7260 : CH 7275	17.48	2.10	15.00	31.46	31.46	
486	CH 7275 : CH 7290	12.84	1.54	15.00	23.10	23.10	
487	CH 7290 : CH 7305	9.40	0.47	15.00	7.05	7.05	
488	CH 7305 : CH 7320	9.09	0.45	15.00	6.81	6.81	
489	CH 7320 : CH 7335	10.59	1.27	15.00	19.06	19.06	
490	CH 7335 : CH 7350	11.93	1.43	15.00	21.48	21.48	
491	CH 7350 : CH 7365	14.62	1.75	15.00	26.31	26.31	
492	CH 7365 : CH 7380	18.72	2.25	15.00	33.70	33.70	
493	CH 7380 : CH 7395	18.20	2.18	15.00	32.77	32.77	
494	CH 7395 : CH 7410	14.11	1.69	15.00	25.39	25.39	
495	CH 7410 : CH 7425	13.98	1.68	15.00	25.17	25.17	
496	CH 7425 : CH 7440	15.54	1.87	15.00	27.98	27.98	
497	CH 7440 : CH 7455	15.19	1.82	15.00	27.34	27.34	
498	CH 7455 : CH 7470	15.40	1.85	15.00	27.72	27.72	
499	CH 7470 : CH 7485	14.59	1.75	15.00	26.27	26.27	
500	CH 7485 : CH 7500	13.05	1.57	15.00	23.48	23.48	
501	CH 7500 : CH 7515	14.34	1.72	15.00	25.80	25.80	
502	CH 7515 : CH 7530	15.30	1.84	15.00	27.55	27.55	
503	CH 7530 : CH 7545	15.58	1.87	15.00	28.04	28.04	
504	CH 7545 : CH 7560	16.14	1.94	15.00	29.06	29.06	
505	CH 7560 : CH 7575	16.07	1.93	15.00	28.92	28.92	
506	CH 7575 : CH 7590	16.02	1.92	15.00	28.84	28.84	
507	CH 7590 : CH 7605	16.49	1.98	15.00	29.68	29.68	
508	CH 7605 : CH 7620	16.33	1.96	15.00	29.39	29.39	
509	CH 7620 : CH 7635	16.41	1.97	15.00	29.55	29.55	

Sl.No	Chainage	DETAILS					Remarks
		W (m)	Based on the concentration (W1)	L (m)	Area (L*W1)	Total Area (Sqm)	
510	CH 7635 : CH 7650	16.60	1.99	15.00	29.88	29.88	
511	CH 7650 : CH 7665	14.60	1.75	15.00	26.28	26.28	
512	CH 7665 : CH 7680	11.01	1.32	15.00	19.82	19.82	
513	CH 7680 : CH 7695	10.26	1.23	15.00	18.46	18.46	
514	CH 7695 : CH 7710	12.10	1.45	15.00	21.78	21.78	
515	CH 7710 : CH 7725	13.07	1.57	15.00	23.53	23.53	
516	CH 7725 : CH 7740	13.22	1.59	15.00	23.79	23.79	
517	CH 7740 : CH 7755	12.99	1.56	15.00	23.38	23.38	
518	CH 7755 : CH 7770	12.64	1.52	15.00	22.74	22.74	
519	CH 7770 : CH 7785	12.28	1.47	15.00	22.10	22.10	
520	CH 7785 : CH 7800	12.32	1.48	15.00	22.17	22.17	
521	CH 7800 : CH 7815	12.44	1.49	15.00	22.40	22.40	
522	CH 7815 : CH 7830	12.30	1.48	15.00	22.14	22.14	
523	CH 7830 : CH 7845	12.39	1.49	15.00	22.31	22.31	
524	CH 7845 : CH 7860	12.66	1.52	15.00	22.79	22.79	
525	CH 7860 : CH 7875	12.79	1.53	15.00	23.02	23.02	
526	CH 7875 : CH 7890	12.76	1.53	15.00	22.96	22.96	
527	CH 7890 : CH 7905	12.60	1.51	15.00	22.68	22.68	
528	CH 7905 : CH 7920	12.52	1.50	15.00	22.54	22.54	
529	CH 7920 : CH 7935	12.51	1.50	15.00	22.51	22.51	
530	CH 7935 : CH 7950	12.47	1.50	15.00	22.45	22.45	
531	CH 7950 : CH 7965	12.49	1.50	15.00	22.47	22.47	
532	CH 7965 : CH 7980	12.51	1.50	15.00	22.52	22.52	
533	CH 7980 : CH 7995	12.54	1.51	15.00	22.58	22.58	
534	CH 7995 : CH 8010	12.37	1.48	15.00	22.26	22.26	
535	CH 8010 : CH 8025	11.18	1.34	15.00	20.12	20.12	
536	CH 8025 : CH 8040	10.33	1.24	15.00	18.59	18.59	
537	CH 8040 : CH 8055	10.27	1.23	15.00	18.49	18.49	
538	CH 8055 : CH 8070	9.91	0.50	15.00	7.43	7.43	
539	CH 8070 : CH 8085	9.64	0.48	15.00	7.23	7.23	
540	CH 8085 : CH 8100	9.48	0.47	15.00	7.11	7.11	
541	CH 8100 : CH 8115	10.19	1.22	15.00	18.34	18.34	
542	CH 8115 : CH 8130	18.38	2.21	15.00	33.08	33.08	
543	CH 8130 : CH 8145	18.52	2.22	15.00	33.34	33.34	
544	CH 8145 : CH 8160	9.59	0.48	15.00	7.19	7.19	
545	CH 8160 : CH 8175	7.94	0.40	15.00	5.95	5.95	
546	CH 8175 : CH 8190	7.95	0.40	15.00	5.96	5.96	
547	CH 8190 : CH 8205	8.08	0.40	15.00	6.06	6.06	
548	CH 8205 : CH 8220	8.37	0.42	15.00	6.27	6.27	
549	CH 8220 : CH 8235	8.51	0.43	15.00	6.39	6.39	
550	CH 8235 : CH 8250	8.25	0.41	15.00	6.19	6.19	
551	CH 8250 : CH 8265	8.27	0.41	15.00	6.20	6.20	
552	CH 8265 : CH 8280	8.13	0.41	15.00	6.10	6.10	
553	CH 8280 : CH 8295	7.87	0.39	15.00	5.90	5.90	
554	CH 8295 : CH 8310	9.35	0.47	15.00	7.01	7.01	
555	CH 8310 : CH 8325	11.07	1.33	15.00	19.92	19.92	
556	CH 8325 : CH 8340	11.46	1.38	15.00	20.63	20.63	
557	CH 8340 : CH 8355	11.41	1.37	15.00	20.53	20.53	
558	CH 8355 : CH 8370	11.30	1.36	15.00	20.34	20.34	
559	CH 8370 : CH 8385	11.16	1.34	15.00	20.09	20.09	
560	CH 8385 : CH 8400	10.36	1.24	15.00	18.64	18.64	

Sl.No	Chainage	DETAILS					Remarks
		W (m)	Based on the concentration (W1)	L (m)	Area (L*W1)	Total Area (Sqm)	
561	CH 8400 : CH 8415	9.47	0.47	15.00	7.11	7.11	
562	CH 8415 : CH 8430	9.06	0.45	15.00	6.80	6.80	
563	CH 8430 : CH 8445	8.42	0.42	15.00	6.31	6.31	
564	CH 8445 : CH 8460	8.58	0.43	15.00	6.44	6.44	
565	CH 8460 : CH 8475	9.37	0.47	15.00	7.03	7.03	
566	CH 8475 : CH 8490	9.36	0.47	15.00	7.02	7.02	
567	CH 8490 : CH 8505	9.33	0.47	15.00	7.00	7.00	
568	CH 8505 : CH 8520	9.79	0.49	15.00	7.34	7.34	
569	CH 8520 : CH 8535	10.30	1.24	15.00	18.54	18.54	
570	CH 8535 : CH 8550	8.86	0.44	15.00	6.65	6.65	
571	CH 8550 : CH 8565	7.83	0.39	15.00	5.87	5.87	
572	CH 8565 : CH 8580	8.72	0.44	15.00	6.54	6.54	
573	CH 8580 : CH 8595	9.07	0.45	15.00	6.80	6.80	
574	CH 8595 : CH 8610	9.34	0.47	15.00	7.00	7.00	
575	CH 8610 : CH 8625	9.84	0.49	15.00	7.38	7.38	
576	CH 8625 : CH 8640	10.15	1.22	15.00	18.28	18.28	
577	CH 8640 : CH 8655	10.03	1.20	15.00	18.05	18.05	
578	CH 8655 : CH 8670	9.98	0.50	15.00	7.48	7.48	
579	CH 8670 : CH 8685	10.15	1.22	15.00	18.26	18.26	
580	CH 8685 : CH 8700	10.50	1.26	15.00	18.90	18.90	
581	CH 8700 : CH 8715	11.05	1.33	15.00	19.89	19.89	
582	CH 8715 : CH 8730	11.77	1.41	15.00	21.18	21.18	
583	CH 8730 : CH 8745	12.44	1.49	15.00	22.40	22.40	
584	CH 8745 : CH 8760	12.73	1.53	15.00	22.92	22.92	
585	CH 8760 : CH 8775	12.74	1.53	15.00	22.93	22.93	
586	CH 8775 : CH 8790	8.61	0.43	15.00	6.46	6.46	
587	CH 8790 : CH 8805	6.53	0.33	15.00	4.90	4.90	
588	CH 8805 : CH 8820	8.62	0.43	15.00	6.47	6.47	
589	CH 8820 : CH 8835	8.93	0.45	15.00	6.70	6.70	
590	CH 8835 : CH 8850	9.67	0.48	15.00	7.25	7.25	
591	CH 8850 : CH 8865	7.65	0.38	15.00	5.74	5.74	
592	CH 8865 : CH 8880	8.75	0.44	15.00	6.56	6.56	
593	CH 8880 : CH 8895	28.73	8.62	15.00	129.30	129.30	
594	CH 8895 : CH 8910	45.14	22.57	15.00	338.54	338.54	
595	CH 8910 : CH 8925	45.35	22.68	15.00	340.15	340.15	
596	CH 8925 : CH 8940	53.12	26.56	15.00	398.40	398.40	
597	CH 8940 : CH 8955	69.01	34.50	15.00	517.56	517.56	
598	CH 8955 : CH 8970	74.80	37.40	15.00	561.02	561.02	
599	CH 8970 : CH 8985	71.82	35.91	15.00	538.65	538.65	
600	CH 8985 : CH 9000	71.44	35.72	15.00	535.79	535.79	
601	CH 9000 : CH 9015	71.63	35.81	15.00	537.21	537.21	
602	CH 9015 : CH 9030	71.91	35.95	15.00	539.31	539.31	
603	CH 9030 : CH 9045	73.15	36.58	15.00	548.63	548.63	
604	CH 9045 : CH 9060	72.67	36.34	15.00	545.06	545.06	
605	CH 9060 : CH 9075	69.39	34.70	15.00	520.44	520.44	
606	CH 9075 : CH 9090	66.64	33.32	15.00	499.80	499.80	
607	CH 9090 : CH 9105	65.20	32.60	15.00	489.02	489.02	
608	CH 9105 : CH 9120	65.51	32.76	15.00	491.34	491.34	
609	CH 9120 : CH 9135	66.33	33.16	15.00	497.46	497.46	
610	CH 9135 : CH 9150	67.38	33.69	15.00	505.32	505.32	
611	CH 9150 : CH 9165	68.89	34.45	15.00	516.69	516.69	

Sl.No	Chainage	DETAILS					Remarks
		W (m)	Based on the concentration (W1)	L (m)	Area (L*W1)	Total Area (Sqm)	
612	CH 9165 : CH 9180	72.09	36.05	15.00	540.71	540.71	
613	CH 9180 : CH 9195	76.78	38.39	15.00	575.85	575.85	
614	CH 9195 : CH 9210	80.56	40.28	15.00	604.19	604.19	
615	CH 9210 : CH 9225	84.22	42.11	15.00	631.65	631.65	
616	CH 9225 : CH 9240	87.33	43.66	15.00	654.97	654.97	
617	CH 9240 : CH 9255	88.77	44.38	15.00	665.76	665.76	
618	CH 9255 : CH 9270	90.25	45.12	15.00	676.86	676.86	
619	CH 9270 : CH 9285	93.18	46.59	15.00	698.87	698.87	
620	CH 9285 : CH 9300	95.57	47.78	15.00	716.74	716.74	
621	CH 9300 : CH 9315	95.92	47.96	15.00	719.37	719.37	
622	CH 9315 : CH 9330	95.65	47.82	15.00	717.34	717.34	
623	CH 9330 : CH 9345	95.95	47.98	15.00	719.64	719.64	
624	CH 9345 : CH 9360	93.67	46.83	15.00	702.50	702.50	
625	CH 9360 : CH 9375	86.92	43.46	15.00	651.92	651.92	
626	CH 9375 : CH 9390	91.45	45.73	15.00	685.90	685.90	
627	CH 9390 : CH 9405	99.38	49.69	15.00	745.37	745.37	
628	CH 9405 : CH 9420	96.29	48.14	15.00	722.16	722.16	
629	CH 9420 : CH 9435	90.94	45.47	15.00	682.06	682.06	
630	CH 9435 : CH 9450	88.15	44.08	15.00	661.14	661.14	
631	CH 9450 : CH 9465	88.64	44.32	15.00	664.82	664.82	
632	CH 9465 : CH 9480	87.56	43.78	15.00	656.70	656.70	
633	CH 9480 : CH 9495	83.71	41.86	15.00	627.84	627.84	
634	CH 9495 : CH 9510	77.89	38.95	15.00	584.19	584.19	
635	CH 9510 : CH 9525	72.00	36.00	15.00	539.98	539.98	
636	CH 9525 : CH 9540	66.20	33.10	15.00	496.46	496.46	
637	CH 9540 : CH 9555	60.62	30.31	15.00	454.68	454.68	
638	CH 9555 : CH 9570	54.40	27.20	15.00	408.03	408.03	
639	CH 9570 : CH 9585	47.16	23.58	15.00	353.70	353.70	
640	CH 9585 : CH 9600	41.04	20.52	15.00	307.79	307.79	
641	CH 9600 : CH 9615	44.41	22.20	15.00	333.04	333.04	
642	CH 9615 : CH 9630	60.63	30.31	15.00	454.71	454.71	
643	CH 9630 : CH 9645	79.97	39.99	15.00	599.79	599.79	
644	CH 9645 : CH 9660	90.19	45.09	15.00	676.41	676.41	
645	CH 9660 : CH 9675	93.14	46.57	15.00	698.52	698.52	
646	CH 9675 : CH 9690	97.81	48.90	15.00	733.55	733.55	
647	CH 9690 : CH 9705	103.96	51.98	15.00	779.72	779.72	
648	CH 9705 : CH 9720	111.06	55.53	15.00	832.97	832.97	
649	CH 9720 : CH 9735	118.45	59.22	15.00	888.36	888.36	
650	CH 9735 : CH 9750	123.13	61.56	15.00	923.45	923.45	
651	CH 9750 : CH 9765	123.42	61.71	15.00	925.61	925.61	
652	CH 9765 : CH 9780	122.01	61.00	15.00	915.04	915.04	
653	CH 9780 : CH 9795	121.36	60.68	15.00	910.20	910.20	
654	CH 9795 : CH 9810	121.07	60.54	15.00	908.05	908.05	
655	CH 9810 : CH 9825	123.94	61.97	15.00	929.55	929.55	
656	CH 9825 : CH 9840	129.23	64.62	15.00	969.25	969.25	
657	CH 9840 : CH 9855	133.05	66.52	15.00	997.85	997.85	
658	CH 9855 : CH 9870	135.95	67.98	15.00	1019.65	1019.65	
659	CH 9870 : CH 9885	138.70	69.35	15.00	1040.22	1040.22	
660	CH 9885 : CH 9900	142.48	71.24	15.00	1068.59	1068.59	
661	CH 9900 : CH 9915	147.10	73.55	15.00	1103.28	1103.28	
662	CH 9915 : CH 9930	154.03	77.02	15.00	1155.24	1155.24	

Sl.No	Chainage	DETAILS					Remarks
		W (m)	Based on the concentration (W1)	L (m)	Area (L*W1)	Total Area (Sqm)	
663	CH 9930 : CH 9945	163.78	81.89	15.00	1228.34	1228.34	
664	CH 9945 : CH 9960	198.86	99.43	15.00	1491.47	1491.47	
665	CH 9960 : CH 9975	230.46	115.23	15.00	1728.45	1728.45	
666	CH 9975 : CH 9990	234.72	117.36	15.00	1760.40	1760.40	
667	CH 9990 : CH 10005	238.51	119.25	15.00	1788.79	1788.79	
668	CH 10005 : CH 10020	241.81	120.91	15.00	1813.60	1813.60	
669	CH 10020 : CH 10035	246.76	123.38	15.00	1850.67	1850.67	
670	CH 10035 : CH 10050	243.21	121.60	15.00	1824.05	1824.05	
671	CH 10050 : CH 10065	238.80	119.40	15.00	1790.98	1790.98	
672	CH 10065 : CH 10080	244.57	122.29	15.00	1834.29	1834.29	
673	CH 10080 : CH 10095	252.73	126.36	15.00	1895.46	1895.46	
674	CH 10095 : CH 10110	259.00	129.50	15.00	1942.49	1942.49	
675	CH 10110 : CH 10125	252.45	126.22	15.00	1893.35	1893.35	
676	CH 10125 : CH 10140	228.10	114.05	15.00	1710.74	1710.74	
677	CH 10140 : CH 10155	195.06	97.53	15.00	1462.97	1462.97	
678	CH 10155 : CH 10170	172.57	86.28	15.00	1294.24	1294.24	
679	CH 10170 : CH 10185	169.73	84.86	15.00	1272.97	1272.97	
680	CH 10185 : CH 10200	177.30	88.65	15.00	1329.74	1329.74	
681	CH 10200 : CH 10215	183.86	91.93	15.00	1378.98	1378.98	
682	CH 10215 : CH 10230	187.13	93.56	15.00	1403.47	1403.47	
683	CH 10230 : CH 10245	190.89	95.45	15.00	1431.71	1431.71	
684	CH 10245 : CH 10260	193.99	97.00	15.00	1454.94	1454.94	
685	CH 10260 : CH 10275	197.61	98.80	15.00	1482.07	1482.07	
686	CH 10275 : CH 10290	203.15	101.58	15.00	1523.63	1523.63	
687	CH 10290 : CH 10305	208.94	104.47	15.00	1567.02	1567.02	
688	CH 10305 : CH 10320	214.11	107.06	15.00	1605.84	1605.84	
689	CH 10320 : CH 10335	219.04	109.52	15.00	1642.77	1642.77	
690	CH 10335 : CH 10350	223.37	111.69	15.00	1675.30	1675.30	
691	CH 10350 : CH 10365	226.63	113.32	15.00	1699.76	1699.76	
692	CH 10365 : CH 10380	229.60	114.80	15.00	1722.03	1722.03	
693	CH 10380 : CH 10395	232.94	116.47	15.00	1747.02	1747.02	
694	CH 10395 : CH 10410	236.24	118.12	15.00	1771.83	1771.83	
695	CH 10410 : CH 10425	236.76	118.38	15.00	1775.71	1775.71	
696	CH 10425 : CH 10440	235.76	117.88	15.00	1768.19	1768.19	
697	CH 10440 : CH 10455	236.06	118.03	15.00	1770.41	1770.41	
698	CH 10455 : CH 10470	237.04	118.52	15.00	1777.80	1777.80	
699	CH 10470 : CH 10485	237.68	118.84	15.00	1782.61	1782.61	
700	CH 10485 : CH 10500	236.91	118.45	15.00	1776.80	1776.80	
701	CH 10500 : CH 10515	235.75	117.88	15.00	1768.14	1768.14	
702	CH 10515 : CH 10530	232.99	116.50	15.00	1747.43	1747.43	
703	CH 10530 : CH 10545	229.15	114.57	15.00	1718.61	1718.61	
704	CH 10545 : CH 10560	225.20	112.60	15.00	1688.99	1688.99	
705	CH 10560 : CH 10575	219.98	109.99	15.00	1649.81	1649.81	
706	CH 10575 : CH 10590	219.61	109.80	15.00	1647.04	1647.04	
707	CH 10590 : CH 10605	222.04	111.02	15.00	1665.33	1665.33	
708	CH 10605 : CH 10620	223.67	111.83	15.00	1677.51	1677.51	
709	CH 10620 : CH 10635	227.85	113.93	15.00	1708.88	1708.88	
710	CH 10635 : CH 10650	232.74	116.37	15.00	1745.57	1745.57	
711	CH 10650 : CH 10665	238.00	119.00	15.00	1784.99	1784.99	
712	CH 10665 : CH 10680	241.35	120.67	15.00	1810.10	1810.10	
713	CH 10680 : CH 10695	240.98	120.49	15.00	1807.33	1807.33	

Sl.No	Chainage	DETAILS					Remarks
		W (m)	Based on the concentration (W1)	L (m)	Area (L*W1)	Total Area (Sqm)	
714	CH 10695 : CH 10710	239.69	119.84	15.00	1797.66	1797.66	
715	CH 10710 : CH 10725	239.54	119.77	15.00	1796.53	1796.53	
716	CH 10725 : CH 10740	240.78	120.39	15.00	1805.85	1805.85	
717	CH 10740 : CH 10755	242.50	121.25	15.00	1818.74	1818.74	
718	CH 10755 : CH 10770	244.55	122.27	15.00	1834.11	1834.11	
719	CH 10770 : CH 10785	246.84	123.42	15.00	1851.30	1851.30	
720	CH 10785 : CH 10800	246.99	123.50	15.00	1852.45	1852.45	
721	CH 10800 : CH 10815	248.20	124.10	15.00	1861.52	1861.52	
722	CH 10815 : CH 10830	254.53	127.27	15.00	1908.99	1908.99	
723	CH 10830 : CH 10845	260.70	130.35	15.00	1955.27	1955.27	
724	CH 10845 : CH 10860	265.08	132.54	15.00	1988.12	1988.12	
725	CH 10860 : CH 10875	269.72	134.86	15.00	2022.92	2022.92	
726	CH 10875 : CH 10890	274.46	137.23	15.00	2058.41	2058.41	
727	CH 10890 : CH 10905	279.27	139.63	15.00	2094.51	2094.51	
728	CH 10905 : CH 10920	284.08	142.04	15.00	2130.63	2130.63	
729	CH 10920 : CH 10935	288.46	144.23	15.00	2163.41	2163.41	
730	CH 10935 : CH 10950	292.25	146.12	15.00	2191.85	2191.85	
731	CH 10950 : CH 10965	295.09	147.55	15.00	2213.18	2213.18	
732	CH 10965 : CH 10980	295.35	147.67	15.00	2215.09	2215.09	
733	CH 10980 : CH 10995	297.21	148.61	15.00	2229.10	2229.10	
734	CH 10995 : CH 11010	302.48	151.24	15.00	2268.63	2268.63	
735	CH 11010 : CH 11025	306.20	153.10	15.00	2296.53	2296.53	
736	CH 11025 : CH 11040	306.73	153.36	15.00	2300.44	2300.44	
737	CH 11040 : CH 11055	305.64	152.82	15.00	2292.29	2292.29	
738	CH 11055 : CH 11070	302.00	151.00	15.00	2265.00	2265.00	
739	CH 11070 : CH 11085	294.68	147.34	15.00	2210.08	2210.08	
740	CH 11085 : CH 11100	288.17	144.08	15.00	2161.26	2161.26	
741	CH 11100 : CH 11115	285.42	142.71	15.00	2140.68	2140.68	
742	CH 11115 : CH 11130	284.35	142.17	15.00	2132.60	2132.60	
743	CH 11130 : CH 11145	159.74	79.87	15.00	1198.05	1198.05	
744	CH 11145 : CH 11150	33.88	16.94	5.00	84.69	84.69	
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Sl.No	Chainage	DETAILS					Remarks
		W (m)	Based on the concentration (W1)	L (m)	Area (L*W1)	Total Area (Sqm)	
1	CH 000 : CH 15	49.64	24.82	15.00	372.27	372.27	
2	CH 15 : CH 30	67.29	33.64	15.00	504.65	504.65	
3	CH 30 : CH 45	63.85	31.93	15.00	478.89	478.89	
4	CH 45 : CH 60	57.70	28.85	15.00	432.77	432.77	
5	CH 60 : CH 75	52.65	26.32	15.00	394.87	394.87	
6	CH 75 : CH 90	49.83	24.92	15.00	373.73	373.73	
7	CH 90 : CH 105	48.31	24.15	15.00	362.30	362.30	
8	CH 105 : CH 120	47.62	23.81	15.00	357.17	357.17	
9	CH 120 : CH 135	43.39	21.69	15.00	325.40	325.40	
10	CH 135 : CH 150	38.44	19.22	15.00	288.31	288.31	
11	CH 150 : CH 165	36.98	18.49	15.00	277.33	277.33	
12	CH 165 : CH 180	35.17	17.59	15.00	263.78	263.78	
13	CH 180 : CH 195	33.52	16.76	15.00	251.36	251.36	
14	CH 195 : CH 210	36.25	18.13	15.00	271.89	271.89	
15	CH 210 : CH 225	46.33	23.16	15.00	347.46	347.46	
16	CH 225 : CH 240	55.63	27.81	15.00	417.21	417.21	
17	CH 240 : CH 255	62.79	31.40	15.00	470.96	470.96	
18	CH 255 : CH 270	73.51	36.76	15.00	551.35	551.35	
19	CH 270 : CH 285	86.06	43.03	15.00	645.42	645.42	
20	CH 285 : CH 300	98.84	49.42	15.00	741.27	741.27	
21	CH 300 : CH 315	109.87	54.94	15.00	824.03	824.03	
22	CH 315 : CH 330	113.68	56.84	15.00	852.58	852.58	
23	CH 330 : CH 345	109.67	54.84	15.00	822.53	822.53	
24	CH 345 : CH 360	106.69	53.35	15.00	800.18	800.18	
25	CH 360 : CH 375	107.16	53.58	15.00	803.69	803.69	
26	CH 375 : CH 390	104.83	52.41	15.00	786.19	786.19	
27	CH 390 : CH 405	98.31	49.16	15.00	737.36	737.36	
28	CH 405 : CH 420	90.38	45.19	15.00	677.81	677.81	
29	CH 420 : CH 435	81.42	40.71	15.00	610.65	610.65	
30	CH 435 : CH 450	72.15	36.08	15.00	541.13	541.13	
31	CH 450 : CH 465	66.10	33.05	15.00	495.76	495.76	
32	CH 465 : CH 480	64.27	32.14	15.00	482.03	482.03	
33	CH 480 : CH 495	64.04	32.02	15.00	480.33	480.33	
34	CH 495 : CH 510	67.15	33.58	15.00	503.66	503.66	
35	CH 510 : CH 525	73.19	36.60	15.00	548.95	548.95	
36	CH 525 : CH 540	77.83	38.92	15.00	583.74	583.74	
37	CH 540 : CH 555	79.66	39.83	15.00	597.42	597.42	
38	CH 555 : CH 570	79.01	39.50	15.00	592.55	592.55	
39	CH 570 : CH 585	78.36	39.18	15.00	587.72	587.72	
40	CH 585 : CH 600	78.61	39.31	15.00	589.60	589.60	
41	CH 600 : CH 615	77.12	38.56	15.00	578.39	578.39	
42	CH 615 : CH 630	73.65	36.82	15.00	552.34	552.34	
43	CH 630 : CH 645	70.01	35.00	15.00	525.06	525.06	
44	CH 645 : CH 660	66.41	33.21	15.00	498.08	498.08	
45	CH 660 : CH 675	62.88	31.44	15.00	471.57	471.57	
46	CH 675 : CH 690	59.83	29.91	15.00	448.71	448.71	
47	CH 690 : CH 705	57.50	28.75	15.00	431.24	431.24	
48	CH 705 : CH 720	55.50	27.75	15.00	416.24	416.24	
49	CH 720 : CH 735	54.08	27.04	15.00	405.57	405.57	

Sl.No	Chainage	DETAILS					Remarks
		W (m)	Based on the concentration (W1)	L (m)	Area (L*W1)	Total Area (Sqm)	
50	CH 735 : CH 750	53.12	26.56	15.00	398.39	398.39	
51	CH 750 : CH 765	52.41	26.21	15.00	393.11	393.11	
52	CH 765 : CH 780	51.56	25.78	15.00	386.72	386.72	
53	CH 780 : CH 795	50.62	25.31	15.00	379.65	379.65	
54	CH 795 : CH 810	51.18	25.59	15.00	383.88	383.88	
55	CH 810 : CH 825	52.09	26.05	15.00	390.68	390.68	
56	CH 825 : CH 840	53.17	26.59	15.00	398.79	398.79	
57	CH 840 : CH 855	55.46	27.73	15.00	415.95	415.95	
58	CH 855 : CH 870	56.63	28.31	15.00	424.72	424.72	
59	CH 870 : CH 885	53.95	26.98	15.00	404.63	404.63	
60	CH 885 : CH 900	49.03	24.52	15.00	367.76	367.76	
61	CH 900 : CH 915	46.52	23.26	15.00	348.89	348.89	
62	CH 915 : CH 930	46.11	23.05	15.00	345.80	345.80	
63	CH 930 : CH 945	46.65	23.32	15.00	349.86	349.86	
64	CH 945 : CH 960	48.58	24.29	15.00	364.35	364.35	
65	CH 960 : CH 975	50.96	25.48	15.00	382.19	382.19	
66	CH 975 : CH 990	52.46	26.23	15.00	393.42	393.42	
67	CH 990 : CH 1005	50.16	25.08	15.00	376.22	376.22	
68	CH 1005 : CH 1020	44.43	22.22	15.00	333.24	333.24	
69	CH 1020 : CH 1035	38.40	19.20	15.00	287.97	287.97	
70	CH 1035 : CH 1050	33.03	16.51	15.00	247.71	247.71	
71	CH 1050 : CH 1065	30.48	15.24	15.00	228.62	228.62	
72	CH 1065 : CH 1080	30.96	15.48	15.00	232.21	232.21	
73	CH 1080 : CH 1095	32.70	16.35	15.00	245.28	245.28	
74	CH 1095 : CH 1110	32.71	16.36	15.00	245.34	245.34	
75	CH 1110 : CH 1125	30.89	15.44	15.00	231.65	231.65	
76	CH 1125 : CH 1140	32.77	16.39	15.00	245.79	245.79	
77	CH 1140 : CH 1155	40.75	20.38	15.00	305.64	305.64	
78	CH 1155 : CH 1170	51.71	25.86	15.00	387.85	387.85	
79	CH 1170 : CH 1185	50.89	25.45	15.00	381.68	381.68	
80	CH 1185 : CH 1200	48.79	24.40	15.00	365.94	365.94	
81	CH 1200 : CH 1215	46.78	23.39	15.00	350.87	350.87	
82	CH 1215 : CH 1230	48.69	24.35	15.00	365.18	365.18	
83	CH 1230 : CH 1245	54.07	27.04	15.00	405.53	405.53	
84	CH 1245 : CH 1260	52.96	26.48	15.00	397.23	397.23	
85	CH 1260 : CH 1275	48.49	24.24	15.00	363.67	363.67	
86	CH 1275 : CH 1290	47.96	23.98	15.00	359.73	359.73	
87	CH 1290 : CH 1305	46.97	23.49	15.00	352.30	352.30	
88	CH 1305 : CH 1320	43.56	21.78	15.00	326.72	326.72	
89	CH 1320 : CH 1335	38.81	19.40	15.00	291.07	291.07	
90	CH 1335 : CH 1350	35.28	17.64	15.00	264.59	264.59	
91	CH 1350 : CH 1365	34.34	17.17	15.00	257.58	257.58	
92	CH 1365 : CH 1380	35.27	17.63	15.00	264.50	264.50	
93	CH 1380 : CH 1395	37.43	18.72	15.00	280.74	280.74	
94	CH 1395 : CH 1410	39.73	19.86	15.00	297.96	297.96	
95	CH 1410 : CH 1425	43.49	21.74	15.00	326.16	326.16	
96	CH 1425 : CH 1440	47.15	23.58	15.00	353.65	353.65	
97	CH 1440 : CH 1455	47.41	23.71	15.00	355.58	355.58	
98	CH 1455 : CH 1470	46.41	23.20	15.00	348.07	348.07	
99	CH 1470 : CH 1485	46.61	23.30	15.00	349.55	349.55	

Sl.No	Chainage	DETAILS					Remarks
		W (m)	Based on the concentration (W1)	L (m)	Area (L*W1)	Total Area (Sqm)	
100	CH 1485 : CH 1500	44.93	22.46	15.00	336.96	336.96	
101	CH 1500 : CH 1515	41.49	20.74	15.00	311.14	311.14	
102	CH 1515 : CH 1530	38.64	19.32	15.00	289.81	289.81	
103	CH 1530 : CH 1545	37.07	18.54	15.00	278.03	278.03	
104	CH 1545 : CH 1560	36.63	18.31	15.00	274.71	274.71	
105	CH 1560 : CH 1575	37.92	18.96	15.00	284.40	284.40	
106	CH 1575 : CH 1590	43.09	21.55	15.00	323.19	323.19	
107	CH 1590 : CH 1605	49.65	24.82	15.00	372.36	372.36	
108	CH 1605 : CH 1620	55.08	27.54	15.00	413.10	413.10	
109	CH 1620 : CH 1635	58.37	29.19	15.00	437.78	437.78	
110	CH 1635 : CH 1650	61.14	30.57	15.00	458.52	458.52	
111	CH 1650 : CH 1665	63.94	31.97	15.00	479.54	479.54	
112	CH 1665 : CH 1680	68.79	34.39	15.00	515.90	515.90	
113	CH 1680 : CH 1695	61.02	30.51	15.00	457.64	457.64	
114	CH 1695 : CH 1710	44.40	22.20	15.00	333.00	333.00	
115	CH 1710 : CH 1725	36.59	18.30	15.00	274.44	274.44	
116	CH 1725 : CH 1740	37.16	18.58	15.00	278.67	278.67	
117	CH 1740 : CH 1755	41.08	20.54	15.00	308.09	308.09	
118	CH 1755 : CH 1770	40.13	20.07	15.00	300.98	300.98	
119	CH 1770 : CH 1785	37.59	18.79	15.00	281.92	281.92	
120	CH 1785 : CH 1800	35.84	17.92	15.00	268.82	268.82	
121	CH 1800 : CH 1815	34.47	17.23	15.00	258.51	258.51	
122	CH 1815 : CH 1830	32.99	16.49	15.00	247.40	247.40	
123	CH 1830 : CH 1845	31.47	15.73	15.00	236.00	236.00	
124	CH 1845 : CH 1860	31.81	15.91	15.00	238.58	238.58	
125	CH 1860 : CH 1875	35.01	17.50	15.00	262.55	262.55	
126	CH 1875 : CH 1890	35.93	17.97	15.00	269.49	269.49	
127	CH 1890 : CH 1905	33.44	16.72	15.00	250.77	250.77	
128	CH 1905 : CH 1920	30.48	15.24	15.00	228.60	228.60	
129	CH 1920 : CH 1935	31.32	15.66	15.00	234.88	234.88	
130	CH 1935 : CH 1950	30.50	15.25	15.00	228.72	228.72	
131	CH 1950 : CH 1965	28.17	8.45	15.00	126.77	126.77	
132	CH 1965 : CH 1980	26.90	8.07	15.00	121.03	121.03	
133	CH 1980 : CH 1995	27.24	8.17	15.00	122.56	122.56	
134	CH 1995 : CH 2010	28.34	8.50	15.00	127.53	127.53	
135	CH 2010 : CH 2025	30.92	15.46	15.00	231.91	231.91	
136	CH 2025 : CH 2040	33.02	16.51	15.00	247.62	247.62	
137	CH 2040 : CH 2055	34.40	17.20	15.00	257.98	257.98	
138	CH 2055 : CH 2070	26.62	7.99	15.00	119.78	119.78	
139	CH 2070 : CH 2085	17.45	2.09	15.00	31.40	31.40	
140	CH 2085 : CH 2100	15.99	1.92	15.00	28.78	28.78	
141	CH 2100 : CH 2115	13.84	1.66	15.00	24.91	24.91	
142	CH 2115 : CH 2130	14.41	1.73	15.00	25.94	25.94	
143	CH 2130 : CH 2145	16.70	2.00	15.00	30.06	30.06	
144	CH 2145 : CH 2160	18.19	2.18	15.00	32.74	32.74	
145	CH 2160 : CH 2175	17.97	2.16	15.00	32.35	32.35	
146	CH 2175 : CH 2190	18.25	2.19	15.00	32.85	32.85	
147	CH 2190 : CH 2205	20.54	6.16	15.00	92.45	92.45	
148	CH 2205 : CH 2220	22.24	6.67	15.00	100.09	100.09	
149	CH 2220 : CH 2235	21.06	6.32	15.00	94.79	94.79	

Sl.No	Chainage	DETAILS					Remarks
		W (m)	Based on the concentration (W1)	L (m)	Area (L*W1)	Total Area (Sqm)	
150	CH 2235 : CH 2250	19.49	2.34	15.00	35.08	35.08	
151	CH 2250 : CH 2265	19.48	2.34	15.00	35.07	35.07	
152	CH 2265 : CH 2280	19.57	2.35	15.00	35.23	35.23	
153	CH 2280 : CH 2295	20.15	6.04	15.00	90.66	90.66	
154	CH 2295 : CH 2310	20.92	6.28	15.00	94.15	94.15	
155	CH 2310 : CH 2325	20.63	6.19	15.00	92.82	92.82	
156	CH 2325 : CH 2340	19.52	2.34	15.00	35.14	35.14	
157	CH 2340 : CH 2355	19.97	2.40	15.00	35.94	35.94	
158	CH 2355 : CH 2370	19.18	2.30	15.00	34.52	34.52	
159	CH 2370 : CH 2385	19.19	2.30	15.00	34.54	34.54	
160	CH 2385 : CH 2400	20.16	6.05	15.00	90.74	90.74	
161	CH 2400 : CH 2415	21.30	6.39	15.00	95.83	95.83	
162	CH 2415 : CH 2430	21.78	6.53	15.00	97.99	97.99	
163	CH 2430 : CH 2445	24.21	7.26	15.00	108.96	108.96	
164	CH 2445 : CH 2460	24.24	7.27	15.00	109.06	109.06	
165	CH 2460 : CH 2475	24.63	7.39	15.00	110.85	110.85	
166	CH 2475 : CH 2490	25.04	7.51	15.00	112.66	112.66	
167	CH 2490 : CH 2505	26.38	7.91	15.00	118.71	118.71	
168	CH 2505 : CH 2520	22.74	6.82	15.00	102.32	102.32	
169	CH 2520 : CH 2535	20.67	6.20	15.00	93.01	93.01	
170	CH 2535 : CH 2550	33.90	16.95	15.00	254.28	254.28	
171	CH 2550 : CH 2565	36.13	18.07	15.00	270.99	270.99	
172	CH 2565 : CH 2580	21.77	6.53	15.00	97.98	97.98	
173	CH 2580 : CH 2595	20.64	6.19	15.00	92.88	92.88	
174	CH 2595 : CH 2610	17.20	2.06	15.00	30.97	30.97	
175	CH 2610 : CH 2625	14.10	1.69	15.00	25.38	25.38	
176	CH 2625 : CH 2640	14.42	1.73	15.00	25.96	25.96	
177	CH 2640 : CH 2655	14.15	1.70	15.00	25.48	25.48	
178	CH 2655 : CH 2670	12.54	1.51	15.00	22.58	22.58	
179	CH 2670 : CH 2685	13.24	1.59	15.00	23.84	23.84	
180	CH 2685 : CH 2700	16.24	1.95	15.00	29.23	29.23	
181	CH 2700 : CH 2715	18.29	2.20	15.00	32.93	32.93	
182	CH 2715 : CH 2730	18.42	2.21	15.00	33.16	33.16	
183	CH 2730 : CH 2745	13.35	1.60	15.00	24.03	24.03	
184	CH 2745 : CH 2760	11.23	1.35	15.00	20.21	20.21	
185	CH 2760 : CH 2775	10.75	1.29	15.00	19.35	19.35	
186	CH 2775 : CH 2790	10.46	1.26	15.00	18.83	18.83	
187	CH 2790 : CH 2805	11.35	1.36	15.00	20.42	20.42	
188	CH 2805 : CH 2820	15.09	1.81	15.00	27.17	27.17	
189	CH 2820 : CH 2835	13.82	1.66	15.00	24.87	24.87	
190	CH 2835 : CH 2850	17.00	2.04	15.00	30.59	30.59	
191	CH 2850 : CH 2865	17.90	2.15	15.00	32.22	32.22	
192	CH 2865 : CH 2880	13.81	1.66	15.00	24.86	24.86	
193	CH 2880 : CH 2895	12.70	1.52	15.00	22.86	22.86	
194	CH 2895 : CH 2910	12.46	1.49	15.00	22.42	22.42	
195	CH 2910 : CH 2925	11.13	1.34	15.00	20.04	20.04	
196	CH 2925 : CH 2940	10.80	1.30	15.00	19.44	19.44	
197	CH 2940 : CH 2955	8.95	0.45	15.00	6.71	6.71	
198	CH 2955 : CH 2970	8.11	0.41	15.00	6.08	6.08	
199	CH 2970 : CH 2985	10.54	1.26	15.00	18.97	18.97	

Sl.No	Chainage	DETAILS					Remarks
		W (m)	Based on the concentration (W1)	L (m)	Area (L*W1)	Total Area (Sqm)	
200	CH 2985 : CH 3000	11.87	1.42	15.00	21.37	21.37	
201	CH 3000 : CH 3015	11.69	1.40	15.00	21.04	21.04	
202	CH 3015 : CH 3030	12.20	1.46	15.00	21.97	21.97	
203	CH 3030 : CH 3045	12.44	1.49	15.00	22.40	22.40	
204	CH 3045 : CH 3060	14.43	1.73	15.00	25.97	25.97	
205	CH 3060 : CH 3075	15.53	1.86	15.00	27.95	27.95	
206	CH 3075 : CH 3090	16.30	1.96	15.00	29.34	29.34	
207	CH 3090 : CH 3105	16.29	1.96	15.00	29.33	29.33	
208	CH 3105 : CH 3120	11.86	1.42	15.00	21.35	21.35	
209	CH 3120 : CH 3135	9.40	0.47	15.00	7.05	7.05	
210	CH 3135 : CH 3150	8.63	0.43	15.00	6.47	6.47	
211	CH 3150 : CH 3165	9.64	0.48	15.00	7.23	7.23	
212	CH 3165 : CH 3180	10.29	1.23	15.00	18.52	18.52	
213	CH 3180 : CH 3195	8.90	0.44	15.00	6.67	6.67	
214	CH 3195 : CH 3210	8.93	0.45	15.00	6.70	6.70	
215	CH 3210 : CH 3225	8.55	0.43	15.00	6.41	6.41	
216	CH 3225 : CH 3240	7.96	0.40	15.00	5.97	5.97	
217	CH 3240 : CH 3255	7.92	0.40	15.00	5.94	5.94	
218	CH 3255 : CH 3270	8.01	0.40	15.00	6.01	6.01	
219	CH 3270 : CH 3285	7.70	0.39	15.00	5.78	5.78	
220	CH 3285 : CH 3300	6.79	0.34	15.00	5.09	5.09	
221	CH 3300 : CH 3315	7.86	0.39	15.00	5.89	5.89	
222	CH 3315 : CH 3330	8.35	0.42	15.00	6.26	6.26	
223	CH 3330 : CH 3345	6.90	0.34	15.00	5.17	5.17	
224	CH 3345 : CH 3360	6.85	0.34	15.00	5.14	5.14	
225	CH 3360 : CH 3375	6.61	0.33	15.00	4.96	4.96	
226	CH 3375 : CH 3390	6.40	0.32	15.00	4.80	4.80	
227	CH 3390 : CH 3405	5.60	0.28	15.00	4.20	4.20	
228	CH 3405 : CH 3420	5.04	0.25	15.00	3.78	3.78	
229	CH 3420 : CH 3435	5.42	0.27	15.00	4.06	4.06	
230	CH 3435 : CH 3450	6.34	0.32	15.00	4.76	4.76	
231	CH 3450 : CH 3465	7.51	0.38	15.00	5.63	5.63	
232	CH 3465 : CH 3480	7.82	0.39	15.00	5.86	5.86	
233	CH 3480 : CH 3495	6.36	0.32	15.00	4.77	4.77	
234	CH 3495 : CH 3510	6.82	0.34	15.00	5.11	5.11	
235	CH 3510 : CH 3525	7.63	0.38	15.00	5.73	5.73	
236	CH 3525 : CH 3540	8.91	0.45	15.00	6.68	6.68	
237	CH 3540 : CH 3555	10.01	1.20	15.00	18.01	18.01	
238	CH 3555 : CH 3570	10.07	1.21	15.00	18.12	18.12	
239	CH 3570 : CH 3585	9.53	0.48	15.00	7.15	7.15	
240	CH 3585 : CH 3600	9.22	0.46	15.00	6.91	6.91	
241	CH 3600 : CH 3615	8.78	0.44	15.00	6.59	6.59	
242	CH 3615 : CH 3630	7.96	0.40	15.00	5.97	5.97	
243	CH 3630 : CH 3645	7.05	0.35	15.00	5.29	5.29	
244	CH 3645 : CH 3660	6.82	0.34	15.00	5.12	5.12	
245	CH 3660 : CH 3675	7.51	0.38	15.00	5.63	5.63	
246	CH 3675 : CH 3690	7.99	0.40	15.00	5.99	5.99	
247	CH 3690 : CH 3705	7.06	0.35	15.00	5.30	5.30	
248	CH 3705 : CH 3720	6.19	0.31	15.00	4.65	4.65	
249	CH 3720 : CH 3735	6.60	0.33	15.00	4.95	4.95	

Sl.No	Chainage	DETAILS					Remarks
		W (m)	Based on the concentration (W1)	L (m)	Area (L*W1)	Total Area (Sqm)	
250	CH 3735 : CH 3750	6.98	0.35	15.00	5.24	5.24	
251	CH 3750 : CH 3765	7.68	0.38	15.00	5.76	5.76	
252	CH 3765 : CH 3780	8.26	0.41	15.00	6.20	6.20	
253	CH 3780 : CH 3795	8.34	0.42	15.00	6.25	6.25	
254	CH 3795 : CH 3810	7.35	0.37	15.00	5.51	5.51	
255	CH 3810 : CH 3825	6.21	0.31	15.00	4.65	4.65	
256	CH 3825 : CH 3840	6.13	0.31	15.00	4.60	4.60	
257	CH 3840 : CH 3855	6.24	0.31	15.00	4.68	4.68	
258	CH 3855 : CH 3870	6.49	0.32	15.00	4.87	4.87	
259	CH 3870 : CH 3885	6.84	0.34	15.00	5.13	5.13	
260	CH 3885 : CH 3900	6.53	0.33	15.00	4.90	4.90	
261	CH 3900 : CH 3915	5.76	0.29	15.00	4.32	4.32	
262	CH 3915 : CH 3930	5.23	0.26	15.00	3.92	3.92	
263	CH 3930 : CH 3945	4.94	0.25	15.00	3.71	3.71	
264	CH 3945 : CH 3960	4.79	0.24	15.00	3.59	3.59	
265	CH 3960 : CH 3975	4.73	0.24	15.00	3.54	3.54	
266	CH 3975 : CH 3990	4.95	0.25	15.00	3.71	3.71	
267	CH 3990 : CH 4005	6.25	0.31	15.00	4.69	4.69	
268	CH 4005 : CH 4020	7.09	0.35	15.00	5.32	5.32	
269	CH 4020 : CH 4035	6.39	0.32	15.00	4.80	4.80	
270	CH 4035 : CH 4050	5.85	0.29	15.00	4.39	4.39	
271	CH 4050 : CH 4065	5.62	0.28	15.00	4.21	4.21	
272	CH 4065 : CH 4080	5.54	0.28	15.00	4.16	4.16	
273	CH 4080 : CH 4095	6.06	0.30	15.00	4.54	4.54	
274	CH 4095 : CH 4110	6.64	0.33	15.00	4.98	4.98	
275	CH 4110 : CH 4125	6.70	0.34	15.00	5.03	5.03	
276	CH 4125 : CH 4140	6.18	0.31	15.00	4.64	4.64	
277	CH 4140 : CH 4155	5.74	0.29	15.00	4.31	4.31	
278	CH 4155 : CH 4170	6.47	0.32	15.00	4.85	4.85	
279	CH 4170 : CH 4185	7.07	0.35	15.00	5.30	5.30	
280	CH 4185 : CH 4200	6.89	0.34	15.00	5.17	5.17	
281	CH 4200 : CH 4215	6.40	0.32	15.00	4.80	4.80	
282	CH 4215 : CH 4230	6.21	0.31	15.00	4.66	4.66	
283	CH 4230 : CH 4245	6.51	0.33	15.00	4.88	4.88	
284	CH 4245 : CH 4260	6.77	0.34	15.00	5.08	5.08	
285	CH 4260 : CH 4275	6.28	0.31	15.00	4.71	4.71	
286	CH 4275 : CH 4290	5.95	0.30	15.00	4.46	4.46	
287	CH 4290 : CH 4305	7.31	0.37	15.00	5.48	5.48	
288	CH 4305 : CH 4320	7.41	0.37	15.00	5.56	5.56	
289	CH 4320 : CH 4335	7.03	0.35	15.00	5.28	5.28	
290	CH 4335 : CH 4350	6.06	0.30	15.00	4.55	4.55	
291	CH 4350 : CH 4365	6.08	0.30	15.00	4.56	4.56	
292	CH 4365 : CH 4380	7.09	0.35	15.00	5.32	5.32	
293	CH 4380 : CH 4395	8.15	0.41	15.00	6.11	6.11	
294	CH 4395 : CH 4410	8.85	0.44	15.00	6.63	6.63	
295	CH 4410 : CH 4425	9.32	0.47	15.00	6.99	6.99	
296	CH 4425 : CH 4440	9.21	0.46	15.00	6.90	6.90	
297	CH 4440 : CH 4455	8.80	0.44	15.00	6.60	6.60	
298	CH 4455 : CH 4470	8.52	0.43	15.00	6.39	6.39	
299	CH 4470 : CH 4485	8.68	0.43	15.00	6.51	6.51	

Sl.No	Chainage	DETAILS					Remarks
		W (m)	Based on the concentration (W1)	L (m)	Area (L*W1)	Total Area (Sqm)	
300	CH 4485 : CH 4500	8.89	0.44	15.00	6.66	6.66	
301	CH 4500 : CH 4515	8.72	0.44	15.00	6.54	6.54	
302	CH 4515 : CH 4530	8.86	0.44	15.00	6.64	6.64	
303	CH 4530 : CH 4545	8.92	0.45	15.00	6.69	6.69	
304	CH 4545 : CH 4560	8.63	0.43	15.00	6.47	6.47	
305	CH 4560 : CH 4575	8.33	0.42	15.00	6.25	6.25	
306	CH 4575 : CH 4590	8.01	0.40	15.00	6.01	6.01	
307	CH 4590 : CH 4605	7.96	0.40	15.00	5.97	5.97	
308	CH 4605 : CH 4620	8.10	0.40	15.00	6.07	6.07	
309	CH 4620 : CH 4635	7.62	0.38	15.00	5.71	5.71	
310	CH 4635 : CH 4650	6.93	0.35	15.00	5.20	5.20	
311	CH 4650 : CH 4665	7.22	0.36	15.00	5.42	5.42	
312	CH 4665 : CH 4680	7.60	0.38	15.00	5.70	5.70	
313	CH 4680 : CH 4695	7.38	0.37	15.00	5.54	5.54	
314	CH 4695 : CH 4710	7.13	0.36	15.00	5.35	5.35	
315	CH 4710 : CH 4725	7.18	0.36	15.00	5.38	5.38	
316	CH 4725 : CH 4740	7.57	0.38	15.00	5.68	5.68	
317	CH 4740 : CH 4755	7.60	0.38	15.00	5.70	5.70	
318	CH 4755 : CH 4770	7.25	0.36	15.00	5.44	5.44	
319	CH 4770 : CH 4785	6.95	0.35	15.00	5.21	5.21	
320	CH 4785 : CH 4800	6.48	0.32	15.00	4.86	4.86	
321	CH 4800 : CH 4815	6.32	0.32	15.00	4.74	4.74	
322	CH 4815 : CH 4830	6.78	0.34	15.00	5.08	5.08	
323	CH 4830 : CH 4845	6.65	0.33	15.00	4.99	4.99	
324	CH 4845 : CH 4860	6.38	0.32	15.00	4.78	4.78	
325	CH 4860 : CH 4875	6.80	0.34	15.00	5.10	5.10	
326	CH 4875 : CH 4890	7.16	0.36	15.00	5.37	5.37	
327	CH 4890 : CH 4905	7.34	0.37	15.00	5.50	5.50	
328	CH 4905 : CH 4920	7.17	0.36	15.00	5.37	5.37	
329	CH 4920 : CH 4935	6.69	0.33	15.00	5.02	5.02	
330	CH 4935 : CH 4950	6.57	0.33	15.00	4.92	4.92	
331	CH 4950 : CH 4965	7.34	0.37	15.00	5.50	5.50	
332	CH 4965 : CH 4980	8.00	0.40	15.00	6.00	6.00	
333	CH 4980 : CH 4995	8.14	0.41	15.00	6.10	6.10	
334	CH 4995 : CH 5010	8.36	0.42	15.00	6.27	6.27	
335	CH 5010 : CH 5025	8.61	0.43	15.00	6.45	6.45	
336	CH 5025 : CH 5040	8.80	0.44	15.00	6.60	6.60	
337	CH 5040 : CH 5055	8.94	0.45	15.00	6.71	6.71	
338	CH 5055 : CH 5070	9.11	0.46	15.00	6.83	6.83	
339	CH 5070 : CH 5085	9.24	0.46	15.00	6.93	6.93	
340	CH 5085 : CH 5100	9.38	0.47	15.00	7.04	7.04	
341	CH 5100 : CH 5115	9.41	0.47	15.00	7.05	7.05	
342	CH 5115 : CH 5130	9.30	0.46	15.00	6.97	6.97	
343	CH 5130 : CH 5145	9.19	0.46	15.00	6.89	6.89	
344	CH 5145 : CH 5160	9.20	0.46	15.00	6.90	6.90	
345	CH 5160 : CH 5175	9.34	0.47	15.00	7.00	7.00	
346	CH 5175 : CH 5190	9.51	0.48	15.00	7.13	7.13	
347	CH 5190 : CH 5205	9.61	0.48	15.00	7.20	7.20	
348	CH 5205 : CH 5220	8.09	0.40	15.00	6.06	6.06	
349	CH 5220 : CH 5235	6.72	0.34	15.00	5.04	5.04	

Sl.No	Chainage	DETAILS					Remarks
		W (m)	Based on the concentration (W1)	L (m)	Area (L*W1)	Total Area (Sqm)	
350	CH 5235 : CH 5250	7.12	0.36	15.00	5.34	5.34	
351	CH 5250 : CH 5265	7.14	0.36	15.00	5.36	5.36	
352	CH 5265 : CH 5280	6.97	0.35	15.00	5.23	5.23	
353	CH 5280 : CH 5295	7.61	0.38	15.00	5.71	5.71	
354	CH 5295 : CH 5310	6.24	0.31	15.00	4.68	4.68	
355	CH 5310 : CH 5325	5.22	0.26	15.00	3.91	3.91	
356	CH 5325 : CH 5340	0.00	0.00	15.00	0.00	0.00	
357	CH 5340 : CH 5355	0.00	0.00	15.00	0.00	0.00	
358	CH 5355 : CH 5370	1.00	0.05	15.00	0.75	0.75	
359	CH 5370 : CH 5385	4.73	0.24	15.00	3.55	3.55	
360	CH 5385 : CH 5400	7.91	0.40	15.00	5.93	5.93	
361	CH 5400 : CH 5415	8.31	0.42	15.00	6.23	6.23	
362	CH 5415 : CH 5430	8.36	0.42	15.00	6.27	6.27	
363	CH 5430 : CH 5445	8.13	0.41	15.00	6.10	6.10	
364	CH 5445 : CH 5460	7.19	0.36	15.00	5.39	5.39	
365	CH 5460 : CH 5475	5.65	0.28	15.00	4.23	4.23	
366	CH 5475 : CH 5490	5.46	0.27	15.00	4.10	4.10	
367	CH 5490 : CH 5505	6.74	0.34	15.00	5.06	5.06	
368	CH 5505 : CH 5520	7.32	0.37	15.00	5.49	5.49	
369	CH 5520 : CH 5535	7.37	0.37	15.00	5.53	5.53	
370	CH 5535 : CH 5550	7.31	0.37	15.00	5.48	5.48	
371	CH 5550 : CH 5565	8.23	0.41	15.00	6.17	6.17	
372	CH 5565 : CH 5580	9.89	0.49	15.00	7.42	7.42	
373	CH 5580 : CH 5595	7.41	0.37	15.00	5.55	5.55	
374	CH 5595 : CH 5610	5.96	0.30	15.00	4.47	4.47	
375	CH 5610 : CH 5625	6.15	0.31	15.00	4.61	4.61	
376	CH 5625 : CH 5640	6.31	0.32	15.00	4.73	4.73	
377	CH 5640 : CH 5655	6.27	0.31	15.00	4.70	4.70	
378	CH 5655 : CH 5670	6.12	0.31	15.00	4.59	4.59	
379	CH 5670 : CH 5685	6.15	0.31	15.00	4.61	4.61	
380	CH 5685 : CH 5700	6.35	0.32	15.00	4.76	4.76	
381	CH 5700 : CH 5715	6.65	0.33	15.00	4.99	4.99	
382	CH 5715 : CH 5730	6.13	0.31	15.00	4.60	4.60	
383	CH 5730 : CH 5745	5.02	0.25	15.00	3.77	3.77	
384	CH 5745 : CH 5760	7.86	0.39	15.00	5.90	5.90	
385	CH 5760 : CH 5775	11.35	1.36	15.00	20.43	20.43	
386	CH 5775 : CH 5790	13.21	1.58	15.00	23.77	23.77	
387	CH 5790 : CH 5805	11.92	1.43	15.00	21.45	21.45	
388	CH 5805 : CH 5820	8.32	0.42	15.00	6.24	6.24	
389	CH 5820 : CH 5835	8.34	0.42	15.00	6.26	6.26	
390	CH 5835 : CH 5850	8.13	0.41	15.00	6.10	6.10	
391	CH 5850 : CH 5865	8.83	0.44	15.00	6.62	6.62	
392	CH 5865 : CH 5880	9.70	0.49	15.00	7.28	7.28	
393	CH 5880 : CH 5895	9.56	0.48	15.00	7.17	7.17	
394	CH 5895 : CH 5910	9.75	0.49	15.00	7.31	7.31	
395	CH 5910 : CH 5925	10.45	1.25	15.00	18.80	18.80	
396	CH 5925 : CH 5940	11.76	1.41	15.00	21.17	21.17	
397	CH 5940 : CH 5955	13.75	1.65	15.00	24.74	24.74	
398	CH 5955 : CH 5970	15.45	1.85	15.00	27.80	27.80	
399	CH 5970 : CH 5985	15.02	1.80	15.00	27.04	27.04	

Sl.No	Chainage	DETAILS					Remarks
		W (m)	Based on the concentration (W1)	L (m)	Area (L*W1)	Total Area (Sqm)	
400	CH 5985 : CH 6000	14.30	1.72	15.00	25.74	25.74	
401	CH 6000 : CH 6015	14.35	1.72	15.00	25.82	25.82	
402	CH 6015 : CH 6030	13.96	1.67	15.00	25.12	25.12	
403	CH 6030 : CH 6045	13.44	1.61	15.00	24.18	24.18	
404	CH 6045 : CH 6060	13.12	1.57	15.00	23.62	23.62	
405	CH 6060 : CH 6075	13.64	1.64	15.00	24.54	24.54	
406	CH 6075 : CH 6090	13.79	1.65	15.00	24.81	24.81	
407	CH 6090 : CH 6105	12.92	1.55	15.00	23.26	23.26	
408	CH 6105 : CH 6120	12.51	1.50	15.00	22.52	22.52	
409	CH 6120 : CH 6135	14.00	1.68	15.00	25.19	25.19	
410	CH 6135 : CH 6150	15.00	1.80	15.00	26.99	26.99	
411	CH 6150 : CH 6165	14.01	1.68	15.00	25.22	25.22	
412	CH 6165 : CH 6180	12.29	1.47	15.00	22.11	22.11	
413	CH 6180 : CH 6195	11.63	1.40	15.00	20.93	20.93	
414	CH 6195 : CH 6210	12.46	1.50	15.00	22.43	22.43	
415	CH 6210 : CH 6225	13.25	1.59	15.00	23.85	23.85	
416	CH 6225 : CH 6240	12.27	1.47	15.00	22.09	22.09	
417	CH 6240 : CH 6255	11.09	1.33	15.00	19.95	19.95	
418	CH 6255 : CH 6270	11.67	1.40	15.00	21.00	21.00	
419	CH 6270 : CH 6285	12.86	1.54	15.00	23.15	23.15	
420	CH 6285 : CH 6300	14.20	1.70	15.00	25.55	25.55	
421	CH 6300 : CH 6315	15.69	1.88	15.00	28.23	28.23	
422	CH 6315 : CH 6330	16.91	2.03	15.00	30.44	30.44	
423	CH 6330 : CH 6345	17.44	2.09	15.00	31.38	31.38	
424	CH 6345 : CH 6360	17.45	2.09	15.00	31.40	31.40	
425	CH 6360 : CH 6375	16.97	2.04	15.00	30.55	30.55	
426	CH 6375 : CH 6390	16.46	1.98	15.00	29.63	29.63	
427	CH 6390 : CH 6405	15.96	1.92	15.00	28.73	28.73	
428	CH 6405 : CH 6420	15.47	1.86	15.00	27.84	27.84	
429	CH 6420 : CH 6435	14.97	1.80	15.00	26.95	26.95	
430	CH 6435 : CH 6450	14.47	1.74	15.00	26.05	26.05	
431	CH 6450 : CH 6465	13.97	1.68	15.00	25.15	25.15	
432	CH 6465 : CH 6480	13.35	1.60	15.00	24.02	24.02	
433	CH 6480 : CH 6495	12.56	1.51	15.00	22.61	22.61	
434	CH 6495 : CH 6510	10.63	1.28	15.00	19.13	19.13	
435	CH 6510 : CH 6525	7.30	0.36	15.00	5.47	5.47	
436	CH 6525 : CH 6540	9.16	0.46	15.00	6.87	6.87	
437	CH 6540 : CH 6555	12.60	1.51	15.00	22.67	22.67	
438	CH 6555 : CH 6570	13.75	1.65	15.00	24.75	24.75	
439	CH 6570 : CH 6585	11.69	1.40	15.00	21.04	21.04	
440	CH 6585 : CH 6600	9.99	0.50	15.00	7.49	7.49	
441	CH 6600 : CH 6615	10.99	1.32	15.00	19.77	19.77	
442	CH 6615 : CH 6630	12.11	1.45	15.00	21.79	21.79	
443	CH 6630 : CH 6645	12.73	1.53	15.00	22.91	22.91	
444	CH 6645 : CH 6660	12.07	1.45	15.00	21.73	21.73	
445	CH 6660 : CH 6675	11.08	1.33	15.00	19.94	19.94	
446	CH 6675 : CH 6690	11.47	1.38	15.00	20.65	20.65	
447	CH 6690 : CH 6705	12.95	1.55	15.00	23.30	23.30	
448	CH 6705 : CH 6720	14.82	1.78	15.00	26.67	26.67	
449	CH 6720 : CH 6735	16.18	1.94	15.00	29.12	29.12	

Sl.No	Chainage	DETAILS					Remarks
		W (m)	Based on the concentration (W1)	L (m)	Area (L*W1)	Total Area (Sqm)	
450	CH 6735 : CH 6750	16.42	1.97	15.00	29.55	29.55	
451	CH 6750 : CH 6765	16.27	1.95	15.00	29.28	29.28	
452	CH 6765 : CH 6780	16.45	1.97	15.00	29.61	29.61	
453	CH 6780 : CH 6795	16.22	1.95	15.00	29.19	29.19	
454	CH 6795 : CH 6810	15.91	1.91	15.00	28.63	28.63	
455	CH 6810 : CH 6825	14.96	1.79	15.00	26.92	26.92	
456	CH 6825 : CH 6840	13.09	1.57	15.00	23.56	23.56	
457	CH 6840 : CH 6855	12.00	1.44	15.00	21.60	21.60	
458	CH 6855 : CH 6870	12.97	1.56	15.00	23.35	23.35	
459	CH 6870 : CH 6885	14.70	1.76	15.00	26.45	26.45	
460	CH 6885 : CH 6900	16.15	1.94	15.00	29.06	29.06	
461	CH 6900 : CH 6915	17.37	2.08	15.00	31.27	31.27	
462	CH 6915 : CH 6930	17.30	2.08	15.00	31.13	31.13	
463	CH 6930 : CH 6945	16.50	1.98	15.00	29.69	29.69	
464	CH 6945 : CH 6960	16.17	1.94	15.00	29.10	29.10	
465	CH 6960 : CH 6975	15.66	1.88	15.00	28.18	28.18	
466	CH 6975 : CH 6990	15.34	1.84	15.00	27.60	27.60	
467	CH 6990 : CH 7005	15.65	1.88	15.00	28.16	28.16	
468	CH 7005 : CH 7020	15.88	1.91	15.00	28.58	28.58	
469	CH 7020 : CH 7035	15.43	1.85	15.00	27.77	27.77	
470	CH 7035 : CH 7050	14.81	1.78	15.00	26.65	26.65	
471	CH 7050 : CH 7065	14.38	1.73	15.00	25.88	25.88	
472	CH 7065 : CH 7080	13.93	1.67	15.00	25.07	25.07	
473	CH 7080 : CH 7095	13.49	1.62	15.00	24.27	24.27	
474	CH 7095 : CH 7110	13.17	1.58	15.00	23.70	23.70	
475	CH 7110 : CH 7125	13.65	1.64	15.00	24.57	24.57	
476	CH 7125 : CH 7140	13.73	1.65	15.00	24.71	24.71	
477	CH 7140 : CH 7155	13.47	1.62	15.00	24.25	24.25	
478	CH 7155 : CH 7170	12.40	1.49	15.00	22.32	22.32	
479	CH 7170 : CH 7185	13.36	1.60	15.00	24.04	24.04	
480	CH 7185 : CH 7200	13.63	1.64	15.00	24.53	24.53	
481	CH 7200 : CH 7215	12.91	1.55	15.00	23.24	23.24	
482	CH 7215 : CH 7230	12.22	1.47	15.00	21.99	21.99	
483	CH 7230 : CH 7245	13.08	1.57	15.00	23.54	23.54	
484	CH 7245 : CH 7260	14.55	1.75	15.00	26.19	26.19	
485	CH 7260 : CH 7275	14.64	1.76	15.00	26.34	26.34	
486	CH 7275 : CH 7290	14.20	1.70	15.00	25.55	25.55	
487	CH 7290 : CH 7305	14.17	1.70	15.00	25.51	25.51	
488	CH 7305 : CH 7320	14.79	1.77	15.00	26.61	26.61	
489	CH 7320 : CH 7335	14.91	1.79	15.00	26.84	26.84	
490	CH 7335 : CH 7350	14.55	1.75	15.00	26.19	26.19	
491	CH 7350 : CH 7365	13.49	1.62	15.00	24.27	24.27	
492	CH 7365 : CH 7380	12.42	1.49	15.00	22.35	22.35	
493	CH 7380 : CH 7395	12.74	1.53	15.00	22.92	22.92	
494	CH 7395 : CH 7410	13.83	1.66	15.00	24.89	24.89	
495	CH 7410 : CH 7425	15.04	1.80	15.00	27.06	27.06	
496	CH 7425 : CH 7440	16.22	1.95	15.00	29.19	29.19	
497	CH 7440 : CH 7455	16.80	2.02	15.00	30.24	30.24	
498	CH 7455 : CH 7470	16.63	2.00	15.00	29.93	29.93	
499	CH 7470 : CH 7485	16.27	1.95	15.00	29.29	29.29	

Sl.No	Chainage	DETAILS					Remarks
		W (m)	Based on the concentration (W1)	L (m)	Area (L*W1)	Total Area (Sqm)	
500	CH 7485 : CH 7500	15.92	1.91	15.00	28.66	28.66	
501	CH 7500 : CH 7515	15.55	1.87	15.00	27.99	27.99	
502	CH 7515 : CH 7530	14.60	1.75	15.00	26.28	26.28	
503	CH 7530 : CH 7545	13.25	1.59	15.00	23.85	23.85	
504	CH 7545 : CH 7560	12.04	1.44	15.00	21.66	21.66	
505	CH 7560 : CH 7575	11.53	1.38	15.00	20.75	20.75	
506	CH 7575 : CH 7590	12.28	1.47	15.00	22.10	22.10	
507	CH 7590 : CH 7605	12.95	1.55	15.00	23.30	23.30	
508	CH 7605 : CH 7620	12.99	1.56	15.00	23.38	23.38	
509	CH 7620 : CH 7635	13.00	1.56	15.00	23.40	23.40	
510	CH 7635 : CH 7650	12.90	1.55	15.00	23.22	23.22	
511	CH 7650 : CH 7665	12.83	1.54	15.00	23.09	23.09	
512	CH 7665 : CH 7680	13.28	1.59	15.00	23.90	23.90	
513	CH 7680 : CH 7695	15.05	1.81	15.00	27.08	27.08	
514	CH 7695 : CH 7710	16.18	1.94	15.00	29.12	29.12	
515	CH 7710 : CH 7725	15.07	1.81	15.00	27.12	27.12	
516	CH 7725 : CH 7740	15.39	1.85	15.00	27.70	27.70	
517	CH 7740 : CH 7755	16.72	2.01	15.00	30.10	30.10	
518	CH 7755 : CH 7770	16.82	2.02	15.00	30.28	30.28	
519	CH 7770 : CH 7785	16.87	2.02	15.00	30.37	30.37	
520	CH 7785 : CH 7800	17.00	2.04	15.00	30.60	30.60	
521	CH 7800 : CH 7815	17.05	2.05	15.00	30.68	30.68	
522	CH 7815 : CH 7830	16.52	1.98	15.00	29.74	29.74	
523	CH 7830 : CH 7845	16.24	1.95	15.00	29.23	29.23	
524	CH 7845 : CH 7860	16.54	1.98	15.00	29.77	29.77	
525	CH 7860 : CH 7875	16.44	1.97	15.00	29.59	29.59	
526	CH 7875 : CH 7890	15.97	1.92	15.00	28.75	28.75	
527	CH 7890 : CH 7905	15.44	1.85	15.00	27.79	27.79	
528	CH 7905 : CH 7920	15.03	1.80	15.00	27.05	27.05	
529	CH 7920 : CH 7935	14.82	1.78	15.00	26.68	26.68	
530	CH 7935 : CH 7950	14.58	1.75	15.00	26.24	26.24	
531	CH 7950 : CH 7965	14.46	1.73	15.00	26.02	26.02	
532	CH 7965 : CH 7980	14.44	1.73	15.00	25.99	25.99	
533	CH 7980 : CH 7995	14.34	1.72	15.00	25.81	25.81	
534	CH 7995 : CH 8010	14.34	1.72	15.00	25.81	25.81	
535	CH 8010 : CH 8025	13.67	1.64	15.00	24.60	24.60	
536	CH 8025 : CH 8040	13.34	1.60	15.00	24.01	24.01	
537	CH 8040 : CH 8055	13.64	1.64	15.00	24.54	24.54	
538	CH 8055 : CH 8070	14.05	1.69	15.00	25.28	25.28	
539	CH 8070 : CH 8085	14.33	1.72	15.00	25.79	25.79	
540	CH 8085 : CH 8100	13.90	1.67	15.00	25.02	25.02	
541	CH 8100 : CH 8115	14.99	1.80	15.00	26.97	26.97	
542	CH 8115 : CH 8130	15.90	1.91	15.00	28.61	28.61	
543	CH 8130 : CH 8145	15.63	1.88	15.00	28.13	28.13	
544	CH 8145 : CH 8160	16.11	1.93	15.00	29.00	29.00	
545	CH 8160 : CH 8175	16.85	2.02	15.00	30.33	30.33	
546	CH 8175 : CH 8190	17.18	2.06	15.00	30.92	30.92	
547	CH 8190 : CH 8205	17.13	2.06	15.00	30.83	30.83	
548	CH 8205 : CH 8220	17.25	2.07	15.00	31.05	31.05	
549	CH 8220 : CH 8235	17.38	2.09	15.00	31.28	31.28	

Sl.No	Chainage	DETAILS					Remarks
		W (m)	Based on the concentration (W1)	L (m)	Area (L*W1)	Total Area (Sqm)	
550	CH 8235 : CH 8250	17.16	2.06	15.00	30.89	30.89	
551	CH 8250 : CH 8265	16.99	2.04	15.00	30.57	30.57	
552	CH 8265 : CH 8280	16.51	1.98	15.00	29.72	29.72	
553	CH 8280 : CH 8295	15.78	1.89	15.00	28.40	28.40	
554	CH 8295 : CH 8310	15.65	1.88	15.00	28.17	28.17	
555	CH 8310 : CH 8325	15.48	1.86	15.00	27.86	27.86	
556	CH 8325 : CH 8340	15.16	1.82	15.00	27.29	27.29	
557	CH 8340 : CH 8355	13.48	1.62	15.00	24.26	24.26	
558	CH 8355 : CH 8370	12.68	1.52	15.00	22.82	22.82	
559	CH 8370 : CH 8385	14.06	1.69	15.00	25.30	25.30	
560	CH 8385 : CH 8400	14.32	1.72	15.00	25.78	25.78	
561	CH 8400 : CH 8415	14.25	1.71	15.00	25.64	25.64	
562	CH 8415 : CH 8430	14.73	1.77	15.00	26.51	26.51	
563	CH 8430 : CH 8445	14.76	1.77	15.00	26.56	26.56	
564	CH 8445 : CH 8460	14.34	1.72	15.00	25.80	25.80	
565	CH 8460 : CH 8475	13.93	1.67	15.00	25.07	25.07	
566	CH 8475 : CH 8490	13.69	1.64	15.00	24.64	24.64	
567	CH 8490 : CH 8505	13.56	1.63	15.00	24.41	24.41	
568	CH 8505 : CH 8520	13.38	1.61	15.00	24.08	24.08	
569	CH 8520 : CH 8535	13.29	1.59	15.00	23.91	23.91	
570	CH 8535 : CH 8550	13.31	1.60	15.00	23.96	23.96	
571	CH 8550 : CH 8565	13.48	1.62	15.00	24.26	24.26	
572	CH 8565 : CH 8580	13.71	1.64	15.00	24.67	24.67	
573	CH 8580 : CH 8595	13.79	1.65	15.00	24.81	24.81	
574	CH 8595 : CH 8610	13.43	1.61	15.00	24.17	24.17	
575	CH 8610 : CH 8625	13.11	1.57	15.00	23.60	23.60	
576	CH 8625 : CH 8640	13.21	1.58	15.00	23.77	23.77	
577	CH 8640 : CH 8655	13.28	1.59	15.00	23.90	23.90	
578	CH 8655 : CH 8670	13.31	1.60	15.00	23.95	23.95	
579	CH 8670 : CH 8685	13.55	1.63	15.00	24.39	24.39	
580	CH 8685 : CH 8700	15.06	1.81	15.00	27.10	27.10	
581	CH 8700 : CH 8715	16.41	1.97	15.00	29.54	29.54	
582	CH 8715 : CH 8730	16.04	1.92	15.00	28.87	28.87	
583	CH 8730 : CH 8745	15.55	1.87	15.00	27.98	27.98	
584	CH 8745 : CH 8760	15.85	1.90	15.00	28.52	28.52	
585	CH 8760 : CH 8775	16.22	1.95	15.00	29.20	29.20	
586	CH 8775 : CH 8790	15.84	1.90	15.00	28.50	28.50	
587	CH 8790 : CH 8805	15.48	1.86	15.00	27.86	27.86	
588	CH 8805 : CH 8820	15.66	1.88	15.00	28.18	28.18	
589	CH 8820 : CH 8835	15.70	1.88	15.00	28.26	28.26	
590	CH 8835 : CH 8850	16.54	1.98	15.00	29.76	29.76	
591	CH 8850 : CH 8865	16.81	2.02	15.00	30.26	30.26	
592	CH 8865 : CH 8880	15.56	1.87	15.00	28.01	28.01	
593	CH 8880 : CH 8895	14.93	1.79	15.00	26.87	26.87	
594	CH 8895 : CH 8910	15.33	1.84	15.00	27.59	27.59	
595	CH 8910 : CH 8925	16.15	1.94	15.00	29.06	29.06	
596	CH 8925 : CH 8940	17.01	2.04	15.00	30.62	30.62	
597	CH 8940 : CH 8955	17.74	2.13	15.00	31.92	31.92	
598	CH 8955 : CH 8970	18.11	2.17	15.00	32.59	32.59	
599	CH 8970 : CH 8985	18.17	2.18	15.00	32.70	32.70	

Sl.No	Chainage	DETAILS					Remarks
		W (m)	Based on the concentration (W1)	L (m)	Area (L*W1)	Total Area (Sqm)	
600	CH 8985 : CH 9000	17.94	2.15	15.00	32.29	32.29	
601	CH 9000 : CH 9015	17.44	2.09	15.00	31.38	31.38	
602	CH 9015 : CH 9030	19.72	2.37	15.00	35.50	35.50	
603	CH 9030 : CH 9045	21.95	6.58	15.00	98.75	98.75	
604	CH 9045 : CH 9060	22.55	6.77	15.00	101.48	101.48	
605	CH 9060 : CH 9075	22.39	6.72	15.00	100.76	100.76	
606	CH 9075 : CH 9090	19.21	2.31	15.00	34.58	34.58	
607	CH 9090 : CH 9105	17.22	2.07	15.00	31.00	31.00	
608	CH 9105 : CH 9120	17.32	2.08	15.00	31.17	31.17	
609	CH 9120 : CH 9135	17.45	2.09	15.00	31.41	31.41	
610	CH 9135 : CH 9150	17.86	2.14	15.00	32.14	32.14	
611	CH 9150 : CH 9165	18.50	2.22	15.00	33.30	33.30	
612	CH 9165 : CH 9180	18.90	2.27	15.00	34.02	34.02	
613	CH 9180 : CH 9195	19.08	2.29	15.00	34.34	34.34	
614	CH 9195 : CH 9210	19.11	2.29	15.00	34.39	34.39	
615	CH 9210 : CH 9225	19.00	2.28	15.00	34.19	34.19	
616	CH 9225 : CH 9240	18.31	2.20	15.00	32.96	32.96	
617	CH 9240 : CH 9255	16.82	2.02	15.00	30.27	30.27	
618	CH 9255 : CH 9270	15.34	1.84	15.00	27.61	27.61	
619	CH 9270 : CH 9285	14.61	1.75	15.00	26.29	26.29	
620	CH 9285 : CH 9300	14.55	1.75	15.00	26.18	26.18	
621	CH 9300 : CH 9315	14.70	1.76	15.00	26.45	26.45	
622	CH 9315 : CH 9330	14.93	1.79	15.00	26.87	26.87	
623	CH 9330 : CH 9345	14.88	1.79	15.00	26.78	26.78	
624	CH 9345 : CH 9360	14.55	1.75	15.00	26.19	26.19	
625	CH 9360 : CH 9375	14.29	1.71	15.00	25.72	25.72	
626	CH 9375 : CH 9390	14.11	1.69	15.00	25.39	25.39	
627	CH 9390 : CH 9405	14.17	1.70	15.00	25.51	25.51	
628	CH 9405 : CH 9420	14.44	1.73	15.00	25.99	25.99	
629	CH 9420 : CH 9435	14.66	1.76	15.00	26.38	26.38	
630	CH 9435 : CH 9450	14.95	1.79	15.00	26.90	26.90	
631	CH 9450 : CH 9465	15.46	1.85	15.00	27.82	27.82	
632	CH 9465 : CH 9480	15.78	1.89	15.00	28.40	28.40	
633	CH 9480 : CH 9495	15.54	1.86	15.00	27.97	27.97	
634	CH 9495 : CH 9510	15.08	1.81	15.00	27.14	27.14	
635	CH 9510 : CH 9525	14.82	1.78	15.00	26.68	26.68	
636	CH 9525 : CH 9540	14.79	1.77	15.00	26.61	26.61	
637	CH 9540 : CH 9555	15.77	1.89	15.00	28.39	28.39	
638	CH 9555 : CH 9570	17.63	2.12	15.00	31.73	31.73	
639	CH 9570 : CH 9585	18.94	2.27	15.00	34.09	34.09	
640	CH 9585 : CH 9600	18.71	2.25	15.00	33.68	33.68	
641	CH 9600 : CH 9615	18.03	2.16	15.00	32.45	32.45	
642	CH 9615 : CH 9630	18.04	2.16	15.00	32.46	32.46	
643	CH 9630 : CH 9645	18.17	2.18	15.00	32.71	32.71	
644	CH 9645 : CH 9660	18.16	2.18	15.00	32.68	32.68	
645	CH 9660 : CH 9675	17.96	2.15	15.00	32.32	32.32	
646	CH 9675 : CH 9690	17.72	2.13	15.00	31.89	31.89	
647	CH 9690 : CH 9705	17.32	2.08	15.00	31.17	31.17	
648	CH 9705 : CH 9720	16.97	2.04	15.00	30.55	30.55	
649	CH 9720 : CH 9735	16.94	2.03	15.00	30.49	30.49	

Sl.No	Chainage	DETAILS					Remarks
		W (m)	Based on the concentration (W1)	L (m)	Area (L*W1)	Total Area (Sqm)	
650	CH 9735 : CH 9750	17.16	2.06	15.00	30.89	30.89	
651	CH 9750 : CH 9765	17.45	2.09	15.00	31.40	31.40	
652	CH 9765 : CH 9780	17.92	2.15	15.00	32.25	32.25	
653	CH 9780 : CH 9795	18.40	2.21	15.00	33.12	33.12	
654	CH 9795 : CH 9810	18.54	2.22	15.00	33.37	33.37	
655	CH 9810 : CH 9825	17.32	2.08	15.00	31.17	31.17	
656	CH 9825 : CH 9840	16.88	2.03	15.00	30.38	30.38	
657	CH 9840 : CH 9855	17.21	2.07	15.00	30.98	30.98	
658	CH 9855 : CH 9868	31.01	15.50	13.00	201.53	201.53	
						65,638.31	

Thevara Canal							
Sl.No	Chainage	DETAILS					Remarks
		W (m)	Based on the concentration (W1)	L (m)	Area (L*W1)	Total Area (Sqm)	
1	CH 000 : CH 15	21.88	6.56	15.00	98.44	98.44	
2	CH 15 : CH 30	20.45	6.13	15.00	92.00	92.00	
3	CH 30 : CH 45	19.53	2.34	15.00	35.15	35.15	
4	CH 45 : CH 60	18.94	2.27	15.00	34.09	34.09	
5	CH 60 : CH 75	18.82	2.26	15.00	33.87	33.87	
6	CH 75 : CH 90	17.64	2.12	15.00	31.74	31.74	
7	CH 90 : CH 105	16.26	1.95	15.00	29.26	29.26	
8	CH 105 : CH 120	15.42	1.85	15.00	27.75	27.75	
9	CH 120 : CH 135	14.60	1.75	15.00	26.28	26.28	
10	CH 135 : CH 150	15.92	1.91	15.00	28.65	28.65	
11	CH 150 : CH 165	18.39	2.21	15.00	33.10	33.10	
12	CH 165 : CH 180	19.32	2.32	15.00	34.78	34.78	
13	CH 180 : CH 195	19.24	2.31	15.00	34.62	34.62	
14	CH 195 : CH 210	19.28	2.31	15.00	34.70	34.70	
15	CH 210 : CH 225	19.18	2.30	15.00	34.52	34.52	
16	CH 225 : CH 240	19.16	2.30	15.00	34.49	34.49	
17	CH 240 : CH 255	19.39	2.33	15.00	34.90	34.90	
18	CH 255 : CH 270	19.52	2.34	15.00	35.13	35.13	
19	CH 270 : CH 285	19.50	2.34	15.00	35.10	35.10	
20	CH 285 : CH 300	19.31	2.32	15.00	34.75	34.75	
21	CH 300 : CH 315	18.93	2.27	15.00	34.07	34.07	
22	CH 315 : CH 330	18.93	2.27	15.00	34.07	34.07	
23	CH 330 : CH 345	19.59	2.35	15.00	35.26	35.26	
24	CH 345 : CH 360	20.02	6.00	15.00	90.07	90.07	
25	CH 360 : CH 375	19.61	2.35	15.00	35.29	35.29	
26	CH 375 : CH 390	18.86	2.26	15.00	33.95	33.95	
27	CH 390 : CH 405	18.40	2.21	15.00	33.11	33.11	
28	CH 405 : CH 420	18.63	2.24	15.00	33.53	33.53	
29	CH 420 : CH 435	18.98	2.28	15.00	34.16	34.16	
30	CH 435 : CH 450	19.22	2.31	15.00	34.60	34.60	
31	CH 450 : CH 465	19.31	2.32	15.00	34.76	34.76	
32	CH 465 : CH 480	19.28	2.31	15.00	34.70	34.70	
33	CH 480 : CH 495	18.86	2.26	15.00	33.94	33.94	
34	CH 495 : CH 510	17.13	2.06	15.00	30.83	30.83	
35	CH 510 : CH 525	15.93	1.91	15.00	28.67	28.67	
36	CH 525 : CH 540	15.82	1.90	15.00	28.48	28.48	
37	CH 540 : CH 555	15.68	1.88	15.00	28.22	28.22	
38	CH 555 : CH 570	15.71	1.88	15.00	28.27	28.27	
39	CH 570 : CH 585	16.43	1.97	15.00	29.57	29.57	
40	CH 585 : CH 600	17.08	2.05	15.00	30.74	30.74	
41	CH 600 : CH 615	16.95	2.03	15.00	30.51	30.51	
42	CH 615 : CH 630	16.24	1.95	15.00	29.22	29.22	
43	CH 630 : CH 645	16.04	1.92	15.00	28.87	28.87	
44	CH 645 : CH 660	16.49	1.98	15.00	29.68	29.68	
45	CH 660 : CH 675	16.76	2.01	15.00	30.16	30.16	
46	CH 675 : CH 690	17.06	2.05	15.00	30.70	30.70	
47	CH 690 : CH 705	17.11	2.05	15.00	30.79	30.79	
48	CH 705 : CH 720	15.96	1.92	15.00	28.73	28.73	

Sl.No	Chainage	DETAILS					Remarks
		W (m)	Based on the concentration (W1)	L (m)	Area (L*W1)	Total Area (Sqm)	
49	CH 720 : CH 735	14.35	1.72	15.00	25.83	25.83	
50	CH 735 : CH 750	13.67	1.64	15.00	24.61	24.61	
51	CH 750 : CH 765	13.25	1.59	15.00	23.85	23.85	
52	CH 765 : CH 780	14.73	1.77	15.00	26.51	26.51	
53	CH 780 : CH 795	17.77	2.13	15.00	31.99	31.99	
54	CH 795 : CH 810	18.48	2.22	15.00	33.26	33.26	
55	CH 810 : CH 825	18.31	2.20	15.00	32.95	32.95	
56	CH 825 : CH 840	20.35	6.10	15.00	91.55	91.55	
57	CH 840 : CH 855	19.64	2.36	15.00	35.34	35.34	
58	CH 855 : CH 870	17.96	2.16	15.00	32.33	32.33	
59	CH 870 : CH 885	19.01	2.28	15.00	34.21	34.21	
60	CH 885 : CH 900	19.93	2.39	15.00	35.87	35.87	
61	CH 900 : CH 915	19.61	2.35	15.00	35.30	35.30	
62	CH 915 : CH 930	18.57	2.23	15.00	33.43	33.43	
63	CH 930 : CH 945	18.06	2.17	15.00	32.51	32.51	
64	CH 945 : CH 960	17.62	2.11	15.00	31.72	31.72	
65	CH 960 : CH 975	17.32	2.08	15.00	31.18	31.18	
66	CH 975 : CH 990	16.69	2.00	15.00	30.03	30.03	
67	CH 990 : CH 1005	16.67	2.00	15.00	30.01	30.01	
68	CH 1005 : CH 1020	16.81	2.02	15.00	30.25	30.25	
69	CH 1020 : CH 1035	16.16	1.94	15.00	29.08	29.08	
70	CH 1035 : CH 1050	15.45	1.85	15.00	27.81	27.81	
71	CH 1050 : CH 1065	15.63	1.88	15.00	28.13	28.13	
72	CH 1065 : CH 1080	16.68	2.00	15.00	30.02	30.02	
73	CH 1080 : CH 1095	16.88	2.03	15.00	30.38	30.38	
74	CH 1095 : CH 1110	16.97	2.04	15.00	30.55	30.55	
75	CH 1110 : CH 1125	17.12	2.05	15.00	30.81	30.81	
76	CH 1125 : CH 1140	17.31	2.08	15.00	31.16	31.16	
77	CH 1140 : CH 1155	18.14	2.18	15.00	32.65	32.65	
78	CH 1155 : CH 1170	19.76	2.37	15.00	35.57	35.57	
79	CH 1170 : CH 1185	22.05	6.62	15.00	99.23	99.23	
80	CH 1185 : CH 1200	24.05	7.21	15.00	108.20	108.20	
81	CH 1200 : CH 1215	24.94	7.48	15.00	112.21	112.21	
82	CH 1215 : CH 1230	24.70	7.41	15.00	111.13	111.13	
83	CH 1230 : CH 1245	23.92	7.17	15.00	107.62	107.62	
84	CH 1245 : CH 1260	22.67	6.80	15.00	101.99	101.99	
85	CH 1260 : CH 1275	21.68	6.50	15.00	97.54	97.54	
86	CH 1275 : CH 1290	21.09	6.33	15.00	94.88	94.88	
87	CH 1290 : CH 1305	20.37	6.11	15.00	91.67	91.67	
88	CH 1305 : CH 1320	19.54	2.34	15.00	35.16	35.16	
89	CH 1320 : CH 1335	18.80	2.26	15.00	33.84	33.84	
90	CH 1335 : CH 1350	18.14	2.18	15.00	32.65	32.65	
91	CH 1350 : CH 1365	17.60	2.11	15.00	31.67	31.67	
92	CH 1365 : CH 1380	17.53	2.10	15.00	31.55	31.55	
93	CH 1380 : CH 1395	17.66	2.12	15.00	31.78	31.78	
94	CH 1395 : CH 1405	17.74	2.13	10.00	21.29	21.29	
	Total length of canal					**3,859.52**	

Market Canal							
Sl. No	Chainage	DETAILS					Remarks
		W (m)	Based on the concentration (W1)	L (m)	Area (L*W1)	Total Area (Sqm)	
1	CH 0 : CH 15	15.46	1.86	15.00	27.83	27.83	
2	CH 15 : CH 30	14.00	1.68	15.00	25.20	25.20	
3	CH 30 : CH 45	13.97	1.68	15.00	25.14	25.14	
4	CH 45 : CH 60	14.07	1.69	15.00	25.33	25.33	
5	CH 60 : CH 75	14.01	1.68	15.00	25.22	25.22	
6	CH 75 : CH 90	15.03	1.80	15.00	27.05	27.05	
7	CH 90 : CH 105	15.84	1.90	15.00	28.51	28.51	
8	CH 105 : CH 120	13.75	1.65	15.00	24.75	24.75	
9	CH 120 : CH 135	12.18	1.46	15.00	21.92	21.92	
10	CH 135 : CH 150	12.32	1.48	15.00	22.18	22.18	
11	CH 150 : CH 165	12.32	1.48	15.00	22.18	22.18	
12	CH 165 : CH 180	12.37	1.48	15.00	22.27	22.27	
13	CH 180 : CH 195	12.31	1.48	15.00	22.15	22.15	
14	CH 195 : CH 210	12.37	1.48	15.00	22.27	22.27	
15	CH 210 : CH 225	12.78	1.53	15.00	23.00	23.00	
16	CH 225 : CH 240	13.08	1.57	15.00	23.54	23.54	
17	CH 240 : CH 255	13.14	1.58	15.00	23.65	23.65	
18	CH 255 : CH 270	13.07	1.57	15.00	23.53	23.53	
19	CH 270 : CH 285	13.11	1.57	15.00	23.60	23.60	
20	CH 285 : CH 300	13.30	1.60	15.00	23.93	23.93	
21	CH 300 : CH 315	19.94	2.39	15.00	35.89	35.89	
22	CH 315 : CH 330	31.56	15.78	15.00	236.66	236.66	
23	CH 330 : CH 345	31.88	15.94	15.00	239.10	239.10	
24	CH 345 : CH 360	27.46	8.24	15.00	123.55	123.55	
25	CH 360 : CH 375	15.27	1.83	15.00	27.48	27.48	
26	CH 375 : CH 390	7.65	0.38	15.00	5.73	5.73	
27	CH 390 : CH 405	7.52	0.38	15.00	5.64	5.64	
28	CH 405 : CH 420	7.39	0.37	15.00	5.54	5.54	
29	CH 420 : CH 435	7.26	0.36	15.00	5.45	5.45	
30	CH 435 : CH 450	7.19	0.36	15.00	5.39	5.39	
31	CH 450 : CH 465	7.15	0.36	15.00	5.36	5.36	
32	CH 465 : CH 480	7.12	0.36	15.00	5.34	5.34	
33	CH 480 : CH 495	7.11	0.36	15.00	5.33	5.33	
34	CH 495 : CH 510	7.11	0.36	15.00	5.33	5.33	
35	CH 510 : CH 525	7.04	0.35	15.00	5.28	5.28	
36	CH 525 : CH 540	6.92	0.35	15.00	5.19	5.19	
37	CH 540 : CH 555	6.83	0.34	15.00	5.12	5.12	
38	CH 555 : CH 570	6.94	0.35	15.00	5.21	5.21	
39	CH 570 : CH 585	7.01	0.35	15.00	5.26	5.26	
40	CH 585 : CH 600	7.14	0.36	15.00	5.36	5.36	
41	CH 600 : CH 615	7.30	0.37	15.00	5.48	5.48	
42	CH 615 : CH 630	7.52	0.38	15.00	5.64	5.64	
43	CH 630 : CH 645	7.72	0.39	15.00	5.79	5.79	
44	CH 645 : CH 660	7.74	0.39	15.00	5.81	5.81	
45	CH 660 : CH 664	5.90	0.30	4.00	1.18	1.18	
						1,250.31	

RATE ANALYSIS							
Sl.No	**code**	**Description**	**Unit**	**Qty**	**Rate**	**Amount**	**Remarks**
1	OD	Cleaning and removal of water hyacinth including weeds,thick and thorny floating jungles, plastics by means of suitable excavator mounted on pontoon specially made to suit the site condition and disposal of the same including cost and conveyance of all materials , Labour charge, lead, lift etc within a lead of 5 km , as directed by Engineer- In -Charge at all levels					
		Details of cost for 100sqm					
		MACHINERY					
	C-0020	Hydraulic Excavator (3D) with driver and fuel	Day	0.041	7000.00	288.75	
	C-0018	Hire and running charges of loader	Day	0.041	5000.00	206.25	
	OD	Hire charges of floating pontoon (C)	day	0.041	2500	102.50	MR
		LABOUR					
	C-128	Beldar	Day	1.08	558.00	602.64	
	C-0115	Coolie	Day	0.34	558.00	186.93	
		TOTAL				1387.07	
		Add 1 % Water charges				13.87	
		TOTAL				1400.94	
		Add 14.05% GST				196.83	
		TOTAL				1597.77	
		Add 10 % Contractor's profit and 5% overheads				239.67	
		TOTAL				1837.44	
		Add 1% Cess				18.37	
						1855.81	
		Add 39.89% Cost index				740.28	
						2596.10	
		Cost for 100 sqm				2596.10	
		Say for 1 sqm				**25.96**	

IURWTS Kochi.WT-2024 Integrate Urban Rejuvenation and Water Transport System Kochi

Abstract

Sl No	Description	Quantity	Units	Rate (Rs)	Amount (Rs)	Remarks
A.1.2	Deepening and widening (Edapally, Thevara, Thevara Perandoor, Chilvanoor, Market Canal)					
1.2.1	Earth work in or under water excavation by mechanical means (Hydraulic excavator with Pontoon)/manual means over areas (exceeding 30 cm in depth, 1.5 m in width as well as 10 sqm on plan) and shifting the mechanical equipments to cross over the obstructions including disposal of excavated earth lead upto 50m and lift upto 1.5 m, spreading the earth in the low lying area in the banks of the canal with layers not greater than 20cm and compacting the same as per the requirements at siteand as per the Engineer in charge etc complete.					
	Edappally Canal	29948.97	m3	630.00	18867849.84	
	Chilavanoor Canal	26109.05	m3	630.00	16448699.55	
	Thevara Perandoor Canal	20859.05	m3	630.00	13141198.87	
	Thevara Canal	3595.21	m3	630.00	2264984.82	
	Market Canal	1120.91	m3	630.00	706171.10	
1.2.2	Earth work excavation on the side of the banks by mechanical means (Hydraulic excavator with Pontoon)/manual means over areas (exceeding 30 cm in depth, 1.5 m in width as well as 10 sqm on plan) and shifting the mechanical equipments to cross over the obstructions including disposal of excavated earth lead upto 50m and lift upto 1.5 m, spreading the earth in the low lying area in the banks of the canal with layers not greater than 20cm and compacting the same as per the requirements at siteand as per the Engineer in charge etc complete.					
	Edappally Canal	9353.67	cum	630.00	5892810.53	
	Chilavanoor Canal	23465.08	cum	630.00	14783001.68	
	Thevara Perandoor Canal	14974.46	cum	630.00	9433909.17	
	Thevara Canal	537.62	cum	630.00	338700.29	
	Market Canal	1503.67	cum	630.00	947311.79	
1.2.3	Earth work in or under water excavation by mechanical means (Hydraulic excavator with Pontoon)/manual means over areas (exceeding 30 cm in depth, 1.5 m in width as well as 10 sqm on plan) and shifting the mechanical equipments to cross over the obstructions including disposal of excavated earth lead upto 25 km and lift upto 1.5 m, spreading the earth in the low lying area in the banks of the canal with layers not greater than 20cm and compacting the same as per the requirements at siteand as per the Engineer in charge etc complete.					
	Edappally Canal	174073.47	cum	450.00	78333060.15	
	Chilavanoor Canal	203125.36	cum	450.00	91406411.17	
	Thevara Perandoor Canal	153577.95	cum	450.00	69110077.31	
	Thevara Canal	23196.73	cum	450.00	10438530.30	
	Market Canal	11527.30	cum	450.00	5187283.43	
					337299999.98	
	Total Amount				**33,73,00,000.00**	

IURWTS Kochi.WT-2024 Integrate Urban Rejuvenation and Water Transport System Kochi

DETAILED ESTIMATE

Sl No	Description	Unit	No.	L	B	H	Qty	Rate (Rs)	Amount	Remarks
1.2.1	Earth work in or under water excavation by mechanical means (Hydraulic excavator with Pontoon)/manual means over areas (exceeding 30 cm in depth, 1.5 m in width as well as 10 sqm on plan) and shifting the mechanical equipments to cross over the obstructions including disposal of excavated earth lead upto 50m and lift upto 1.5 m, spreading the earth in the low lying area in the banks of the canal with layers not greater than 20cm and compacting the same as per the requirements at siteand as per the Engineer in charge etc complete.									
	Edappally Canal						29,948.97			
	Chilavanoor Canal						26,109.05			
	Thevara Perandoor Canal						20,859.05			
	Thevara Canal						3,595.21			
	Market Canal						1,120.91			
		m3					**81,633.18**	**630.00**	**5,14,28,904.17**	
1.2.2	Earth work excavation on the side of the banks by mechanical means (Hydraulic excavator with Pontoon)/manual means over areas (exceeding 30 cm in depth, 1.5 m in width as well as 10 sqm on plan) and shifting the mechanical equipments to cross over the obstructions including disposal of excavated earth lead upto 50m and lift upto 1.5 m, spreading the earth in the low lying area in the banks of the canal with layers not greater than 20cm and compacting the same as per the requirements at siteand as per the Engineer in charge etc complete.									
	Edappally Canal						9,353.67			
	Chilavanoor Canal						23,465.08			
	Thevara Perandoor Canal						14,974.46			
	Thevara Canal						537.62			
	Market Canal						1,503.67			
		m3					**49,834.50**	**630.00**	**3,13,95,733.45**	
1.2.3	Earth work in or under water excavation by mechanical means (Hydraulic excavator with Pontoon)/manual means over areas (exceeding 30 cm in depth, 1.5 m in width as well as 10 sqm on plan) and shifting the mechanical equipments to cross over the obstructions including disposal of excavated earth lead upto 25 km and lift upto 1.5 m, spreading the earth in the low lying area in the banks of the canal with layers not greater than 20cm and compacting the same as per the requirements at siteand as per the Engineer in charge etc complete.									
	Edappally Canal						1,74,073.47			
	Chilavanoor Canal						2,03,125.36			
	Thevara Perandoor Canal						1,53,577.95			
	Thevara Canal						23,196.73			
	Market Canal						11,527.30			
		m3					**5,65,500.81**	**450.00**	**25,44,75,362.36**	
	TOTAL								**33,72,99,999.98**	

Subcanals De-silting details						
Sl.No	**Name of Canal**	**No of subcanals**	**Total Length (km)**	**De-silting Quantity**	**Rate/cum**	**Remarks**
1	Edapally canal	14	14.99		450.00	-
2	Chilavanoor Canal	26	12.042	11045.89	450.00	49,70,648.59
3	Thevara_Perandoor Canal	19	10.286	10243.93	450.00	46,09,768.62
4	Thevara Canal	2	1.288	6665.40	450.00	29,99,430.00
5	Martket Canal	2	2.407	1028.99	450.00	4,63,046.63
	Total	63	**41.013**	**28,984.21**		**1,30,42,893.83**

Edapally Canal							
Sl.No	Chainage	Desilting details					Remarks
		W (m)	Wd (m)	L (m)		De-Silting Quantity (m3)	
1	CH 000 : CH 15	13.23	13.23	15.00	0.70	138.88	
2	CH 15 : CH 30	11.77	11.77	15.00	0.70	123.57	
3	CH 30 : CH 45	9.03	9.03	15.00	0.70	94.83	
4	CH 45 : CH 60	7.05	7.05	15.00	0.70	74.03	
5	CH 60 : CH 75	7.48	7.48	15.00	0.70	78.51	
6	CH 75 : CH 90	6.53	6.53	15.00	0.70	68.51	
7	CH 90 : CH 105	7.00	7.00	15.00	0.70	73.50	
8	CH 105 : CH 120	7.45	7.45	15.00	0.70	78.23	
9	CH 120 : CH 135	7.10	7.10	15.00	0.70	74.59	
10	CH 135 : CH 150	7.70	7.70	15.00	0.70	80.80	
11	CH 150 : CH 165	9.37	9.37	15.00	0.70	98.39	
12	CH 165 : CH 180	10.35	10.35	15.00	0.70	108.68	
13	CH 180 : CH 195	7.66	7.66	15.00	0.70	80.43	
14	CH 195 : CH 210	7.09	7.09	15.00	0.70	74.39	
15	CH 210 : CH 225	7.60	7.60	15.00	0.70	79.77	
16	CH 225 : CH 240	7.16	7.16	15.00	0.70	75.13	
17	CH 240 : CH 255	10.36	10.36	15.00	0.70	108.73	
18	CH 255 : CH 270	15.50	15.50	15.00	0.70	162.75	
19	CH 270 : CH 285	11.10	11.10	15.00	0.70	116.55	
20	CH 285 : CH 300	6.23	6.23	15.00	0.70	65.36	
21	CH 300 : CH 315	5.99	5.99	15.00	0.70	62.90	
22	CH 315 : CH 330	6.34	6.34	15.00	0.70	66.52	
23	CH 330 : CH 345	6.13	6.13	15.00	0.70	64.31	
24	CH 345 : CH 360	6.33	6.33	15.00	0.70	66.47	
25	CH 360 : CH 375	6.18	6.18	15.00	0.70	64.84	
26	CH 375 : CH 390	6.15	6.15	15.00	0.70	64.58	
27	CH 390 : CH 405	7.20	7.20	15.00	0.70	75.60	
28	CH 405 : CH 420	8.22	8.22	15.00	0.70	86.28	
29	CH 420 : CH 435	8.50	8.50	15.00	0.70	89.25	
30	CH 435 : CH 450	10.90	10.90	15.00	0.70	114.40	
31	CH 450 : CH 465	12.14	12.14	15.00	0.70	127.42	
32	CH 465 : CH 480	11.42	11.42	15.00	0.70	119.91	
33	CH 480 : CH 495	11.09	11.09	15.00	0.70	116.39	
34	CH 495 : CH 510	11.19	11.19	15.00	0.70	117.53	
35	CH 510 : CH 525	10.05	10.05	15.00	0.70	105.53	
36	CH 525 : CH 540	9.34	9.34	15.00	0.70	98.07	
37	CH 540 : CH 555	9.59	9.59	15.00	0.70	100.64	
38	CH 555 : CH 570	10.22	10.22	15.00	0.70	107.31	
39	CH 570 : CH 585	10.95	10.95	15.00	0.70	114.94	
40	CH 585 : CH 600	11.08	11.08	15.00	0.70	116.34	
41	CH 600 : CH 615	11.85	11.85	15.00	0.70	124.43	
42	CH 615 : CH 630	12.96	12.96	15.00	0.70	136.03	
43	CH 630 : CH 645	13.09	13.09	15.00	0.70	137.39	
44	CH 645 : CH 660	12.91	12.91	15.00	0.70	135.56	
45	CH 660 : CH 675	13.17	13.17	15.00	0.70	138.23	

Sl.No	Chainage	Desilting details					Remarks
		W (m)	Wd (m)	L (m)		De-Silting Quantity (m3)	
46	CH 675 : CH 690	12.87	12.87	15.00	0.70	135.14	
47	CH 690 : CH 705	11.70	11.70	15.00	0.70	122.85	
48	CH 705 : CH 720	9.48	9.48	15.00	0.70	99.49	
49	CH 720 : CH 735	8.01	8.01	15.00	0.70	84.05	
50	CH 735 : CH 750	7.84	7.84	15.00	0.70	82.27	
51	CH 750 : CH 765	7.40	7.40	15.00	0.70	77.65	
52	CH 765 : CH 780	7.52	7.52	15.00	0.70	78.96	
53	CH 780 : CH 795	8.07	8.07	15.00	0.70	84.68	
54	CH 795 : CH 810	7.85	7.85	15.00	0.70	82.37	
55	CH 810 : CH 825	8.02	8.02	15.00	0.70	84.21	
56	CH 825 : CH 840	8.67	8.67	15.00	0.70	90.98	
57	CH 840 : CH 855	10.20	10.20	15.00	0.70	107.07	
58	CH 855 : CH 870	10.98	10.98	15.00	0.70	115.24	
59	CH 870 : CH 885	10.03	10.03	15.00	0.70	105.32	
60	CH 885 : CH 900	9.30	9.30	15.00	0.70	97.60	
61	CH 900 : CH 915	9.51	9.51	15.00	0.70	99.89	
62	CH 915 : CH 930	8.28	8.28	15.00	0.70	86.89	
63	CH 930 : CH 945	8.61	8.61	15.00	0.70	90.41	
64	CH 945 : CH 960	8.59	8.59	15.00	0.70	90.20	
65	CH 960 : CH 975	8.02	8.02	15.00	0.70	84.16	
66	CH 975 : CH 990	8.52	8.52	15.00	0.70	89.46	
67	CH 990 : CH 1005	7.90	7.90	15.00	0.70	82.95	
68	CH 1005 : CH 1020	7.89	7.89	15.00	0.70	82.85	
69	CH 1020 : CH 1035	8.88	8.88	15.00	0.70	93.24	
70	CH 1035 : CH 1050	9.49	9.49	15.00	0.70	99.59	
71	CH 1050 : CH 1065	9.94	9.94	15.00	0.70	104.37	
72	CH 1065 : CH 1080	10.33	10.33	15.00	0.70	108.47	
73	CH 1080 : CH 1095	11.34	11.34	15.00	0.70	119.02	
74	CH 1095 : CH 1110	15.86	15.86	15.00	0.70	166.57	
75	CH 1110 : CH 1125	17.77	17.77	15.00	0.70	186.59	
76	CH 1125 : CH 1140	17.54	17.54	15.00	0.70	184.12	
77	CH 1140 : CH 1155	15.42	15.42	15.00	0.70	161.91	
78	CH 1155 : CH 1170	13.81	13.81	15.00	0.70	144.95	
79	CH 1170 : CH 1185	13.28	13.28	15.00	0.70	139.39	
80	CH 1185 : CH 1200	13.41	13.41	15.00	0.70	140.75	
81	CH 1200 : CH 1215	12.93	12.93	15.00	0.70	135.77	
82	CH 1215 : CH 1230	11.16	11.16	15.00	0.70	117.13	
83	CH 1230 : CH 1245	10.45	10.45	15.00	0.70	109.67	
84	CH 1245 : CH 1260	11.16	11.16	15.00	0.70	117.18	
85	CH 1260 : CH 1275	11.61	11.61	15.00	0.70	121.85	
86	CH 1275 : CH 1290	10.93	10.93	15.00	0.70	114.71	
87	CH 1290 : CH 1305	10.02	10.02	15.00	0.70	105.21	
88	CH 1305 : CH 1320	10.29	10.29	15.00	0.70	108.05	
89	CH 1320 : CH 1335	10.70	10.70	15.00	0.70	112.39	
90	CH 1335 : CH 1350	10.21	10.21	15.00	0.70	107.15	
91	CH 1350 : CH 1365	10.37	10.37	15.00	0.70	108.83	
92	CH 1365 : CH 1380	10.53	10.53	15.00	0.70	110.51	

Sl.No	Chainage	Desilting details					Remarks
		W (m)	Wd (m)	L (m)		De-Silting Quantity (m3)	
93	CH 1380 : CH 1395	10.78	10.78	15.00	0.70	113.14	
94	CH 1395 : CH 1410	11.38	11.38	15.00	0.70	119.49	
95	CH 1410 : CH 1425	11.66	11.66	15.00	0.70	122.43	
96	CH 1425 : CH 1440	10.70	10.70	15.00	0.70	112.30	
97	CH 1440 : CH 1455	10.47	10.47	15.00	0.70	109.94	
98	CH 1455 : CH 1470	10.51	10.51	15.00	0.70	110.39	
99	CH 1470 : CH 1485	9.81	9.81	15.00	0.70	102.95	
100	CH 1485 : CH 1500	11.20	11.20	15.00	0.70	117.55	
101	CH 1500 : CH 1515	12.11	12.11	15.00	0.70	127.10	
102	CH 1515 : CH 1530	9.78	9.78	15.00	0.70	102.69	
103	CH 1530 : CH 1545	8.09	8.09	15.00	0.70	84.89	
104	CH 1545 : CH 1560	8.93	8.93	15.00	0.70	93.77	
105	CH 1560 : CH 1575	9.06	9.06	15.00	0.70	95.13	
106	CH 1575 : CH 1590	8.52	8.52	15.00	0.70	89.46	
107	CH 1590 : CH 1605	8.64	8.64	15.00	0.70	90.67	
108	CH 1605 : CH 1620	8.82	8.82	15.00	0.70	92.61	
109	CH 1620 : CH 1635	8.80	8.80	15.00	0.70	92.40	
110	CH 1635 : CH 1650	9.73	9.73	15.00	0.70	102.11	
111	CH 1650 : CH 1665	10.85	10.85	15.00	0.70	113.87	
112	CH 1665 : CH 1680	11.92	11.92	15.00	0.70	125.16	
113	CH 1680 : CH 1695	12.03	12.03	15.00	0.70	126.32	
114	CH 1695 : CH 1710	10.11	10.11	15.00	0.70	106.10	
115	CH 1710 : CH 1725	9.90	9.90	15.00	0.70	103.95	
116	CH 1725 : CH 1740	10.28	10.28	15.00	0.70	107.94	
117	CH 1740 : CH 1755	11.46	11.46	15.00	0.70	120.28	
118	CH 1755 : CH 1770	12.49	12.49	15.00	0.70	131.15	
119	CH 1770 : CH 1785	12.31	12.31	15.00	0.70	129.29	
120	CH 1785 : CH 1800	10.82	10.82	15.00	0.70	113.61	
121	CH 1800 : CH 1815	9.97	9.97	15.00	0.70	104.69	
122	CH 1815 : CH 1830	10.55	10.55	15.00	0.70	110.72	
123	CH 1830 : CH 1845	11.51	11.51	15.00	0.70	120.86	
124	CH 1845 : CH 1860	12.45	12.45	15.00	0.70	130.67	
125	CH 1860 : CH 1875	13.00	13.00	15.00	0.70	136.47	
126	CH 1875 : CH 1890	12.24	12.24	15.00	0.70	128.49	
127	CH 1890 : CH 1905	12.64	12.64	15.00	0.70	132.67	
128	CH 1905 : CH 1920	13.14	13.14	15.00	0.70	138.01	
129	CH 1920 : CH 1935	11.43	11.43	15.00	0.70	119.96	
130	CH 1935 : CH 1950	10.81	10.81	15.00	0.70	113.51	
131	CH 1950 : CH 1965	10.95	10.95	15.00	0.70	114.98	
132	CH 1965 : CH 1980	11.11	11.11	15.00	0.70	116.60	
133	CH 1980 : CH 1995	10.90	10.90	15.00	0.70	114.40	
134	CH 1995 : CH 2010	10.81	10.81	15.00	0.70	113.51	
135	CH 2010 : CH 2025	11.08	11.08	15.00	0.70	116.34	
136	CH 2025 : CH 2040	12.10	12.10	15.00	0.70	127.09	
137	CH 2040 : CH 2055	12.90	12.90	15.00	0.70	135.40	
138	CH 2055 : CH 2070	14.67	14.67	15.00	0.70	153.98	
139	CH 2070 : CH 2085	15.97	15.97	15.00	0.70	167.69	

Sl.No	Chainage	Desilting details					Remarks
		W (m)	Wd (m)	L (m)		De-Silting Quantity (m3)	
140	CH 2085 : CH 2100	17.78	17.78	15.00	0.70	186.64	w>16.50
141	CH 2100 : CH 2115	20.81	20.81	15.00	0.70	218.45	"
142	CH 2115 : CH 2130	22.87	22.87	15.00	0.70	240.17	"
143	CH 2130 : CH 2145	19.57	19.57	15.00	0.70	205.43	"
144	CH 2145 : CH 2160	18.09	18.09	15.00	0.70	189.89	"
145	CH 2160 : CH 2175	19.51	19.51	15.00	0.70	204.86	"
146	CH 2175 : CH 2190	18.27	18.27	15.00	0.70	191.78	
147	CH 2190 : CH 2205	15.24	15.24	15.00	0.70	160.02	
148	CH 2205 : CH 2220	14.93	14.93	15.00	0.70	156.71	
149	CH 2220 : CH 2235	17.56	17.56	15.00	0.70	184.33	
150	CH 2235 : CH 2250	19.12	19.12	15.00	0.70	200.71	w>16.50
151	CH 2250 : CH 2265	19.14	19.14	15.00	0.70	200.97	"
152	CH 2265 : CH 2280	18.58	18.58	15.00	0.70	195.04	"
153	CH 2280 : CH 2295	17.33	17.33	15.00	0.70	181.91	"
154	CH 2295 : CH 2310	16.48	16.48	15.00	0.70	172.99	
155	CH 2310 : CH 2325	16.09	16.09	15.00	0.70	168.89	
156	CH 2325 : CH 2340	15.56	15.56	15.00	0.70	163.38	
157	CH 2340 : CH 2355	14.61	14.61	15.00	0.70	153.35	
158	CH 2355 : CH 2370	14.45	14.45	15.00	0.70	151.67	
159	CH 2370 : CH 2385	17.04	17.04	15.00	0.70	178.87	
160	CH 2385 : CH 2400	18.02	18.02	15.00	0.70	189.21	w>16.50
161	CH 2400 : CH 2415	16.43	16.43	15.00	0.70	172.46	
162	CH 2415 : CH 2430	17.03	17.03	15.00	0.70	178.82	w>16.50
163	CH 2430 : CH 2445	18.88	18.88	15.00	0.70	198.19	"
164	CH 2445 : CH 2460	20.09	20.09	15.00	0.70	210.89	"
165	CH 2460 : CH 2475	22.07	22.07	15.00	0.70	231.68	"
166	CH 2475 : CH 2490	23.83	23.83	15.00	0.70	250.22	"
167	CH 2490 : CH 2505	21.91	21.91	15.00	0.70	230.06	"
168	CH 2505 : CH 2520	17.51	17.51	15.00	0.70	183.86	
169	CH 2520 : CH 2535	14.88	14.88	15.00	0.70	156.24	
170	CH 2535 : CH 2550	15.12	15.12	15.00	0.70	158.76	
171	CH 2550 : CH 2565	16.16	16.16	15.00	0.70	169.68	
172	CH 2565 : CH 2580	16.15	16.15	15.00	0.70	169.52	
173	CH 2580 : CH 2595	16.19	16.19	15.00	0.70	170.00	
174	CH 2595 : CH 2610	16.63	16.63	15.00	0.70	174.62	w>16.50
175	CH 2610 : CH 2625	16.39	16.39	15.00	0.70	172.10	
176	CH 2625 : CH 2640	15.49	15.49	15.00	0.70	162.59	
177	CH 2640 : CH 2655	14.30	14.30	15.00	0.70	150.10	
178	CH 2655 : CH 2670	13.43	13.43	15.00	0.70	141.02	
179	CH 2670 : CH 2685	13.02	13.02	15.00	0.70	136.66	
180	CH 2685 : CH 2700	13.88	13.88	15.00	0.70	145.69	
181	CH 2700 : CH 2715	15.69	15.69	15.00	0.70	164.75	
182	CH 2715 : CH 2730	14.14	14.14	15.00	0.70	148.44	
183	CH 2730 : CH 2745	15.03	15.03	15.00	0.70	157.76	
184	CH 2745 : CH 2760	15.31	15.31	15.00	0.70	160.76	
185	CH 2760 : CH 2775	15.21	15.21	15.00	0.70	159.71	
186	CH 2775 : CH 2790	14.04	14.04	15.00	0.70	147.42	

Sl.No	Chainage	Desilting details					Remarks
		W (m)	Wd (m)	L (m)		De-Silting Quantity (m3)	
187	CH 2790 : CH 2805	12.42	12.42	15.00	0.70	130.41	
188	CH 2805 : CH 2820	10.88	10.88	15.00	0.70	114.24	
189	CH 2820 : CH 2835	10.10	10.10	15.00	0.70	106.00	
190	CH 2835 : CH 2850	10.33	10.33	15.00	0.70	108.47	
191	CH 2850 : CH 2865	12.26	12.26	15.00	0.70	128.68	
192	CH 2865 : CH 2880	14.00	14.00	15.00	0.70	147.00	
193	CH 2880 : CH 2895	14.48	14.48	15.00	0.70	151.99	
194	CH 2895 : CH 2910	13.57	13.57	15.00	0.70	142.43	
195	CH 2910 : CH 2925	11.74	11.74	15.00	0.70	123.27	
196	CH 2925 : CH 2940	11.56	11.56	15.00	0.70	121.38	
197	CH 2940 : CH 2955	11.94	11.94	15.00	0.70	125.32	
198	CH 2955 : CH 2970	11.76	11.76	15.00	0.70	123.43	
199	CH 2970 : CH 2985	12.58	12.58	15.00	0.70	132.09	
200	CH 2985 : CH 3000	14.59	14.59	15.00	0.70	153.20	
201	CH 3000 : CH 3015	16.45	16.45	15.00	0.70	172.67	
202	CH 3015 : CH 3030	16.85	16.85	15.00	0.70	176.93	
203	CH 3030 : CH 3045	14.84	14.84	15.00	0.70	155.77	
204	CH 3045 : CH 3060	12.84	12.84	15.00	0.70	134.77	
205	CH 3060 : CH 3075	12.22	12.22	15.00	0.70	128.26	
206	CH 3075 : CH 3090	11.99	11.99	15.00	0.70	125.84	
207	CH 3090 : CH 3105	12.13	12.13	15.00	0.70	127.37	
208	CH 3105 : CH 3120	12.55	12.55	15.00	0.70	131.78	
209	CH 3120 : CH 3135	12.58	12.58	15.00	0.70	132.04	
210	CH 3135 : CH 3150	12.59	12.59	15.00	0.70	132.14	
211	CH 3150 : CH 3165	13.15	13.15	15.00	0.70	138.08	
212	CH 3165 : CH 3180	13.51	13.51	15.00	0.70	141.86	
213	CH 3180 : CH 3195	12.72	12.72	15.00	0.70	133.51	
214	CH 3195 : CH 3210	11.55	11.55	15.00	0.70	121.28	
215	CH 3210 : CH 3225	10.43	10.43	15.00	0.70	109.46	
216	CH 3225 : CH 3240	9.67	9.67	15.00	0.70	101.48	
217	CH 3240 : CH 3255	10.30	10.30	15.00	0.70	108.15	
218	CH 3255 : CH 3270	11.37	11.37	15.00	0.70	119.39	
219	CH 3270 : CH 3285	11.84	11.84	15.00	0.70	124.27	
220	CH 3285 : CH 3300	13.00	13.00	15.00	0.70	136.45	
221	CH 3300 : CH 3315	15.11	15.11	15.00	0.70	158.60	
222	CH 3315 : CH 3330	16.70	16.70	15.00	0.70	175.30	
223	CH 3330 : CH 3345	17.48	17.48	15.00	0.70	183.49	w>16.50
224	CH 3345 : CH 3360	17.48	17.48	15.00	0.70	183.49	"
225	CH 3360 : CH 3375	17.61	17.61	15.00	0.70	184.85	"
226	CH 3375 : CH 3390	17.83	17.83	15.00	0.70	187.22	"
227	CH 3390 : CH 3405	17.41	17.41	15.00	0.70	182.81	"
228	CH 3405 : CH 3420	16.78	16.78	15.00	0.70	176.14	"
229	CH 3420 : CH 3435	16.43	16.43	15.00	0.70	172.46	
230	CH 3435 : CH 3450	16.14	16.14	15.00	0.70	169.47	
231	CH 3450 : CH 3465	15.82	15.82	15.00	0.70	166.11	
232	CH 3465 : CH 3480	15.48	15.48	15.00	0.70	162.54	
233	CH 3480 : CH 3495	16.36	16.36	15.00	0.70	171.78	

Sl.No	Chainage	Desilting details					Remarks
		W (m)	Wd (m)	L (m)		De-Silting Quantity (m3)	
234	CH 3495 : CH 3510	17.95	17.95	15.00	0.70	188.42	w>16.50
235	CH 3510 : CH 3525	16.15	16.15	15.00	0.70	169.52	
236	CH 3525 : CH 3540	12.70	12.70	15.00	0.70	133.39	
237	CH 3540 : CH 3555	12.96	12.96	15.00	0.70	136.03	
238	CH 3555 : CH 3570	13.25	13.25	15.00	0.70	139.07	
239	CH 3570 : CH 3585	13.11	13.11	15.00	0.70	137.66	
240	CH 3585 : CH 3600	12.96	12.96	15.00	0.70	136.03	
241	CH 3600 : CH 3615	12.06	12.06	15.00	0.70	126.63	
242	CH 3615 : CH 3630	10.60	10.60	15.00	0.70	111.25	
243	CH 3630 : CH 3645	10.15	10.15	15.00	0.70	106.58	
244	CH 3645 : CH 3660	10.47	10.47	15.00	0.70	109.88	
245	CH 3660 : CH 3675	10.49	10.49	15.00	0.70	110.15	
246	CH 3675 : CH 3690	10.51	10.51	15.00	0.70	110.36	
247	CH 3690 : CH 3705	10.79	10.79	15.00	0.70	113.30	
248	CH 3705 : CH 3720	10.80	10.80	15.00	0.70	113.35	
249	CH 3720 : CH 3735	10.66	10.66	15.00	0.70	111.88	
250	CH 3735 : CH 3750	11.16	11.16	15.00	0.70	117.13	
251	CH 3750 : CH 3765	12.29	12.29	15.00	0.70	128.99	
252	CH 3765 : CH 3780	13.55	13.55	15.00	0.70	142.28	
253	CH 3780 : CH 3795	14.78	14.78	15.00	0.70	155.14	
254	CH 3795 : CH 3810	15.25	15.25	15.00	0.70	160.07	
255	CH 3810 : CH 3825	15.28	15.28	15.00	0.70	160.39	
256	CH 3825 : CH 3840	16.19	16.19	15.00	0.70	170.00	
257	CH 3840 : CH 3855	16.21	16.21	15.00	0.70	170.15	
258	CH 3855 : CH 3870	15.55	15.55	15.00	0.70	163.22	
259	CH 3870 : CH 3885	16.23	16.23	15.00	0.70	170.42	
260	CH 3885 : CH 3900	18.01	18.01	15.00	0.70	189.05	w>16.50
261	CH 3900 : CH 3915	18.96	18.96	15.00	0.70	199.08	"
262	CH 3915 : CH 3930	17.60	17.60	15.00	0.70	184.80	"
263	CH 3930 : CH 3945	15.32	15.32	15.00	0.70	160.86	
264	CH 3945 : CH 3960	12.50	12.50	15.00	0.70	131.20	
265	CH 3960 : CH 3975	11.19	11.19	15.00	0.70	117.50	
266	CH 3975 : CH 3990	12.06	12.06	15.00	0.70	126.63	
267	CH 3990 : CH 4005	12.14	12.14	15.00	0.70	127.47	
268	CH 4005 : CH 4020	11.43	11.43	15.00	0.70	120.02	
269	CH 4020 : CH 4035	12.75	12.75	15.00	0.70	133.82	
270	CH 4035 : CH 4050	14.87	14.87	15.00	0.70	156.08	
271	CH 4050 : CH 4065	13.54	13.54	15.00	0.70	142.12	
272	CH 4065 : CH 4080	11.47	11.47	15.00	0.70	120.44	
273	CH 4080 : CH 4095	11.10	11.10	15.00	0.70	116.55	
274	CH 4095 : CH 4110	11.08	11.08	15.00	0.70	116.29	
275	CH 4110 : CH 4125	11.90	11.90	15.00	0.70	124.95	
276	CH 4125 : CH 4140	13.29	13.29	15.00	0.70	139.58	
277	CH 4140 : CH 4155	13.21	13.21	15.00	0.70	138.65	
278	CH 4155 : CH 4170	13.47	13.47	15.00	0.70	141.44	
279	CH 4170 : CH 4185	15.62	15.62	15.00	0.70	163.96	
280	CH 4185 : CH 4200	16.55	16.55	15.00	0.70	173.72	

Sl.No	Chainage	Desilting details					Remarks
		W (m)	Wd (m)	L (m)		De-Silting Quantity (m3)	
281	CH 4200 : CH 4215	15.38	15.38	15.00	0.70	161.49	
282	CH 4215 : CH 4230	14.59	14.59	15.00	0.70	153.16	
283	CH 4230 : CH 4245	15.63	15.63	15.00	0.70	164.12	
284	CH 4245 : CH 4260	15.79	15.79	15.00	0.70	165.74	
285	CH 4260 : CH 4275	14.36	14.36	15.00	0.70	150.78	
286	CH 4275 : CH 4290	14.04	14.04	15.00	0.70	147.42	
287	CH 4290 : CH 4305	15.22	15.22	15.00	0.70	159.81	
288	CH 4305 : CH 4320	15.99	15.99	15.00	0.70	167.84	
289	CH 4320 : CH 4335	16.46	16.46	15.00	0.70	172.78	
290	CH 4335 : CH 4350	16.61	16.61	15.00	0.70	174.41	w>16.50
291	CH 4350 : CH 4365	16.24	16.24	15.00	0.70	170.52	
292	CH 4365 : CH 4380	15.61	15.61	15.00	0.70	163.85	
293	CH 4380 : CH 4395	15.51	15.51	15.00	0.70	162.80	
294	CH 4395 : CH 4410	15.94	15.94	15.00	0.70	167.32	
295	CH 4410 : CH 4425	16.59	16.59	15.00	0.70	174.20	
296	CH 4425 : CH 4440	17.44	17.44	15.00	0.70	183.07	w>16.50
297	CH 4440 : CH 4455	17.54	17.54	15.00	0.70	184.12	w>16.50
298	CH 4455 : CH 4470	17.14	17.14	15.00	0.70	179.97	w>16.50
299	CH 4470 : CH 4485	16.41	16.41	15.00	0.70	172.25	
300	CH 4485 : CH 4500	14.86	14.86	15.00	0.70	155.98	
301	CH 4500 : CH 4515	13.95	13.95	15.00	0.70	146.42	
302	CH 4515 : CH 4530	14.84	14.84	15.00	0.70	155.77	
303	CH 4530 : CH 4545	16.83	16.83	15.00	0.70	176.66	
304	CH 4545 : CH 4560	17.80	17.80	15.00	0.70	186.90	w>16.50
305	CH 4560 : CH 4575	18.79	18.79	15.00	0.70	197.30	"
306	CH 4575 : CH 4590	20.27	20.27	15.00	0.70	212.78	"
307	CH 4590 : CH 4605	20.30	20.30	15.00	0.70	213.15	"
308	CH 4605 : CH 4620	18.32	18.32	15.00	0.70	192.31	"
309	CH 4620 : CH 4635	16.56	16.56	15.00	0.70	173.88	"
310	CH 4635 : CH 4650	16.27	16.27	15.00	0.70	170.84	
311	CH 4650 : CH 4665	16.08	16.08	15.00	0.70	168.84	
312	CH 4665 : CH 4680	15.60	15.60	15.00	0.70	163.80	
313	CH 4680 : CH 4695	15.84	15.84	15.00	0.70	166.32	
314	CH 4695 : CH 4710	16.23	16.23	15.00	0.70	170.36	
315	CH 4710 : CH 4725	14.75	14.75	15.00	0.70	154.82	
316	CH 4725 : CH 4740	13.93	13.93	15.00	0.70	146.21	
317	CH 4740 : CH 4755	14.79	14.79	15.00	0.70	155.24	
318	CH 4755 : CH 4770	16.01	16.01	15.00	0.70	168.11	
319	CH 4770 : CH 4785	17.51	17.51	15.00	0.70	183.86	w>16.50
320	CH 4785 : CH 4800	18.52	18.52	15.00	0.70	194.46	"
321	CH 4800 : CH 4815	18.23	18.23	15.00	0.70	191.42	"
322	CH 4815 : CH 4830	17.31	17.31	15.00	0.70	181.76	"
323	CH 4830 : CH 4845	16.87	16.87	15.00	0.70	177.14	"
324	CH 4845 : CH 4860	17.34	17.34	15.00	0.70	182.02	"
325	CH 4860 : CH 4875	18.09	18.09	15.00	0.70	189.95	"
326	CH 4875 : CH 4890	18.39	18.39	15.00	0.70	193.10	"
327	CH 4890 : CH 4905	18.77	18.77	15.00	0.70	197.03	"

Sl.No	Chainage	Desilting details					Remarks
		W (m)	Wd (m)	L (m)		De-Silting Quantity (m3)	
328	CH 4905 : CH 4920	20.20	20.20	15.00	0.70	212.05	"
329	CH 4920 : CH 4935	21.75	21.75	15.00	0.70	228.38	"
330	CH 4935 : CH 4950	22.27	22.27	15.00	0.70	233.78	"
331	CH 4950 : CH 4965	22.30	22.30	15.00	0.70	234.10	"
332	CH 4965 : CH 4980	20.87	20.87	15.00	0.70	219.14	"
333	CH 4980 : CH 4995	18.84	18.84	15.00	0.70	197.82	"
334	CH 4995 : CH 5010	17.98	17.98	15.00	0.70	188.74	"
335	CH 5010 : CH 5025	17.67	17.67	15.00	0.70	185.54	"
336	CH 5025 : CH 5040	17.17	17.17	15.00	0.70	180.23	"
337	CH 5040 : CH 5055	16.63	16.63	15.00	0.70	174.62	"
338	CH 5055 : CH 5070	16.90	16.90	15.00	0.70	177.45	"
339	CH 5070 : CH 5085	17.59	17.59	15.00	0.70	184.64	"
340	CH 5085 : CH 5100	16.83	16.83	15.00	0.70	176.72	
341	CH 5100 : CH 5115	15.15	15.15	15.00	0.70	159.02	
342	CH 5115 : CH 5130	14.79	14.79	15.00	0.70	155.24	
343	CH 5130 : CH 5145	16.74	16.74	15.00	0.70	175.72	
344	CH 5145 : CH 5160	18.01	18.01	15.00	0.70	189.11	w>16.50
345	CH 5160 : CH 5175	16.69	16.69	15.00	0.70	175.25	"
346	CH 5175 : CH 5190	15.60	15.60	15.00	0.70	163.75	
347	CH 5190 : CH 5205	16.85	16.85	15.00	0.70	176.93	
348	CH 5205 : CH 5220	19.46	19.46	15.00	0.70	204.28	w>16.50
349	CH 5220 : CH 5235	21.14	21.14	15.00	0.70	221.97	"
350	CH 5235 : CH 5250	21.47	21.47	15.00	0.70	225.38	"
351	CH 5250 : CH 5265	21.01	21.01	15.00	0.70	220.55	"
352	CH 5265 : CH 5280	21.10	21.10	15.00	0.70	221.55	"
353	CH 5280 : CH 5295	21.56	21.56	15.00	0.70	226.38	"
354	CH 5295 : CH 5310	21.95	21.95	15.00	0.70	230.42	"
355	CH 5310 : CH 5325	22.46	22.46	15.00	0.70	235.83	"
356	CH 5325 : CH 5340	22.89	22.89	15.00	0.70	240.29	"
357	CH 5340 : CH 5355	23.02	23.02	15.00	0.70	241.66	"
358	CH 5355 : CH 5370	22.53	22.53	15.00	0.70	236.57	"
359	CH 5370 : CH 5385	21.61	21.61	15.00	0.70	226.91	"
360	CH 5385 : CH 5400	20.63	20.63	15.00	0.70	216.56	"
361	CH 5400 : CH 5415	19.51	19.51	15.00	0.70	204.80	"
362	CH 5415 : CH 5430	19.63	19.63	15.00	0.70	206.06	"
363	CH 5430 : CH 5445	20.56	20.56	15.00	0.70	215.88	"
364	CH 5445 : CH 5460	22.15	22.15	15.00	0.70	232.58	"
365	CH 5460 : CH 5475	23.23	23.23	15.00	0.70	243.86	"
366	CH 5475 : CH 5490	24.26	24.26	15.00	0.70	254.68	"
367	CH 5490 : CH 5505	25.36	24.50	15.00	0.70	257.25	"
368	CH 5505 : CH 5520	24.80	24.50	15.00	0.70	257.25	"
369	CH 5520 : CH 5535	24.03	24.03	15.00	0.70	252.26	"
370	CH 5535 : CH 5550	22.43	22.43	15.00	0.70	235.52	"
371	CH 5550 : CH 5565	21.20	21.20	15.00	0.70	222.55	"
372	CH 5565 : CH 5580	19.71	19.71	15.00	0.70	206.96	"
373	CH 5580 : CH 5595	17.97	17.97	15.00	0.70	188.69	"
374	CH 5595 : CH 5610	18.82	18.82	15.00	0.70	197.61	"

Sl.No	Chainage	Desilting details					Remarks
		W (m)	Wd (m)	L (m)		De-Silting Quantity (m3)	
375	CH 5610 : CH 5625	19.44	19.44	15.00	0.70	204.12	"
376	CH 5625 : CH 5640	19.72	19.72	15.00	0.70	207.01	"
377	CH 5640 : CH 5655	20.09	20.09	15.00	0.70	210.89	"
378	CH 5655 : CH 5670	19.79	19.79	15.00	0.70	207.80	"
379	CH 5670 : CH 5685	20.42	20.42	15.00	0.70	214.41	"
380	CH 5685 : CH 5700	22.00	22.00	15.00	0.70	230.95	"
381	CH 5700 : CH 5715	22.98	22.98	15.00	0.70	241.29	"
382	CH 5715 : CH 5730	22.80	22.80	15.00	0.70	239.40	"
383	CH 5730 : CH 5745	22.42	22.42	15.00	0.70	235.41	"
384	CH 5745 : CH 5760	21.82	21.82	15.00	0.70	229.06	"
385	CH 5760 : CH 5775	21.64	21.64	15.00	0.70	227.22	"
386	CH 5775 : CH 5790	22.17	22.17	15.00	0.70	232.79	"
387	CH 5790 : CH 5805	23.21	23.21	15.00	0.70	243.71	"
388	CH 5805 : CH 5820	24.07	24.07	15.00	0.70	252.68	"
389	CH 5820 : CH 5835	23.64	23.64	15.00	0.70	248.22	"
390	CH 5835 : CH 5850	22.26	22.26	15.00	0.70	233.68	"
391	CH 5850 : CH 5865	21.71	21.71	15.00	0.70	227.90	"
392	CH 5865 : CH 5880	21.52	21.52	15.00	0.70	225.91	"
393	CH 5880 : CH 5895	19.64	19.64	15.00	0.70	206.17	"
394	CH 5895 : CH 5910	16.91	16.91	15.00	0.70	177.50	
395	CH 5910 : CH 5925	15.24	15.24	15.00	0.70	160.02	
396	CH 5925 : CH 5940	16.85	16.85	15.00	0.70	176.87	
397	CH 5940 : CH 5955	21.03	21.03	15.00	0.70	220.76	w>16.50
398	CH 5955 : CH 5970	22.96	22.96	15.00	0.70	241.08	"
399	CH 5970 : CH 5985	24.13	24.13	15.00	0.70	253.37	"
400	CH 5985 : CH 6000	25.55	24.50	15.00	0.70	257.25	"
401	CH 6000 : CH 6015	25.51	24.50	15.00	0.70	257.25	"
402	CH 6015 : CH 6030	26.13	24.50	15.00	0.70	257.25	"
403	CH 6030 : CH 6045	27.31	24.50	15.00	0.70	257.25	"
404	CH 6045 : CH 6060	27.38	24.50	15.00	0.70	257.25	"
405	CH 6060 : CH 6075	26.16	24.50	15.00	0.70	257.25	"
406	CH 6075 : CH 6090	25.36	24.50	15.00	0.70	257.25	"
407	CH 6090 : CH 6105	26.30	24.50	15.00	0.70	257.25	"
408	CH 6105 : CH 6120	28.11	24.50	15.00	0.70	257.25	"
409	CH 6120 : CH 6135	31.04	24.50	15.00	0.70	257.25	"
410	CH 6135 : CH 6150	33.51	24.50	15.00	0.70	257.25	"
411	CH 6150 : CH 6165	32.16	24.50	15.00	0.70	257.25	"
412	CH 6165 : CH 6180	28.96	24.50	15.00	0.70	257.25	"
413	CH 6180 : CH 6195	27.98	24.50	15.00	0.70	257.25	"
414	CH 6195 : CH 6210	27.60	24.50	15.00	0.70	257.25	"
415	CH 6210 : CH 6225	25.18	24.50	15.00	0.70	257.25	"
416	CH 6225 : CH 6240	22.73	22.73	15.00	0.70	238.67	"
417	CH 6240 : CH 6255	21.03	21.03	15.00	0.70	220.76	"
418	CH 6255 : CH 6270	20.45	20.45	15.00	0.70	214.73	"
419	CH 6270 : CH 6285	21.39	21.39	15.00	0.70	224.60	"
420	CH 6285 : CH 6300	22.92	22.92	15.00	0.70	240.66	"
421	CH 6300 : CH 6315	25.16	24.50	15.00	0.70	257.25	"

Sl.No	Chainage	Desilting details					Remarks
		W (m)	Wd (m)	L (m)		De-Silting Quantity (m3)	
422	CH 6315 : CH 6330	26.96	24.50	15.00	0.70	257.25	"
423	CH 6330 : CH 6345	26.18	24.50	15.00	0.70	257.25	"
424	CH 6345 : CH 6360	25.20	24.50	15.00	0.70	257.25	"
425	CH 6360 : CH 6375	25.44	24.50	15.00	0.70	257.25	"
426	CH 6375 : CH 6390	25.64	24.50	15.00	0.70	257.25	"
427	CH 6390 : CH 6405	26.70	24.50	15.00	0.70	257.25	"
428	CH 6405 : CH 6420	28.20	24.50	15.00	0.70	257.25	"
429	CH 6420 : CH 6435	29.18	24.50	15.00	0.70	257.25	"
430	CH 6435 : CH 6450	27.85	24.50	15.00	0.70	257.25	"
431	CH 6450 : CH 6465	25.68	24.50	15.00	0.70	257.25	"
432	CH 6465 : CH 6480	27.81	24.50	15.00	0.70	257.25	"
433	CH 6480 : CH 6495	30.65	24.50	15.00	0.70	257.25	"
434	CH 6495 : CH 6510	31.33	24.50	15.00	0.70	257.25	"
435	CH 6510 : CH 6525	30.77	24.50	15.00	0.70	257.25	"
436	CH 6525 : CH 6540	25.96	24.50	15.00	0.70	257.25	"
437	CH 6540 : CH 6555	20.33	20.33	15.00	0.70	213.41	"
438	CH 6555 : CH 6570	17.77	17.77	15.00	0.70	186.53	"
439	CH 6570 : CH 6585	17.22	17.22	15.00	0.70	180.81	"
440	CH 6585 : CH 6600	18.54	18.54	15.00	0.70	194.67	"
441	CH 6600 : CH 6615	21.38	21.38	15.00	0.70	224.44	"
442	CH 6615 : CH 6630	23.41	23.41	15.00	0.70	245.75	"
443	CH 6630 : CH 6645	24.06	24.06	15.00	0.70	252.63	"
444	CH 6645 : CH 6660	24.69	24.50	15.00	0.70	257.25	"
445	CH 6660 : CH 6675	24.29	24.29	15.00	0.70	255.05	"
446	CH 6675 : CH 6690	22.91	22.91	15.00	0.70	240.50	"
447	CH 6690 : CH 6705	22.32	22.32	15.00	0.70	234.31	"
448	CH 6705 : CH 6720	22.58	22.58	15.00	0.70	237.09	"
449	CH 6720 : CH 6735	22.88	22.88	15.00	0.70	240.24	"
450	CH 6735 : CH 6750	24.92	24.50	15.00	0.70	257.25	"
451	CH 6750 : CH 6765	27.08	24.50	15.00	0.70	257.25	"
452	CH 6765 : CH 6780	27.70	24.50	15.00	0.70	257.25	"
453	CH 6780 : CH 6795	25.98	24.50	15.00	0.70	257.25	"
454	CH 6795 : CH 6810	25.43	24.50	15.00	0.70	257.25	"
455	CH 6810 : CH 6825	28.13	24.50	15.00	0.70	257.25	"
456	CH 6825 : CH 6840	30.28	24.50	15.00	0.70	257.25	"
457	CH 6840 : CH 6855	31.35	24.50	15.00	0.70	257.25	"
458	CH 6855 : CH 6870	30.16	24.50	15.00	0.70	257.25	"
459	CH 6870 : CH 6885	29.32	24.50	15.00	0.70	257.25	"
460	CH 6885 : CH 6900	30.99	24.50	15.00	0.70	257.25	"
461	CH 6900 : CH 6915	33.40	24.50	15.00	0.70	257.25	"
462	CH 6915 : CH 6930	34.06	24.50	15.00	0.70	257.25	"
463	CH 6930 : CH 6945	32.19	24.50	15.00	0.70	257.25	"
464	CH 6945 : CH 6960	29.79	24.50	15.00	0.70	257.25	"
465	CH 6960 : CH 6975	28.41	24.50	15.00	0.70	257.25	"
466	CH 6975 : CH 6990	27.25	24.50	15.00	0.70	257.25	"
467	CH 6990 : CH 7005	26.02	24.50	15.00	0.70	257.25	"
468	CH 7005 : CH 7020	26.37	24.50	15.00	0.70	257.25	"

Sl.No	Chainage	Desilting details					Remarks
		W (m)	Wd (m)	L (m)		De-Silting Quantity (m3)	
469	CH 7020 : CH 7035	26.18	24.50	15.00	0.70	257.25	"
470	CH 7035 : CH 7050	25.02	24.50	15.00	0.70	257.25	"
471	CH 7050 : CH 7065	24.90	24.50	15.00	0.70	257.25	"
472	CH 7065 : CH 7080	24.07	24.07	15.00	0.70	252.74	"
473	CH 7080 : CH 7095	22.65	22.65	15.00	0.70	237.83	"
474	CH 7095 : CH 7110	21.07	21.07	15.00	0.70	221.24	"
475	CH 7110 : CH 7125	24.43	24.43	15.00	0.70	256.46	"
476	CH 7125 : CH 7140	31.75	24.50	15.00	0.70	257.25	"
477	CH 7140 : CH 7155	36.44	24.50	15.00	0.70	257.25	"
478	CH 7155 : CH 7170	40.43	24.50	15.00	0.70	257.25	"
479	CH 7170 : CH 7185	38.78	24.50	15.00	0.70	257.25	"
480	CH 7185 : CH 7200	35.19	24.50	15.00	0.70	257.25	"
481	CH 7200 : CH 7215	33.31	24.50	15.00	0.70	257.25	"
482	CH 7215 : CH 7230	30.07	24.50	15.00	0.70	257.25	"
483	CH 7230 : CH 7245	28.86	24.50	15.00	0.70	257.25	"
484	CH 7245 : CH 7260	25.38	24.50	15.00	0.70	257.25	"
485	CH 7260 : CH 7275	23.07	23.07	15.00	0.70	242.24	"
486	CH 7275 : CH 7290	25.23	24.50	15.00	0.70	257.25	"
487	CH 7290 : CH 7305	27.32	24.50	15.00	0.70	257.25	"
488	CH 7305 : CH 7320	29.60	24.50	15.00	0.70	257.25	"
489	CH 7320 : CH 7335	31.18	24.50	15.00	0.70	257.25	"
490	CH 7335 : CH 7350	31.90	24.50	15.00	0.70	257.25	"
491	CH 7350 : CH 7365	32.63	24.50	15.00	0.70	257.25	"
492	CH 7365 : CH 7380	33.60	24.50	15.00	0.70	257.25	"
493	CH 7380 : CH 7395	33.81	24.50	15.00	0.70	257.25	"
494	CH 7395 : CH 7410	32.98	24.50	15.00	0.70	257.25	"
495	CH 7410 : CH 7425	32.10	24.50	15.00	0.70	257.25	"
496	CH 7425 : CH 7440	31.62	24.50	15.00	0.70	257.25	"
497	CH 7440 : CH 7455	31.66	24.50	15.00	0.70	257.25	"
498	CH 7455 : CH 7470	31.95	24.50	15.00	0.70	257.25	"
499	CH 7470 : CH 7485	32.38	24.50	15.00	0.70	257.25	"
500	CH 7485 : CH 7500	32.82	24.50	15.00	0.70	257.25	"
501	CH 7500 : CH 7515	33.93	24.50	15.00	0.70	257.25	"
502	CH 7515 : CH 7530	36.05	24.50	15.00	0.70	257.25	"
503	CH 7530 : CH 7545	37.49	24.50	15.00	0.70	257.25	"
504	CH 7545 : CH 7560	37.40	24.50	15.00	0.70	257.25	"
505	CH 7560 : CH 7575	37.17	24.50	15.00	0.70	257.25	"
506	CH 7575 : CH 7590	36.05	24.50	15.00	0.70	257.25	"
507	CH 7590 : CH 7605	34.35	24.50	15.00	0.70	257.25	"
508	CH 7605 : CH 7620	33.28	24.50	15.00	0.70	257.25	"
509	CH 7620 : CH 7635	32.58	24.50	15.00	0.70	257.25	"
510	CH 7635 : CH 7650	30.59	24.50	15.00	0.70	257.25	"
511	CH 7650 : CH 7665	28.09	24.50	15.00	0.70	257.25	"
512	CH 7665 : CH 7680	27.23	24.50	15.00	0.70	257.25	"
513	CH 7680 : CH 7695	29.32	24.50	15.00	0.70	257.25	"
514	CH 7695 : CH 7710	34.59	24.50	15.00	0.70	257.25	"
515	CH 7710 : CH 7725	39.65	24.50	15.00	0.70	257.25	"

Sl.No	Chainage	Desilting details					Remarks
		W (m)	Wd (m)	L (m)		De-Silting Quantity (m3)	
516	CH 7725 : CH 7740	40.30	24.50	15.00	0.70	257.25	"
517	CH 7740 : CH 7755	35.88	24.50	15.00	0.70	257.25	"
518	CH 7755 : CH 7770	31.74	24.50	15.00	0.70	257.25	"
519	CH 7770 : CH 7785	30.17	24.50	15.00	0.70	257.25	"
520	CH 7785 : CH 7800	28.29	24.50	15.00	0.70	257.25	"
521	CH 7800 : CH 7815	26.49	24.50	15.00	0.70	257.25	"
522	CH 7815 : CH 7830	27.25	24.50	15.00	0.70	257.25	"
523	CH 7830 : CH 7845	30.46	24.50	15.00	0.70	257.25	"
524	CH 7845 : CH 7860	33.49	24.50	15.00	0.70	257.25	"
525	CH 7860 : CH 7875	34.32	24.50	15.00	0.70	257.25	"
526	CH 7875 : CH 7890	35.31	24.50	15.00	0.70	257.25	"
527	CH 7890 : CH 7905	37.48	24.50	15.00	0.70	257.25	"
528	CH 7905 : CH 7920	37.60	24.50	15.00	0.70	257.25	"
529	CH 7920 : CH 7935	35.09	24.50	15.00	0.70	257.25	"
530	CH 7935 : CH 7950	31.74	24.50	15.00	0.70	257.25	"
531	CH 7950 : CH 7965	29.69	24.50	15.00	0.70	257.25	"
532	CH 7965 : CH 7980	28.84	24.50	15.00	0.70	257.25	"
533	CH 7980 : CH 7995	27.60	24.50	15.00	0.70	257.25	"
534	CH 7995 : CH 8010	26.35	24.50	15.00	0.70	257.25	"
535	CH 8010 : CH 8025	26.52	24.50	15.00	0.70	257.25	"
536	CH 8025 : CH 8040	28.13	24.50	15.00	0.70	257.25	"
537	CH 8040 : CH 8055	28.86	24.50	15.00	0.70	257.25	"
538	CH 8055 : CH 8070	28.56	24.50	15.00	0.70	257.25	"
539	CH 8070 : CH 8085	27.95	24.50	15.00	0.70	257.25	"
540	CH 8085 : CH 8100	27.15	24.50	15.00	0.70	257.25	"
541	CH 8100 : CH 8115	26.84	24.50	15.00	0.70	257.25	"
542	CH 8115 : CH 8130	27.19	24.50	15.00	0.70	257.25	"
543	CH 8130 : CH 8145	28.29	24.50	15.00	0.70	257.25	"
544	CH 8145 : CH 8160	30.64	24.50	15.00	0.70	257.25	"
545	CH 8160 : CH 8175	32.75	24.50	15.00	0.70	257.25	"
546	CH 8175 : CH 8190	32.74	24.50	15.00	0.70	257.25	"
547	CH 8190 : CH 8205	31.49	24.50	15.00	0.70	257.25	"
548	CH 8205 : CH 8220	30.26	24.50	15.00	0.70	257.25	"
549	CH 8220 : CH 8235	29.95	24.50	15.00	0.70	257.25	"
550	CH 8235 : CH 8250	32.06	24.50	15.00	0.70	257.25	"
551	CH 8250 : CH 8265	33.65	24.50	15.00	0.70	257.25	"
552	CH 8265 : CH 8280	33.13	24.50	15.00	0.70	257.25	"
553	CH 8280 : CH 8295	33.43	24.50	15.00	0.70	257.25	"
554	CH 8295 : CH 8310	33.12	24.50	15.00	0.70	257.25	"
555	CH 8310 : CH 8325	31.11	24.50	15.00	0.70	257.25	"
556	CH 8325 : CH 8340	30.83	24.50	15.00	0.70	257.25	"
557	CH 8340 : CH 8355	35.54	24.50	15.00	0.70	257.25	"
558	CH 8355 : CH 8370	43.52	24.50	15.00	0.70	257.25	"
559	CH 8370 : CH 8385	54.40	24.50	15.00	0.70	257.25	"
560	CH 8385 : CH 8400	59.05	24.50	15.00	0.70	257.25	"
561	CH 8400 : CH 8415	54.58	24.50	15.00	0.70	257.25	"
562	CH 8415 : CH 8430	53.32	24.50	15.00	0.70	257.25	"

Sl.No	Chainage	Desilting details					Remarks
		W (m)	Wd (m)	L (m)		De-Silting Quantity (m3)	
563	CH 8430 : CH 8445	55.61	24.50	15.00	0.70	257.25	"
564	CH 8445 : CH 8460	55.62	24.50	15.00	0.70	257.25	"
565	CH 8460 : CH 8475	55.62	24.50	15.00	0.70	257.25	"
566	CH 8475 : CH 8490	58.77	24.50	15.00	0.70	257.25	"
567	CH 8490 : CH 8505	62.18	24.50	15.00	0.70	257.25	"
568	CH 8505 : CH 8520	62.69	24.50	15.00	0.70	257.25	"
569	CH 8520 : CH 8535	59.54	24.50	15.00	0.70	257.25	"
570	CH 8535 : CH 8550	56.89	24.50	15.00	0.70	257.25	"
571	CH 8550 : CH 8565	55.98	24.50	15.00	0.70	257.25	"
572	CH 8565 : CH 8580	54.77	24.50	15.00	0.70	257.25	"
573	CH 8580 : CH 8595	54.40	24.50	15.00	0.70	257.25	"
574	CH 8595 : CH 8610	55.37	24.50	15.00	0.70	257.25	"
575	CH 8610 : CH 8625	56.34	24.50	15.00	0.70	257.25	"
576	CH 8625 : CH 8640	57.13	24.50	15.00	0.70	257.25	"
577	CH 8640 : CH 8655	55.99	24.50	15.00	0.70	257.25	"
578	CH 8655 : CH 8670	52.77	24.50	15.00	0.70	257.25	"
579	CH 8670 : CH 8685	52.29	24.50	15.00	0.70	257.25	"
580	CH 8685 : CH 8700	54.38	24.50	15.00	0.70	257.25	"
581	CH 8700 : CH 8715	56.59	24.50	15.00	0.70	257.25	"
582	CH 8715 : CH 8730	57.65	24.50	15.00	0.70	257.25	"
583	CH 8730 : CH 8745	60.41	24.50	15.00	0.70	257.25	"
584	CH 8745 : CH 8760	72.49	24.50	15.00	0.70	257.25	"
585	CH 8760 : CH 8775	104.23	24.50	15.00	0.70	257.25	"
586	CH 8775 : CH 8790	151.67	24.50	15.00	0.70	257.25	"
587	CH 8790 : CH 8805	170.85	24.50	15.00	0.70	257.25	"
588	CH 8805 : CH 8820	123.65	24.50	15.00	0.70	257.25	"
589	CH 8820 : CH 8835	85.75	24.50	15.00	0.70	257.25	"
590	CH 8835 : CH 8850	77.10	24.50	15.00	0.70	257.25	"
591	CH 8850 : CH 8865	75.48	24.50	15.00	0.70	257.25	"
592	CH 8865 : CH 8880	76.00	24.50	15.00	0.70	257.25	"
593	CH 8880 : CH 8895	76.90	24.50	15.00	0.70	257.25	"
594	CH 8895 : CH 8910	75.81	24.50	15.00	0.70	257.25	"
595	CH 8910 : CH 8925	73.30	24.50	15.00	0.70	257.25	"
596	CH 8925 : CH 8940	71.93	24.50	15.00	0.70	257.25	"
597	CH 8940 : CH 8955	69.95	24.50	15.00	0.70	257.25	"
598	CH 8955 : CH 8970	66.09	24.50	15.00	0.70	257.25	"
599	CH 8970 : CH 8985	59.97	24.50	15.00	0.70	257.25	"
600	CH 8985 : CH 9000	54.43	24.50	15.00	0.70	257.25	"
601	CH 9000 : CH 9015	57.70	24.50	15.00	0.70	257.25	"
602	CH 9015 : CH 9030	67.51	24.50	15.00	0.70	257.25	"
603	CH 9030 : CH 9045	81.22	24.50	15.00	0.70	257.25	"
604	CH 9045 : CH 9060	109.44	24.50	15.00	0.70	257.25	"
605	CH 9060 : CH 9075	130.75	24.50	15.00	0.70	257.25	"
606	CH 9075 : CH 9090	134.15	24.50	15.00	0.70	257.25	"
607	CH 9090 : CH 9105	135.61	24.50	15.00	0.70	257.25	"
608	CH 9105 : CH 9120	137.19	24.50	15.00	0.70	257.25	"
609	CH 9120 : CH 9135	119.75	24.50	15.00	0.70	257.25	"

Sl.No	Chainage	Desilting details					Remarks
		W (m)	Wd (m)	L (m)		De-Silting Quantity (m3)	
610	CH 9135 : CH 9150	90.99	24.50	15.00	0.70	257.25	"
611	CH 9150 : CH 9165	76.87	24.50	15.00	0.70	257.25	"
612	CH 9165 : CH 9180	69.45	24.50	15.00	0.70	257.25	"
613	CH 9180 : CH 9195	65.55	24.50	15.00	0.70	257.25	"
614	CH 9195 : CH 9210	63.63	24.50	15.00	0.70	257.25	"
615	CH 9210 : CH 9225	61.47	24.50	15.00	0.70	257.25	"
616	CH 9225 : CH 9240	58.99	24.50	15.00	0.70	257.25	"
617	CH 9240 : CH 9255	57.22	24.50	15.00	0.70	257.25	"
618	CH 9255 : CH 9270	57.36	24.50	15.00	0.70	257.25	"
619	CH 9270 : CH 9285	54.06	24.50	15.00	0.70	257.25	"
620	CH 9285 : CH 9300	50.88	24.50	15.00	0.70	257.25	"
621	CH 9300 : CH 9315	52.38	24.50	15.00	0.70	257.25	"
622	CH 9315 : CH 9330	53.14	24.50	15.00	0.70	257.25	"
623	CH 9330 : CH 9345	53.63	24.50	15.00	0.70	257.25	"
624	CH 9345 : CH 9360	53.80	24.50	15.00	0.70	257.25	"
625	CH 9360 : CH 9375	53.55	24.50	15.00	0.70	257.25	"
626	CH 9375 : CH 9390	52.78	24.50	15.00	0.70	257.25	"
627	CH 9390 : CH 9405	51.34	24.50	15.00	0.70	257.25	"
628	CH 9405 : CH 9420	51.09	24.50	15.00	0.70	257.25	"
629	CH 9420 : CH 9435	53.12	24.50	15.00	0.70	257.25	"
630	CH 9435 : CH 9450	56.15	24.50	15.00	0.70	257.25	"
631	CH 9450 : CH 9465	57.10	24.50	15.00	0.70	257.25	"
632	CH 9465 : CH 9480	55.42	24.50	15.00	0.70	257.25	"
633	CH 9480 : CH 9495	51.78	24.50	15.00	0.70	257.25	"
634	CH 9495 : CH 9510	48.21	24.50	15.00	0.70	257.25	"
635	CH 9510 : CH 9525	46.71	24.50	15.00	0.70	257.25	"
636	CH 9525 : CH 9540	47.83	24.50	15.00	0.70	257.25	"
637	CH 9540 : CH 9555	49.60	24.50	15.00	0.70	257.25	"
638	CH 9555 : CH 9570	49.72	24.50	15.00	0.70	257.25	"
639	CH 9570 : CH 9585	49.51	24.50	15.00	0.70	257.25	"
640	CH 9585 : CH 9600	50.16	24.50	15.00	0.70	257.25	"
641	CH 9600 : CH 9615	51.15	24.50	15.00	0.70	257.25	"
642	CH 9615 : CH 9630	51.80	24.50	15.00	0.70	257.25	"
643	CH 9630 : CH 9645	52.38	24.50	15.00	0.70	257.25	"
644	CH 9645 : CH 9660	52.92	24.50	15.00	0.70	257.25	"
645	CH 9660 : CH 9675	53.42	24.50	15.00	0.70	257.25	"
646	CH 9675 : CH 9690	53.90	24.50	15.00	0.70	257.25	"
647	CH 9690 : CH 9705	54.16	24.50	15.00	0.70	257.25	"
648	CH 9705 : CH 9720	53.65	24.50	15.00	0.70	257.25	"
649	CH 9720 : CH 9735	52.49	24.50	15.00	0.70	257.25	"
650	CH 9735 : CH 9750	51.68	24.50	15.00	0.70	257.25	"
651	CH 9750 : CH 9765	51.52	24.50	15.00	0.70	257.25	"
652	CH 9765 : CH 9780	52.07	24.50	15.00	0.70	257.25	"
653	CH 9780 : CH 9795	52.24	24.50	15.00	0.70	257.25	"
654	CH 9795 : CH 9810	50.76	24.50	15.00	0.70	257.25	"
655	CH 9810 : CH 9825	48.37	24.50	15.00	0.70	257.25	"
656	CH 9825 : CH 9840	47.51	24.50	15.00	0.70	257.25	"

Sl.No	Chainage	Desilting details					Remarks
		W (m)	Wd (m)	L (m)		De-Silting Quantity (m3)	
657	CH 9840 : CH 9855	49.73	24.50	15.00	0.70	257.25	"
658	CH 9855 : CH 9870	53.46	24.50	15.00	0.70	257.25	"
659	CH 9870 : CH 9885	56.92	24.50	15.00	0.70	257.25	"
660	CH 9885 : CH 9900	58.96	24.50	15.00	0.70	257.25	"
661	CH 9900 : CH 9915	57.04	24.50	15.00	0.70	257.25	"
662	CH 9915 : CH 9930	56.69	24.50	15.00	0.70	257.25	"
663	CH 9930 : CH 9945	56.62	24.50	15.00	0.70	257.25	"
664	CH 9945 : CH 9960	53.61	24.50	15.00	0.70	257.25	"
665	CH 9960 : CH 9975	53.16	24.50	15.00	0.70	257.25	"
666	CH 9975 : CH 9990	57.48	24.50	15.00	0.70	257.25	"
667	CH 9990 : CH 10005	60.38	24.50	15.00	0.70	257.25	"
668	CH 10005 : CH 10020	61.92	24.50	15.00	0.70	257.25	"
669	CH 10020 : CH 10035	64.26	24.50	15.00	0.70	257.25	"
670	CH 10035 : CH 10050	65.02	24.50	15.00	0.70	257.25	"
671	CH 10050 : CH 10065	62.78	24.50	15.00	0.70	257.25	"
672	CH 10065 : CH 10080	60.81	24.50	15.00	0.70	257.25	"
673	CH 10080 : CH 10095	57.15	24.50	15.00	0.70	257.25	"
674	CH 10095 : CH 10110	51.61	24.50	15.00	0.70	257.25	"
675	CH 10110 : CH 10125	47.21	24.50	15.00	0.70	257.25	"
676	CH 10125 : CH 10140	45.93	24.50	15.00	0.70	257.25	"
677	CH 10140 : CH 10155	46.08	24.50	15.00	0.70	257.25	"
678	CH 10155 : CH 10170	46.44	24.50	15.00	0.70	257.25	"
679	CH 10170 : CH 10185	48.74	24.50	15.00	0.70	257.25	"
680	CH 10185 : CH 10200	51.79	24.50	15.00	0.70	257.25	"
681	CH 10200 : CH 10215	54.59	24.50	15.00	0.70	257.25	"
682	CH 10215 : CH 10230	56.04	24.50	15.00	0.70	257.25	"
683	CH 10230 : CH 10245	56.17	24.50	15.00	0.70	257.25	"
684	CH 10245 : CH 10260	57.95	24.50	15.00	0.70	257.25	"
685	CH 10260 : CH 10275	55.06	24.50	15.00	0.70	257.25	"
686	CH 10275 : CH 10290	52.91	24.50	15.00	0.70	257.25	"
687	CH 10290 : CH 10305	54.13	24.50	15.00	0.70	257.25	"
688	CH 10305 : CH 10320	52.86	24.50	15.00	0.70	257.25	"
689	CH 10320 : CH 10335	52.69	24.50	15.00	0.70	257.25	"
690	CH 10335 : CH 10350	51.89	24.50	15.00	0.70	257.25	"
691	CH 10350 : CH 10365	52.13	24.50	15.00	0.70	257.25	"
692	CH 10365 : CH 10380	53.94	24.50	15.00	0.70	257.25	"
693	CH 10380 : CH 10395	54.60	24.50	15.00	0.70	257.25	"
694	CH 10395 : CH 10410	54.10	24.50	15.00	0.70	257.25	"
695	CH 10410 : CH 10425	51.91	24.50	15.00	0.70	257.25	"
696	CH 10425 : CH 10440	51.34	24.50	15.00	0.70	257.25	"
697	CH 10440 : CH 10455	52.68	24.50	15.00	0.70	257.25	"
698	CH 10455 : CH 10470	53.79	24.50	15.00	0.70	257.25	"
699	CH 10470 : CH 10485	55.46	24.50	15.00	0.70	257.25	"
700	CH 10485 : CH 10500	55.82	24.50	15.00	0.70	257.25	"
701	CH 10500 : CH 10515	55.04	24.50	15.00	0.70	257.25	"
702	CH 10515 : CH 10530	55.55	24.50	15.00	0.70	257.25	"
703	CH 10530 : CH 10545	55.62	24.50	15.00	0.70	257.25	"

Sl.No	Chainage	Desilting details					Remarks
		W (m)	Wd (m)	L (m)		De-Silting Quantity (m3)	
704	CH 10545 : CH 10560	55.13	24.50	15.00	0.70	257.25	"
705	CH 10560 : CH 10575	59.01	24.50	15.00	0.70	257.25	"
706	CH 10575 : CH 10590	59.79	24.50	15.00	0.70	257.25	"
707	CH 10590 : CH 10605	55.46	24.50	15.00	0.70	257.25	"
708	CH 10605 : CH 10620	55.63	24.50	15.00	0.70	257.25	"
709	CH 10620 : CH 10635	57.68	24.50	15.00	0.70	257.25	"
710	CH 10635 : CH 10650	57.25	24.50	15.00	0.70	257.25	"
711	CH 10650 : CH 10665	56.52	24.50	15.00	0.70	257.25	"
712	CH 10665 : CH 10680	56.77	24.50	15.00	0.70	257.25	"
713	CH 10680 : CH 10695	58.15	24.50	15.00	0.70	257.25	"
714	CH 10695 : CH 10710	60.01	24.50	15.00	0.70	257.25	"
715	CH 10710 : CH 10725	60.64	24.50	15.00	0.70	257.25	"
716	CH 10725 : CH 10740	61.17	24.50	15.00	0.70	257.25	"
717	CH 10740 : CH 10755	62.15	24.50	15.00	0.70	257.25	"
718	CH 10755 : CH 10770	59.80	24.50	15.00	0.70	257.25	"
719	CH 10770 : CH 10785	58.50	24.50	15.00	0.70	257.25	"
720	CH 10785 : CH 10800	60.70	24.50	15.00	0.70	257.25	"
721	CH 10800 : CH 10815	62.81	24.50	15.00	0.70	257.25	"
722	CH 10815 : CH 10830	66.72	24.50	15.00	0.70	257.25	"
723	CH 10830 : CH 10845	68.60	24.50	15.00	0.70	257.25	"
724	CH 10845 : CH 10860	66.62	24.50	15.00	0.70	257.25	"
725	CH 10860 : CH 10875	65.68	24.50	15.00	0.70	257.25	"
726	CH 10875 : CH 10890	64.89	24.50	15.00	0.70	257.25	"
727	CH 10890 : CH 10905	63.02	24.50	15.00	0.70	257.25	"
728	CH 10905 : CH 10920	62.80	24.50	15.00	0.70	257.25	"
729	CH 10920 : CH 10935	63.22	24.50	15.00	0.70	257.25	"
730	CH 10935 : CH 10950	64.11	24.50	15.00	0.70	257.25	"
731	CH 10950 : CH 10965	68.17	24.50	15.00	0.70	257.25	"
732	CH 10965 : CH 10980	76.45	24.50	15.00	0.70	257.25	"
733	CH 10980 : CH 10995	88.04	24.50	15.00	0.70	257.25	"
734	CH 10995 : CH 11010	94.56	24.50	15.00	0.70	257.25	"
735	CH 11010 : CH 11025	95.31	24.50	15.00	0.70	257.25	"
736	CH 11025 : CH 11040	99.38	24.50	15.00	0.70	257.25	"
737	CH 11040 : CH 11055	106.00	24.50	15.00	0.70	257.25	"
738	CH 11055 : CH 11070	112.14	24.50	15.00	0.70	257.25	"
739	CH 11070 : CH 11085	99.65	24.50	15.00	0.70	257.25	"
740	CH 11085 : CH 11100	77.99	24.50	15.00	0.70	257.25	"
741	CH 11100 : CH 11115	65.67	24.50	15.00	0.70	257.25	"
742	CH 11115 : CH 11130	51.92	24.50	15.00	0.70	257.25	"
743	CH 11130 : CH 11145	43.00	24.50	15.00	0.70	257.25	"
744	CH 11145 : CH 11160	40.66	24.50	15.00	0.70	257.25	"
745	CH 11160 : CH 11175	41.17	24.50	15.00	0.70	257.25	"
746	CH 11175 : CH 11190	47.27	24.50	15.00	0.70	257.25	"
747	CH 11190 : CH 11205	55.83	24.50	15.00	0.70	257.25	"
748	CH 11205 : CH 11220	64.05	24.50	15.00	0.70	257.25	"
749	CH 11220 : CH 11231	80.60	24.50	11.00	0.70	188.65	"
	Total Quantity					**1,49,744.84**	

Sl.No	Chainage	Desilting details					Remarks
		W (m)	Wd (m)	L (m)		De-Silting Quantity (m3)	
750	De-silting quantity of subcanals (14 nos)	3.78		14890.00	0.30	16862.93	
	Grand Total					**1,66,607.77**	

Chilavanoor Canal							
Sl.No	Chainage	Desilting details					Remarks
		W (m)	Wd	L (m)		De-Silting Quantity (m3)	
1	CH 0 : CH 15	51.29	24.50	15.00	0.70	257.25	w>16.50
2	CH 15 : CH 30	42.05	24.50	15.00	0.70	257.25	"
3	CH 30 : CH 45	29.99	24.50	15.00	1.00	367.50	"
4	CH 45 : CH 60	22.39	22.39	15.00	1.00	335.87	"
5	CH 60 : CH 75	20.58	20.58	15.00	1.00	308.64	"
6	CH 75 : CH 90	21.77	21.77	15.00	1.00	326.61	"
7	CH 90 : CH 105	23.82	23.82	15.00	1.00	357.37	"
8	CH 105 : CH 120	25.31	24.50	15.00	1.00	367.50	"
9	CH 120 : CH 135	27.15	24.50	15.00	1.00	367.50	"
10	CH 135 : CH 150	29.08	24.50	15.00	1.00	367.50	"
11	CH 150 : CH 165	30.42	24.50	15.00	1.00	367.50	"
12	CH 165 : CH 180	29.31	24.50	15.00	1.00	367.50	"
13	CH 180 : CH 195	24.12	24.12	15.00	1.20	434.21	"
14	CH 195 : CH 210	18.15	18.15	15.00	1.20	326.75	
15	CH 210 : CH 225	16.50	16.50	15.00	1.20	296.96	
16	CH 225 : CH 240	16.93	16.93	15.00	1.20	304.78	"
17	CH 240 : CH 255	17.00	17.00	15.00	1.20	305.92	"
18	CH 255 : CH 270	17.07	17.07	15.00	1.20	307.32	"
19	CH 270 : CH 285	18.97	18.97	15.00	1.20	341.51	"
20	CH 285 : CH 300	20.54	20.54	15.00	1.20	369.68	"
21	CH 300 : CH 315	19.79	19.79	15.00	1.20	356.20	"
22	CH 315 : CH 330	19.15	19.15	15.00	1.20	344.77	"
23	CH 330 : CH 345	20.83	20.83	15.00	1.20	374.90	"
24	CH 345 : CH 360	22.09	22.09	15.00	1.20	397.55	"
25	CH 360 : CH 375	17.48	17.48	15.00	1.20	314.59	
26	CH 375 : CH 390	13.66	13.66	15.00	1.20	245.80	
27	CH 390 : CH 405	11.85	11.85	15.00	1.20	213.38	
28	CH 405 : CH 420	17.18	17.18	15.00	1.20	309.17	
29	CH 420 : CH 435	18.56	18.56	15.00	1.20	334.08	"
30	CH 435 : CH 450	18.85	18.85	15.00	1.20	339.37	"
31	CH 450 : CH 465	19.43	19.43	15.00	1.20	349.65	"
32	CH 465 : CH 480	20.37	20.37	15.00	1.20	366.71	"
33	CH 480 : CH 495	20.83	20.83	15.00	1.20	374.85	"
34	CH 495 : CH 510	18.48	18.48	15.00	1.20	332.65	"
35	CH 510 : CH 525	19.74	19.74	15.00	1.20	355.37	"
36	CH 525 : CH 540	26.37	24.50	15.00	1.20	441.00	"
37	CH 540 : CH 555	29.15	24.50	15.00	1.20	441.00	"
38	CH 555 : CH 570	28.47	24.50	15.00	1.20	441.00	"
39	CH 570 : CH 585	27.46	24.50	15.00	1.20	441.00	"
40	CH 585 : CH 600	26.20	24.50	15.00	1.20	441.00	"
41	CH 600 : CH 615	24.68	24.50	15.00	1.20	441.00	"
42	CH 615 : CH 630	24.59	24.50	15.00	1.20	441.00	"
43	CH 630 : CH 645	24.35	24.35	15.00	1.20	438.30	"
44	CH 645 : CH 660	22.08	22.08	15.00	1.20	397.46	"
45	CH 660 : CH 675	18.79	18.79	15.00	1.20	338.22	"
46	CH 675 : CH 690	16.30	16.30	15.00	1.20	293.43	
47	CH 690 : CH 705	15.60	15.60	15.00	1.20	280.88	
48	CH 705 : CH 720	14.02	14.02	15.00	1.20	252.34	
49	CH 720 : CH 735	13.23	13.23	15.00	1.20	238.14	
50	CH 735 : CH 750	14.39	14.39	15.00	1.20	259.00	
51	CH 750 : CH 765	15.36	15.36	15.00	1.20	276.44	
52	CH 765 : CH 780	15.37	15.37	15.00	1.20	276.64	
53	CH 780 : CH 795	15.51	15.51	15.00	1.20	279.23	
54	CH 795 : CH 810	15.68	15.68	15.00	1.20	282.20	
55	CH 810 : CH 825	15.58	15.58	15.00	1.20	280.51	

Sl.No	Chainage	Desilting details					Remarks
		W (m)	Wd	L (m)		De-Silting Quantity (m3)	
56	CH 825 : CH 840	15.47	15.47	15.00	1.20	278.49	
57	CH 840 : CH 855	15.38	15.38	15.00	1.20	276.79	
58	CH 855 : CH 870	15.73	15.73	15.00	1.20	283.10	
59	CH 870 : CH 885	16.75	16.75	15.00	1.20	301.52	
60	CH 885 : CH 900	17.08	17.08	15.00	1.20	307.37	"
61	CH 900 : CH 915	16.25	16.25	15.00	1.20	292.52	
62	CH 915 : CH 930	15.66	15.66	15.00	1.20	281.92	
63	CH 930 : CH 945	15.54	15.54	15.00	1.20	279.75	
64	CH 945 : CH 960	17.53	17.53	15.00	1.20	315.61	
65	CH 960 : CH 975	19.95	19.95	15.00	1.20	359.07	"
66	CH 975 : CH 990	18.49	18.49	15.00	1.20	332.83	"
67	CH 990 : CH 1005	15.62	15.62	15.00	1.20	281.21	
68	CH 1005 : CH 1020	13.86	13.86	15.00	1.20	249.50	
69	CH 1020 : CH 1035	13.52	13.52	15.00	1.20	243.31	
70	CH 1035 : CH 1050	14.22	14.22	15.00	1.20	255.96	
71	CH 1050 : CH 1065	14.35	14.35	15.00	1.20	258.24	
72	CH 1065 : CH 1080	13.77	13.77	15.00	1.20	247.91	
73	CH 1080 : CH 1095	13.04	13.04	15.00	1.20	234.71	
74	CH 1095 : CH 1110	12.50	12.50	15.00	1.20	224.96	
75	CH 1110 : CH 1125	12.02	12.02	15.00	1.20	216.43	
76	CH 1125 : CH 1140	11.41	11.41	15.00	1.20	205.43	
77	CH 1140 : CH 1155	11.46	11.46	15.00	1.20	206.19	
78	CH 1155 : CH 1170	12.60	12.60	15.00	1.20	226.74	
79	CH 1170 : CH 1185	14.03	14.03	15.00	1.20	252.56	
80	CH 1185 : CH 1200	15.37	15.37	15.00	1.20	276.68	
81	CH 1200 : CH 1215	16.89	16.89	15.00	1.20	303.96	
82	CH 1215 : CH 1230	17.82	17.82	15.00	1.20	320.84	"
83	CH 1230 : CH 1245	16.72	16.72	15.00	1.20	301.00	
84	CH 1245 : CH 1260	15.29	15.29	15.00	1.20	275.29	
85	CH 1260 : CH 1275	14.23	14.23	15.00	1.20	256.13	
86	CH 1275 : CH 1290	13.40	13.40	15.00	1.20	241.25	
87	CH 1290 : CH 1305	13.59	13.59	15.00	1.20	244.63	
88	CH 1305 : CH 1320	14.40	14.40	15.00	1.20	259.17	
89	CH 1320 : CH 1335	16.36	16.36	15.00	1.20	294.39	
90	CH 1335 : CH 1350	20.22	20.22	15.00	1.20	363.96	"
91	CH 1350 : CH 1365	18.57	18.57	15.00	1.20	334.34	
92	CH 1365 : CH 1380	12.24	12.24	15.00	1.20	220.31	
93	CH 1380 : CH 1395	9.83	9.83	15.00	1.20	176.89	
94	CH 1395 : CH 1410	9.42	9.42	15.00	1.20	169.52	
95	CH 1410 : CH 1425	9.92	9.92	15.00	1.20	178.59	
96	CH 1425 : CH 1440	11.30	11.30	15.00	1.20	203.33	
97	CH 1440 : CH 1455	11.56	11.56	15.00	1.20	208.10	
98	CH 1455 : CH 1470	10.54	10.54	15.00	1.20	189.66	
99	CH 1470 : CH 1485	9.35	9.35	15.00	1.20	168.26	
100	CH 1485 : CH 1500	8.96	8.96	15.00	1.20	161.30	
101	CH 1500 : CH 1515	8.98	8.98	15.00	1.20	161.69	
102	CH 1515 : CH 1530	9.77	9.77	15.00	1.20	175.92	
103	CH 1530 : CH 1545	10.74	10.74	15.00	1.20	193.38	
104	CH 1545 : CH 1560	11.20	11.20	15.00	1.20	201.59	
105	CH 1560 : CH 1575	12.88	12.88	15.00	1.20	231.82	
106	CH 1575 : CH 1590	14.52	14.52	15.00	1.20	261.41	
107	CH 1590 : CH 1605	15.35	15.35	15.00	1.20	276.29	
108	CH 1605 : CH 1620	16.03	16.03	15.00	1.20	288.58	
109	CH 1620 : CH 1635	16.47	16.47	15.00	1.20	296.47	
110	CH 1635 : CH 1650	16.31	16.31	15.00	1.20	293.62	
111	CH 1650 : CH 1665	15.26	15.26	15.00	1.20	274.62	

Sl.No	Chainage	Desilting details					Remarks
		W (m)	Wd	L (m)		De-Silting Quantity (m3)	
112	CH 1665 : CH 1680	13.84	13.84	15.00	1.20	249.13	
113	CH 1680 : CH 1695	12.98	12.98	15.00	1.20	233.69	
114	CH 1695 : CH 1710	12.51	12.51	15.00	1.20	225.21	
115	CH 1710 : CH 1725	11.53	11.53	15.00	1.20	207.52	
116	CH 1725 : CH 1740	11.12	11.12	15.00	1.20	200.23	
117	CH 1740 : CH 1755	11.51	11.51	15.00	1.20	207.10	
118	CH 1755 : CH 1770	11.41	11.41	15.00	1.20	205.29	
119	CH 1770 : CH 1785	11.59	11.59	15.00	1.20	208.64	
120	CH 1785 : CH 1800	12.29	12.29	15.00	1.20	221.14	
121	CH 1800 : CH 1815	12.42	12.42	15.00	1.20	223.52	
122	CH 1815 : CH 1830	12.06	12.06	15.00	1.20	217.08	
123	CH 1830 : CH 1845	11.43	11.43	15.00	1.20	205.78	
124	CH 1845 : CH 1860	10.59	10.59	15.00	1.20	190.66	
125	CH 1860 : CH 1875	10.04	10.04	15.00	1.20	180.75	
126	CH 1875 : CH 1890	9.13	9.13	15.00	1.20	164.30	
127	CH 1890 : CH 1905	8.62	8.62	15.00	1.20	155.11	
128	CH 1905 : CH 1920	8.70	8.70	15.00	1.20	156.56	
129	CH 1920 : CH 1935	8.62	8.62	15.00	1.20	155.09	
130	CH 1935 : CH 1950	8.78	8.78	15.00	1.20	157.97	
131	CH 1950 : CH 1965	8.96	8.96	15.00	1.20	161.27	
132	CH 1965 : CH 1980	8.99	8.99	15.00	1.20	161.86	
133	CH 1980 : CH 1995	8.47	8.47	15.00	1.20	152.53	
134	CH 1995 : CH 2010	7.58	7.58	15.00	1.20	136.47	
135	CH 2010 : CH 2025	6.69	6.69	15.00	1.20	120.46	
136	CH 2025 : CH 2040	5.97	5.97	15.00	1.20	107.41	
137	CH 2040 : CH 2055	6.11	6.11	15.00	1.20	109.95	
138	CH 2055 : CH 2070	6.74	6.74	15.00	1.20	121.27	
139	CH 2070 : CH 2085	6.53	6.53	15.00	1.20	117.59	
140	CH 2085 : CH 2100	6.19	6.19	15.00	1.20	111.49	
141	CH 2100 : CH 2115	6.26	6.26	15.00	1.20	112.66	
142	CH 2115 : CH 2130	6.03	6.03	15.00	1.20	108.61	
143	CH 2130 : CH 2145	5.52	5.52	15.00	1.20	99.29	
144	CH 2145 : CH 2160	5.50	5.50	15.00	1.20	99.07	
145	CH 2160 : CH 2175	5.46	5.46	15.00	1.20	98.29	
146	CH 2175 : CH 2190	5.18	5.18	15.00	1.20	93.29	
147	CH 2190 : CH 2205	5.72	5.72	15.00	1.20	102.88	
148	CH 2205 : CH 2220	6.07	6.07	15.00	1.20	109.30	
149	CH 2220 : CH 2235	6.03	6.03	15.00	1.20	108.60	
150	CH 2235 : CH 2250	5.28	5.28	15.00	1.20	94.95	
151	CH 2250 : CH 2265	5.47	5.47	15.00	1.20	98.46	
152	CH 2265 : CH 2280	6.25	6.25	15.00	1.20	112.46	
153	CH 2280 : CH 2295	5.53	5.53	15.00	1.20	99.60	
154	CH 2295 : CH 2310	5.72	5.72	15.00	1.20	102.99	
155	CH 2310 : CH 2325	6.14	6.14	15.00	1.20	110.56	
156	CH 2325 : CH 2340	6.11	6.11	15.00	1.20	110.03	
157	CH 2340 : CH 2355	6.42	6.42	15.00	1.20	115.50	
158	CH 2355 : CH 2370	5.67	5.67	15.00	1.20	102.03	
159	CH 2370 : CH 2385	4.56	4.56	15.00	1.20	82.13	
160	CH 2385 : CH 2400	4.53	4.53	15.00	1.20	81.56	
161	CH 2400 : CH 2415	5.10	5.10	15.00	1.20	91.84	
162	CH 2415 : CH 2430	5.10	5.10	15.00	1.20	91.84	
163	CH 2430 : CH 2445	4.43	4.43	15.00	1.20	79.66	
164	CH 2445 : CH 2460	4.71	4.71	15.00	1.20	84.75	
165	CH 2460 : CH 2475	5.03	5.03	15.00	1.20	90.45	
166	CH 2475 : CH 2490	4.51	4.51	15.00	1.20	81.11	
167	CH 2490 : CH 2505	4.42	4.42	15.00	1.20	79.50	

Sl.No	Chainage	Desilting details					Remarks
		W (m)	Wd	L (m)		De-Silting Quantity (m3)	
168	CH 2505 : CH 2520	5.17	5.17	15.00	1.20	93.12	
169	CH 2520 : CH 2535	5.41	5.41	15.00	1.20	97.43	
170	CH 2535 : CH 2550	4.82	4.82	15.00	1.20	86.73	
171	CH 2550 : CH 2565	4.82	4.82	15.00	1.20	86.74	
172	CH 2565 : CH 2580	5.28	5.28	15.00	1.20	95.08	
173	CH 2580 : CH 2595	5.48	5.48	15.00	1.20	98.70	
174	CH 2595 : CH 2610	5.36	5.36	15.00	1.20	96.44	
175	CH 2610 : CH 2625	5.28	5.28	15.00	1.20	95.00	
176	CH 2625 : CH 2640	5.00	5.00	15.00	1.20	90.06	
177	CH 2640 : CH 2655	4.92	4.92	15.00	1.20	88.48	
178	CH 2655 : CH 2670	5.44	5.44	15.00	1.20	97.97	
179	CH 2670 : CH 2685	5.44	5.44	15.00	1.20	97.95	
180	CH 2685 : CH 2700	4.51	4.51	15.00	1.20	81.18	
181	CH 2700 : CH 2715	3.92	3.92	15.00	1.20	70.61	
182	CH 2715 : CH 2730	4.12	4.12	15.00	1.20	74.09	
183	CH 2730 : CH 2745	4.24	4.24	15.00	1.20	76.39	
184	CH 2745 : CH 2760	3.92	3.92	15.00	1.20	70.61	
185	CH 2760 : CH 2775	3.55	3.55	15.00	1.20	63.86	
186	CH 2775 : CH 2790	3.50	3.50	15.00	1.20	62.99	
187	CH 2790 : CH 2805	3.77	3.77	15.00	1.20	67.84	
188	CH 2805 : CH 2820	3.86	3.86	15.00	1.20	69.50	
189	CH 2820 : CH 2835	3.72	3.72	15.00	1.20	67.03	
190	CH 2835 : CH 2850	3.66	3.66	15.00	1.20	65.84	
191	CH 2850 : CH 2865	3.73	3.73	15.00	1.20	67.06	
192	CH 2865 : CH 2880	3.82	3.82	15.00	1.20	68.75	
193	CH 2880 : CH 2895	3.57	3.57	15.00	1.20	64.21	
194	CH 2895 : CH 2910	3.40	3.40	15.00	1.20	61.12	
195	CH 2910 : CH 2925	3.30	3.30	15.00	1.20	59.36	
196	CH 2925 : CH 2940	3.42	3.42	15.00	1.20	61.58	
197	CH 2940 : CH 2955	3.72	3.72	15.00	1.20	67.03	
198	CH 2955 : CH 2970	3.70	3.70	15.00	1.20	66.62	
199	CH 2970 : CH 2985	3.65	3.65	15.00	1.20	65.63	
200	CH 2985 : CH 3000	3.62	3.62	15.00	1.20	65.09	
201	CH 3000 : CH 3015	3.57	3.57	15.00	1.20	64.28	
202	CH 3015 : CH 3030	3.40	3.40	15.00	1.20	61.17	
203	CH 3030 : CH 3045	3.12	3.12	15.00	1.20	56.13	
204	CH 3045 : CH 3060	3.31	3.31	15.00	1.20	59.56	
205	CH 3060 : CH 3075	3.75	3.75	15.00	1.20	67.49	
206	CH 3075 : CH 3090	3.54	3.54	15.00	1.20	63.74	
207	CH 3090 : CH 3105	3.13	3.13	15.00	1.20	56.40	
208	CH 3105 : CH 3120	3.11	3.11	15.00	1.20	55.94	
209	CH 3120 : CH 3135	3.20	3.20	15.00	1.20	57.55	
210	CH 3135 : CH 3150	3.08	3.08	15.00	1.20	55.51	
211	CH 3150 : CH 3165	3.02	3.02	15.00	1.20	54.28	
212	CH 3165 : CH 3180	3.21	3.21	15.00	1.20	57.72	
213	CH 3180 : CH 3195	3.32	3.32	15.00	1.20	59.68	
214	CH 3195 : CH 3210	3.07	3.07	15.00	1.20	55.32	
215	CH 3210 : CH 3225	3.12	3.12	15.00	1.20	56.07	
216	CH 3225 : CH 3240	3.11	3.11	15.00	1.20	55.94	
217	CH 3240 : CH 3255	3.05	3.05	15.00	1.20	54.91	
218	CH 3255 : CH 3270	3.13	3.13	15.00	1.20	56.41	
219	CH 3270 : CH 3285	3.17	3.17	15.00	1.20	57.06	
220	CH 3285 : CH 3300	3.27	3.27	15.00	1.20	58.80	
221	CH 3300 : CH 3315	3.24	3.24	15.00	1.20	58.40	
222	CH 3315 : CH 3330	3.03	3.03	15.00	1.20	54.53	
223	CH 3330 : CH 3345	3.22	3.22	15.00	1.20	58.04	

Sl.No	Chainage	Desilting details					Remarks
		W (m)	Wd	L (m)		De-Silting Quantity (m3)	
224	CH 3345 : CH 3360	3.38	3.38	15.00	1.20	60.87	
225	CH 3360 : CH 3375	2.86	2.86	15.00	1.20	51.51	
226	CH 3375 : CH 3390	2.77	2.77	15.00	1.20	49.87	
227	CH 3390 : CH 3405	3.39	3.39	15.00	1.20	61.03	
228	CH 3405 : CH 3420	3.72	3.72	15.00	1.20	66.92	
229	CH 3420 : CH 3435	2.82	2.82	15.00	1.20	50.81	
230	CH 3435 : CH 3450	2.31	2.31	15.00	1.20	41.49	
231	CH 3450 : CH 3465	2.27	2.27	15.00	1.20	40.82	
232	CH 3465 : CH 3480	2.29	2.29	15.00	1.20	41.17	
233	CH 3480 : CH 3495	2.51	2.51	15.00	1.20	45.12	
234	CH 3495 : CH 3510	2.57	2.57	15.00	1.20	46.27	
235	CH 3510 : CH 3525	2.49	2.49	15.00	1.20	44.80	
236	CH 3525 : CH 3540	2.43	2.43	15.00	1.20	43.74	
237	CH 3540 : CH 3555	2.56	2.56	15.00	1.20	46.07	
238	CH 3555 : CH 3570	2.48	2.48	15.00	1.20	44.55	
239	CH 3570 : CH 3585	2.52	2.52	15.00	1.20	45.42	
240	CH 3585 : CH 3600	2.59	2.59	15.00	1.20	46.63	
241	CH 3600 : CH 3615	2.43	2.43	15.00	1.20	43.68	
242	CH 3615 : CH 3630	2.20	2.20	15.00	1.20	39.53	
243	CH 3630 : CH 3645	2.14	2.14	15.00	1.20	38.57	
244	CH 3645 : CH 3660	2.11	2.11	15.00	1.20	37.91	
245	CH 3660 : CH 3675	2.01	2.01	15.00	1.20	36.14	
246	CH 3675 : CH 3690	2.40	2.40	15.00	1.20	43.20	
247	CH 3690 : CH 3705	2.99	2.99	15.00	1.20	53.89	
248	CH 3705 : CH 3720	3.16	3.16	15.00	1.20	56.79	
249	CH 3720 : CH 3735	2.61	2.61	15.00	1.20	46.92	
250	CH 3735 : CH 3750	2.10	2.10	15.00	1.20	37.71	
251	CH 3750 : CH 3765	2.12	2.12	15.00	1.20	38.10	
252	CH 3765 : CH 3780	2.82	2.82	15.00	1.20	50.75	
253	CH 3780 : CH 3795	3.47	3.47	15.00	1.20	62.42	
254	CH 3795 : CH 3810	3.54	3.54	15.00	1.20	63.77	
255	CH 3810 : CH 3825	3.46	3.46	15.00	1.20	62.23	
256	CH 3825 : CH 3840	3.10	3.10	15.00	1.20	55.76	
257	CH 3840 : CH 3855	2.78	2.78	15.00	1.20	50.09	
258	CH 3855 : CH 3870	2.76	2.76	15.00	1.20	49.75	
259	CH 3870 : CH 3885	3.39	3.39	15.00	1.20	61.01	
260	CH 3885 : CH 3900	3.27	3.27	15.00	1.20	58.77	
261	CH 3900 : CH 3915	2.63	2.63	15.00	1.20	47.39	
262	CH 3915 : CH 3930	2.63	2.63	15.00	1.20	47.41	
263	CH 3930 : CH 3945	2.60	2.60	15.00	1.20	46.82	
264	CH 3945 : CH 3960	2.65	2.65	15.00	1.20	47.66	
265	CH 3960 : CH 3975	2.70	2.70	15.00	1.20	48.56	
266	CH 3975 : CH 3990	2.64	2.64	15.00	1.20	47.51	
267	CH 3990 : CH 4005	2.63	2.63	15.00	1.20	47.33	
268	CH 4005 : CH 4020	2.62	2.62	15.00	1.20	47.21	
269	CH 4020 : CH 4035	2.60	2.60	15.00	1.20	46.76	
270	CH 4035 : CH 4050	2.67	2.67	15.00	1.20	48.07	
271	CH 4050 : CH 4065	2.73	2.73	15.00	1.20	49.13	
272	CH 4065 : CH 4080	2.68	2.68	15.00	1.20	48.19	
273	CH 4080 : CH 4095	2.68	2.68	15.00	1.20	48.32	
274	CH 4095 : CH 4110	2.74	2.74	15.00	1.20	49.29	
275	CH 4110 : CH 4125	2.64	2.64	15.00	1.20	47.47	
276	CH 4125 : CH 4140	1.27	1.27	15.00	1.20	22.85	"
277	CH 4140 : CH 4155	0.00	0.00	15.00	1.20	0.00	"
278	CH 4155 : CH 4170	0.00	0.00	15.00	1.20	0.00	"
279	CH 4170 : CH 4185	0.00	0.00	15.00	1.20	0.00	"

Sl.No	Chainage	Desilting details					Remarks
		W (m)	Wd	L (m)		De-Silting Quantity (m3)	
280	CH 4185 : CH 4200	0.00	0.00	15.00	1.20	0.00	"
281	CH 4200 : CH 4215	0.00	0.00	15.00	1.20	0.00	"
282	CH 4215 : CH 4230	0.00	0.00	15.00	1.20	0.00	"
283	CH 4230 : CH 4245	0.00	0.00	15.00	1.20	0.00	"
284	CH 4245 : CH 4260	0.00	0.00	15.00	1.20	0.00	"
285	CH 4260 : CH 4275	0.00	0.00	15.00	1.20	0.00	"
286	CH 4275 : CH 4290	2.01	2.01	15.00	1.20	36.23	
287	CH 4290 : CH 4305	3.96	3.96	15.00	1.20	71.31	
288	CH 4305 : CH 4320	4.02	4.02	15.00	1.20	72.32	
289	CH 4320 : CH 4335	4.17	4.17	15.00	1.20	75.11	
290	CH 4335 : CH 4350	4.14	4.14	15.00	1.20	74.48	
291	CH 4350 : CH 4365	4.34	4.34	15.00	1.20	78.05	
292	CH 4365 : CH 4380	4.49	4.49	15.00	1.20	80.89	
293	CH 4380 : CH 4395	4.46	4.46	15.00	1.20	80.29	
294	CH 4395 : CH 4410	4.55	4.55	15.00	1.20	81.86	
295	CH 4410 : CH 4425	4.33	4.33	15.00	1.20	77.98	
296	CH 4425 : CH 4440	4.15	4.15	15.00	1.20	74.68	
297	CH 4440 : CH 4455	4.24	4.24	15.00	1.20	76.29	
298	CH 4455 : CH 4470	4.19	4.19	15.00	1.20	75.49	
299	CH 4470 : CH 4485	4.24	4.24	15.00	1.20	76.24	
300	CH 4485 : CH 4500	4.24	4.24	15.00	1.20	76.27	
301	CH 4500 : CH 4515	4.39	4.39	15.00	1.20	79.09	
302	CH 4515 : CH 4530	4.51	4.51	15.00	1.20	81.09	
303	CH 4530 : CH 4545	4.21	4.21	15.00	1.20	75.73	
304	CH 4545 : CH 4560	4.17	4.17	15.00	1.20	75.03	
305	CH 4560 : CH 4575	4.26	4.26	15.00	1.20	76.64	
306	CH 4575 : CH 4590	4.27	4.27	15.00	1.20	76.77	
307	CH 4590 : CH 4605	4.43	4.43	15.00	1.20	79.70	
308	CH 4605 : CH 4620	4.07	4.07	15.00	1.20	73.18	
309	CH 4620 : CH 4635	4.08	4.08	15.00	1.20	73.41	
310	CH 4635 : CH 4650	4.51	4.51	15.00	1.20	81.26	
311	CH 4650 : CH 4665	4.08	4.08	15.00	1.20	73.51	
312	CH 4665 : CH 4680	3.92	3.92	15.00	1.20	70.52	
313	CH 4680 : CH 4695	4.24	4.24	15.00	1.20	76.28	
314	CH 4695 : CH 4710	4.00	4.00	15.00	1.20	72.01	
315	CH 4710 : CH 4725	3.36	3.36	15.00	1.20	60.42	
316	CH 4725 : CH 4740	3.49	3.49	15.00	1.20	62.87	
317	CH 4740 : CH 4755	3.67	3.67	15.00	1.20	66.07	
318	CH 4755 : CH 4770	3.38	3.38	15.00	1.20	60.83	
319	CH 4770 : CH 4785	3.28	3.28	15.00	1.20	59.10	
320	CH 4785 : CH 4800	3.30	3.30	15.00	1.20	59.45	
321	CH 4800 : CH 4815	3.79	3.79	15.00	1.20	68.20	
322	CH 4815 : CH 4830	4.26	4.26	15.00	1.20	76.68	
323	CH 4830 : CH 4845	4.27	4.27	15.00	1.20	76.80	
324	CH 4845 : CH 4860	4.11	4.11	15.00	1.20	74.04	
325	CH 4860 : CH 4875	3.73	3.73	15.00	1.20	67.05	
326	CH 4875 : CH 4890	3.92	3.92	15.00	1.20	70.60	
327	CH 4890 : CH 4905	4.77	4.77	15.00	1.20	85.85	
328	CH 4905 : CH 4920	4.91	4.91	15.00	1.20	88.44	
329	CH 4920 : CH 4935	4.51	4.51	15.00	1.20	81.15	
330	CH 4935 : CH 4950	4.43	4.43	15.00	1.20	79.76	
331	CH 4950 : CH 4965	4.46	4.46	15.00	1.20	80.19	
332	CH 4965 : CH 4980	4.37	4.37	15.00	1.20	78.57	
333	CH 4980 : CH 4995	4.28	4.28	15.00	1.20	76.96	
334	CH 4995 : CH 5010	4.19	4.19	15.00	1.20	75.35	
335	CH 5010 : CH 5025	4.10	4.10	15.00	1.20	73.73	

Sl.No	Chainage	Desilting details					Remarks
		W (m)	Wd	L (m)		De-Silting Quantity (m3)	
336	CH 5025 : CH 5040	4.62	4.62	15.00	1.20	83.16	
337	CH 5040 : CH 5055	5.17	5.17	15.00	1.20	93.12	
338	CH 5055 : CH 5070	5.04	5.04	15.00	1.20	90.64	
339	CH 5070 : CH 5085	5.05	5.05	15.00	1.20	90.82	
340	CH 5085 : CH 5100	5.11	5.11	15.00	1.20	91.96	
341	CH 5100 : CH 5115	4.77	4.77	15.00	1.20	85.80	
342	CH 5115 : CH 5130	4.53	4.53	15.00	1.20	81.58	
343	CH 5130 : CH 5145	4.83	4.83	15.00	1.20	86.98	
344	CH 5145 : CH 5160	4.84	4.84	15.00	1.20	87.10	
345	CH 5160 : CH 5175	4.81	4.81	15.00	1.20	86.50	
346	CH 5175 : CH 5190	5.15	5.15	15.00	1.20	92.72	
347	CH 5190 : CH 5205	5.31	5.31	15.00	1.20	95.52	
348	CH 5205 : CH 5220	5.33	5.33	15.00	1.20	96.00	
349	CH 5220 : CH 5235	5.58	5.58	15.00	1.20	100.52	
350	CH 5235 : CH 5250	5.90	5.90	15.00	1.20	106.28	
351	CH 5250 : CH 5265	6.40	6.40	15.00	1.20	115.21	
352	CH 5265 : CH 5280	5.82	5.82	15.00	1.20	104.80	
353	CH 5280 : CH 5295	4.71	4.71	15.00	1.20	84.80	
354	CH 5295 : CH 5310	4.87	4.87	15.00	1.20	87.59	
355	CH 5310 : CH 5325	5.02	5.02	15.00	1.20	90.27	
356	CH 5325 : CH 5340	5.37	5.37	15.00	1.20	96.61	
357	CH 5340 : CH 5355	6.16	6.16	15.00	1.20	110.81	
358	CH 5355 : CH 5370	6.89	6.89	15.00	1.20	124.07	
359	CH 5370 : CH 5385	6.65	6.65	15.00	1.20	119.61	
360	CH 5385 : CH 5400	5.71	5.71	15.00	1.20	102.77	
361	CH 5400 : CH 5415	5.99	5.99	15.00	1.20	107.83	
362	CH 5415 : CH 5430	6.23	6.23	15.00	1.20	112.17	
363	CH 5430 : CH 5445	5.06	5.06	15.00	1.20	91.08	
364	CH 5445 : CH 5460	3.86	3.86	15.00	1.20	69.49	
365	CH 5460 : CH 5475	4.80	4.80	15.00	1.20	86.44	
366	CH 5475 : CH 5490	6.06	6.06	15.00	1.20	109.15	
367	CH 5490 : CH 5505	6.03	6.03	15.00	1.20	108.46	
368	CH 5505 : CH 5520	5.75	5.75	15.00	1.20	103.46	
369	CH 5520 : CH 5535	5.34	5.34	15.00	1.20	96.08	
370	CH 5535 : CH 5550	5.30	5.30	15.00	1.20	95.36	
371	CH 5550 : CH 5565	5.57	5.57	15.00	1.20	100.25	
372	CH 5565 : CH 5580	5.93	5.93	15.00	1.20	106.79	
373	CH 5580 : CH 5595	5.93	5.93	15.00	1.20	106.79	
374	CH 5595 : CH 5610	6.02	6.02	15.00	1.20	108.37	
375	CH 5610 : CH 5625	6.51	6.51	15.00	1.20	117.23	
376	CH 5625 : CH 5640	6.72	6.72	15.00	1.20	121.03	
377	CH 5640 : CH 5655	6.82	6.82	15.00	1.20	122.77	
378	CH 5655 : CH 5670	6.60	6.60	15.00	1.20	118.83	
379	CH 5670 : CH 5685	6.37	6.37	15.00	1.20	114.64	
380	CH 5685 : CH 5700	5.72	5.72	15.00	1.20	102.98	
381	CH 5700 : CH 5715	5.23	5.23	15.00	1.20	94.11	
382	CH 5715 : CH 5730	5.96	5.96	15.00	1.20	107.21	
383	CH 5730 : CH 5745	6.72	6.72	15.00	1.20	120.99	
384	CH 5745 : CH 5760	6.33	6.33	15.00	1.20	113.96	
385	CH 5760 : CH 5775	5.68	5.68	15.00	1.20	102.32	
386	CH 5775 : CH 5790	5.64	5.64	15.00	1.20	101.50	
387	CH 5790 : CH 5805	5.58	5.58	15.00	1.20	100.35	
388	CH 5805 : CH 5820	5.33	5.33	15.00	1.20	95.89	
389	CH 5820 : CH 5835	5.35	5.35	15.00	1.20	96.28	
390	CH 5835 : CH 5850	5.76	5.76	15.00	1.20	103.64	
391	CH 5850 : CH 5865	6.10	6.10	15.00	1.20	109.82	

Sl.No	Chainage	Desilting details					Remarks
		W (m)	Wd	L (m)		De-Silting Quantity (m3)	
392	CH 5865 : CH 5880	7.29	7.29	15.00	1.20	131.23	
393	CH 5880 : CH 5895	7.98	7.98	15.00	1.20	143.65	
394	CH 5895 : CH 5910	7.35	7.35	15.00	1.20	132.31	
395	CH 5910 : CH 5925	7.23	7.23	15.00	1.20	130.10	
396	CH 5925 : CH 5940	7.58	7.58	15.00	1.20	136.35	
397	CH 5940 : CH 5955	8.04	8.04	15.00	1.20	144.72	
398	CH 5955 : CH 5970	8.36	8.36	15.00	1.20	150.55	
399	CH 5970 : CH 5985	8.42	8.42	15.00	1.20	151.61	
400	CH 5985 : CH 6000	7.52	7.52	15.00	1.20	135.32	
401	CH 6000 : CH 6015	6.15	6.15	15.00	1.20	110.67	
402	CH 6015 : CH 6030	6.36	6.36	15.00	1.20	114.40	
403	CH 6030 : CH 6045	7.24	7.24	15.00	1.20	130.35	
404	CH 6045 : CH 6060	7.99	7.99	15.00	1.20	143.78	
405	CH 6060 : CH 6075	8.48	8.48	15.00	1.20	152.71	
406	CH 6075 : CH 6090	8.75	8.75	15.00	1.20	157.46	
407	CH 6090 : CH 6105	9.16	9.16	15.00	1.20	164.95	
408	CH 6105 : CH 6120	9.53	9.53	15.00	1.20	171.52	
409	CH 6120 : CH 6135	9.93	9.93	15.00	1.20	178.81	
410	CH 6135 : CH 6150	12.20	12.20	15.00	1.20	219.62	
411	CH 6150 : CH 6165	13.79	13.79	15.00	1.20	248.19	
412	CH 6165 : CH 6180	11.95	11.95	15.00	1.20	215.10	
413	CH 6180 : CH 6195	10.43	10.43	15.00	1.20	187.79	
414	CH 6195 : CH 6210	10.27	10.27	15.00	1.20	184.86	
415	CH 6210 : CH 6225	10.35	10.35	15.00	1.20	186.24	
416	CH 6225 : CH 6240	10.55	10.55	15.00	1.20	189.96	
417	CH 6240 : CH 6255	10.76	10.76	15.00	1.20	193.69	
418	CH 6255 : CH 6270	10.97	10.97	15.00	1.20	197.42	
419	CH 6270 : CH 6285	10.85	10.85	15.00	1.20	195.26	
420	CH 6285 : CH 6300	11.33	11.33	15.00	1.20	203.89	
421	CH 6300 : CH 6315	12.09	12.09	15.00	1.20	217.69	
422	CH 6315 : CH 6330	12.04	12.04	15.00	1.20	216.77	
423	CH 6330 : CH 6345	10.92	10.92	15.00	1.20	196.62	
424	CH 6345 : CH 6360	9.14	9.14	15.00	1.20	164.59	
425	CH 6360 : CH 6375	8.26	8.26	15.00	1.20	148.60	
426	CH 6375 : CH 6390	8.07	8.07	15.00	1.20	145.25	
427	CH 6390 : CH 6405	7.84	7.84	15.00	1.20	141.14	
428	CH 6405 : CH 6420	7.42	7.42	15.00	1.20	133.60	
429	CH 6420 : CH 6435	7.00	7.00	15.00	1.20	126.02	
430	CH 6435 : CH 6450	7.22	7.22	15.00	1.20	130.02	
431	CH 6450 : CH 6465	7.69	7.69	15.00	1.20	138.45	
432	CH 6465 : CH 6480	8.26	8.26	15.00	1.20	148.61	
433	CH 6480 : CH 6495	8.04	8.04	15.00	1.20	144.79	
434	CH 6495 : CH 6510	7.31	7.31	15.00	1.20	131.50	
435	CH 6510 : CH 6525	7.55	7.55	15.00	1.20	135.91	
436	CH 6525 : CH 6540	8.19	8.19	15.00	1.20	147.34	
437	CH 6540 : CH 6555	8.80	8.80	15.00	1.20	158.37	
438	CH 6555 : CH 6570	10.63	10.63	15.00	1.20	191.30	
439	CH 6570 : CH 6585	14.04	14.04	15.00	1.20	252.78	
440	CH 6585 : CH 6600	15.32	15.32	15.00	1.20	275.71	
441	CH 6600 : CH 6615	14.60	14.60	15.00	1.20	262.82	
442	CH 6615 : CH 6630	14.37	14.37	15.00	1.20	258.66	
443	CH 6630 : CH 6645	14.02	14.02	15.00	1.20	252.36	
444	CH 6645 : CH 6660	13.43	13.43	15.00	1.20	241.65	
445	CH 6660 : CH 6675	13.06	13.06	15.00	1.20	235.09	
446	CH 6675 : CH 6690	12.26	12.26	15.00	1.20	220.62	
447	CH 6690 : CH 6705	11.39	11.39	15.00	1.20	204.95	

Sl.No	Chainage	Desilting details					Remarks
		W (m)	Wd	L (m)		De-Silting Quantity (m3)	
448	CH 6705 : CH 6720	12.05	12.05	15.00	1.20	216.92	
449	CH 6720 : CH 6735	13.01	13.01	15.00	1.20	234.17	
450	CH 6735 : CH 6750	13.27	13.27	15.00	1.20	238.93	
451	CH 6750 : CH 6765	13.71	13.71	15.00	1.20	246.71	
452	CH 6765 : CH 6780	14.56	14.56	15.00	1.20	262.07	
453	CH 6780 : CH 6795	15.35	15.35	15.00	1.20	276.37	
454	CH 6795 : CH 6810	15.29	15.29	15.00	1.20	275.28	
455	CH 6810 : CH 6825	14.35	14.35	15.00	1.20	258.26	
456	CH 6825 : CH 6840	13.71	13.71	15.00	1.20	246.85	
457	CH 6840 : CH 6855	13.25	13.25	15.00	1.20	238.53	
458	CH 6855 : CH 6870	12.96	12.96	15.00	1.20	233.24	
459	CH 6870 : CH 6885	13.44	13.44	15.00	1.20	241.88	
460	CH 6885 : CH 6900	14.33	14.33	15.00	1.20	257.85	
461	CH 6900 : CH 6915	14.54	14.54	15.00	1.20	261.68	
462	CH 6915 : CH 6930	14.41	14.41	15.00	1.20	259.30	
463	CH 6930 : CH 6945	14.75	14.75	15.00	1.20	265.52	
464	CH 6945 : CH 6960	14.74	14.74	15.00	1.20	265.35	
465	CH 6960 : CH 6975	14.15	14.15	15.00	1.20	254.61	
466	CH 6975 : CH 6990	14.71	14.71	15.00	1.20	264.83	
467	CH 6990 : CH 7005	17.66	17.66	15.00	1.20	317.93	
468	CH 7005 : CH 7020	17.44	17.44	15.00	1.20	313.99	
469	CH 7020 : CH 7035	15.87	15.87	15.00	1.20	285.58	
470	CH 7035 : CH 7050	16.37	16.37	15.00	1.20	294.58	
471	CH 7050 : CH 7065	15.60	15.60	15.00	1.20	280.88	
472	CH 7065 : CH 7080	14.94	14.94	15.00	1.20	268.83	
473	CH 7080 : CH 7095	14.79	14.79	15.00	1.20	266.22	
474	CH 7095 : CH 7110	15.29	15.29	15.00	1.20	275.27	
475	CH 7110 : CH 7125	15.47	15.47	15.00	1.20	278.40	
476	CH 7125 : CH 7140	15.45	15.45	15.00	1.20	278.13	
477	CH 7140 : CH 7155	14.89	14.89	15.00	1.20	268.07	
478	CH 7155 : CH 7170	13.73	13.73	15.00	1.20	247.22	
479	CH 7170 : CH 7185	12.85	12.85	15.00	1.20	231.38	
480	CH 7185 : CH 7200	12.79	12.79	15.00	1.20	230.21	
481	CH 7200 : CH 7215	15.01	15.01	15.00	1.20	270.17	
482	CH 7215 : CH 7230	16.75	16.75	15.00	1.20	301.54	"
483	CH 7230 : CH 7245	22.85	22.85	15.00	1.20	411.32	"
484	CH 7245 : CH 7260	28.11	24.50	15.00	1.20	441.00	"
485	CH 7260 : CH 7275	17.48	17.48	15.00	1.20	314.56	
486	CH 7275 : CH 7290	12.84	12.84	15.00	1.20	231.05	
487	CH 7290 : CH 7305	9.40	9.40	15.00	1.20	169.17	
488	CH 7305 : CH 7320	9.09	9.09	15.00	1.20	163.54	
489	CH 7320 : CH 7335	10.59	10.59	15.00	1.20	190.63	
490	CH 7335 : CH 7350	11.93	11.93	15.00	1.20	214.81	
491	CH 7350 : CH 7365	14.62	14.62	15.00	1.20	263.12	
492	CH 7365 : CH 7380	18.72	18.72	15.00	1.20	337.01	
493	CH 7380 : CH 7395	18.20	18.20	15.00	1.20	327.66	
494	CH 7395 : CH 7410	14.11	14.11	15.00	1.20	253.91	
495	CH 7410 : CH 7425	13.98	13.98	15.00	1.20	251.66	
496	CH 7425 : CH 7440	15.54	15.54	15.00	1.20	279.77	
497	CH 7440 : CH 7455	15.19	15.19	15.00	1.20	273.41	
498	CH 7455 : CH 7470	15.40	15.40	15.00	1.20	277.22	
499	CH 7470 : CH 7485	14.59	14.59	15.00	1.20	262.67	
500	CH 7485 : CH 7500	13.05	13.05	15.00	1.20	234.84	
501	CH 7500 : CH 7515	14.34	14.34	15.00	1.20	258.05	
502	CH 7515 : CH 7530	15.30	15.30	15.00	1.20	275.47	
503	CH 7530 : CH 7545	15.58	15.58	15.00	1.20	280.37	

Sl.No	Chainage	Desilting details					Remarks
		W (m)	Wd	L (m)		De-Silting Quantity (m3)	
504	CH 7545 : CH 7560	16.14	16.14	15.00	1.20	290.57	
505	CH 7560 : CH 7575	16.07	16.07	15.00	1.20	289.22	
506	CH 7575 : CH 7590	16.02	16.02	15.00	1.20	288.41	
507	CH 7590 : CH 7605	16.49	16.49	15.00	1.20	296.76	
508	CH 7605 : CH 7620	16.33	16.33	15.00	1.20	293.90	
509	CH 7620 : CH 7635	16.41	16.41	15.00	1.20	295.45	
510	CH 7635 : CH 7650	16.60	16.60	15.00	1.20	298.80	
511	CH 7650 : CH 7665	14.60	14.60	15.00	1.20	262.84	
512	CH 7665 : CH 7680	11.01	11.01	15.00	1.20	198.23	
513	CH 7680 : CH 7695	10.26	10.26	15.00	1.20	184.64	
514	CH 7695 : CH 7710	12.10	12.10	15.00	1.20	217.85	
515	CH 7710 : CH 7725	13.07	13.07	15.00	1.20	235.27	
516	CH 7725 : CH 7740	13.22	13.22	15.00	1.20	237.87	
517	CH 7740 : CH 7755	12.99	12.99	15.00	1.20	233.79	
518	CH 7755 : CH 7770	12.64	12.64	15.00	1.20	227.43	
519	CH 7770 : CH 7785	12.28	12.28	15.00	1.20	221.00	
520	CH 7785 : CH 7800	12.32	12.32	15.00	1.20	221.71	
521	CH 7800 : CH 7815	12.44	12.44	15.00	1.20	223.98	
522	CH 7815 : CH 7830	12.30	12.30	15.00	1.20	221.42	
523	CH 7830 : CH 7845	12.39	12.39	15.00	1.20	223.08	
524	CH 7845 : CH 7860	12.66	12.66	15.00	1.20	227.92	
525	CH 7860 : CH 7875	12.79	12.79	15.00	1.20	230.23	
526	CH 7875 : CH 7890	12.76	12.76	15.00	1.20	229.59	
527	CH 7890 : CH 7905	12.60	12.60	15.00	1.20	226.77	
528	CH 7905 : CH 7920	12.52	12.52	15.00	1.20	225.42	
529	CH 7920 : CH 7935	12.51	12.51	15.00	1.20	225.11	
530	CH 7935 : CH 7950	12.47	12.47	15.00	1.20	224.54	
531	CH 7950 : CH 7965	12.49	12.49	15.00	1.20	224.75	
532	CH 7965 : CH 7980	12.51	12.51	15.00	1.20	225.21	
533	CH 7980 : CH 7995	12.54	12.54	15.00	1.20	225.77	
534	CH 7995 : CH 8010	12.37	12.37	15.00	1.20	222.57	
535	CH 8010 : CH 8025	11.18	11.18	15.00	1.20	201.15	
536	CH 8025 : CH 8040	10.33	10.33	15.00	1.20	185.86	
537	CH 8040 : CH 8055	10.27	10.27	15.00	1.20	184.90	
538	CH 8055 : CH 8070	9.91	9.91	15.00	1.20	178.42	
539	CH 8070 : CH 8085	9.64	9.64	15.00	1.20	173.45	
540	CH 8085 : CH 8100	9.48	9.48	15.00	1.20	170.64	
541	CH 8100 : CH 8115	10.19	10.19	15.00	1.20	183.39	
542	CH 8115 : CH 8130	18.38	18.38	15.00	1.20	330.75	
543	CH 8130 : CH 8145	18.52	18.52	15.00	1.20	333.41	
544	CH 8145 : CH 8160	9.59	9.59	15.00	1.20	172.62	
545	CH 8160 : CH 8175	7.94	7.94	15.00	1.20	142.83	
546	CH 8175 : CH 8190	7.95	7.95	15.00	1.20	143.12	
547	CH 8190 : CH 8205	8.08	8.08	15.00	1.20	145.45	
548	CH 8205 : CH 8220	8.37	8.37	15.00	1.20	150.58	
549	CH 8220 : CH 8235	8.51	8.51	15.00	1.20	153.26	
550	CH 8235 : CH 8250	8.25	8.25	15.00	1.20	148.47	
551	CH 8250 : CH 8265	8.27	8.27	15.00	1.20	148.83	
552	CH 8265 : CH 8280	8.13	8.13	15.00	1.20	146.35	
553	CH 8280 : CH 8295	7.87	7.87	15.00	1.20	141.62	
554	CH 8295 : CH 8310	9.35	9.35	15.00	1.20	168.34	
555	CH 8310 : CH 8325	11.07	11.07	15.00	1.20	199.21	
556	CH 8325 : CH 8340	11.46	11.46	15.00	1.20	206.30	
557	CH 8340 : CH 8355	11.41	11.41	15.00	1.20	205.33	
558	CH 8355 : CH 8370	11.30	11.30	15.00	1.20	203.36	
559	CH 8370 : CH 8385	11.16	11.16	15.00	1.20	200.85	

Sl.No	Chainage	Desilting details					Remarks
		W (m)	Wd	L (m)		De-Silting Quantity (m3)	
560	CH 8385 : CH 8400	10.36	10.36	15.00	1.20	186.42	
561	CH 8400 : CH 8415	9.47	9.47	15.00	1.20	170.52	
562	CH 8415 : CH 8430	9.06	9.06	15.00	1.20	163.11	
563	CH 8430 : CH 8445	8.42	8.42	15.00	1.20	151.47	
564	CH 8445 : CH 8460	8.58	8.58	15.00	1.20	154.44	
565	CH 8460 : CH 8475	9.37	9.37	15.00	1.20	168.73	
566	CH 8475 : CH 8490	9.36	9.36	15.00	1.20	168.41	
567	CH 8490 : CH 8505	9.33	9.33	15.00	1.20	167.90	
568	CH 8505 : CH 8520	9.79	9.79	15.00	1.20	176.25	
569	CH 8520 : CH 8535	10.30	10.30	15.00	1.20	185.39	
570	CH 8535 : CH 8550	8.86	8.86	15.00	1.20	159.50	
571	CH 8550 : CH 8565	7.83	7.83	15.00	1.20	140.86	
572	CH 8565 : CH 8580	8.72	8.72	15.00	1.20	156.99	
573	CH 8580 : CH 8595	9.07	9.07	15.00	1.20	163.18	
574	CH 8595 : CH 8610	9.34	9.34	15.00	1.20	168.05	
575	CH 8610 : CH 8625	9.84	9.84	15.00	1.20	177.18	
576	CH 8625 : CH 8640	10.15	10.15	15.00	1.20	182.75	
577	CH 8640 : CH 8655	10.03	10.03	15.00	1.20	180.45	
578	CH 8655 : CH 8670	9.98	9.98	15.00	1.20	179.57	
579	CH 8670 : CH 8685	10.15	10.15	15.00	1.20	182.64	
580	CH 8685 : CH 8700	10.50	10.50	15.00	1.20	189.04	
581	CH 8700 : CH 8715	11.05	11.05	15.00	1.20	198.88	
582	CH 8715 : CH 8730	11.77	11.77	15.00	1.20	211.77	
583	CH 8730 : CH 8745	12.44	12.44	15.00	1.20	224.00	
584	CH 8745 : CH 8760	12.73	12.73	15.00	1.20	229.19	
585	CH 8760 : CH 8775	12.74	12.74	15.00	1.20	229.29	
586	CH 8775 : CH 8790	8.61	8.61	15.00	1.20	154.97	
587	CH 8790 : CH 8805	6.53	6.53	15.00	1.20	117.49	
588	CH 8805 : CH 8820	8.62	8.62	15.00	1.20	155.21	
589	CH 8820 : CH 8835	8.93	8.93	15.00	1.20	160.72	
590	CH 8835 : CH 8850	9.67	9.67	15.00	1.20	174.03	
591	CH 8850 : CH 8865	7.65	7.65	15.00	1.20	137.70	
592	CH 8865 : CH 8880	8.75	8.75	15.00	1.20	157.48	
593	CH 8880 : CH 8895	28.73	24.50	15.00	1.00	367.50	
594	CH 8895 : CH 8910	45.14	24.50	15.00	0.70	257.25	"
595	CH 8910 : CH 8925	45.35	24.50	15.00	0.70	257.25	"
596	CH 8925 : CH 8940	53.12	24.50	15.00	0.70	257.25	"
597	CH 8940 : CH 8955	69.01	24.50	15.00	0.70	257.25	"
598	CH 8955 : CH 8970	74.80	24.50	15.00	0.70	257.25	"
599	CH 8970 : CH 8985	71.82	24.50	15.00	0.70	257.25	"
600	CH 8985 : CH 9000	71.44	24.50	15.00	0.70	257.25	"
601	CH 9000 : CH 9015	71.63	24.50	15.00	0.70	257.25	"
602	CH 9015 : CH 9030	71.91	24.50	15.00	0.70	257.25	"
603	CH 9030 : CH 9045	73.15	24.50	15.00	0.70	257.25	"
604	CH 9045 : CH 9060	72.67	24.50	15.00	0.70	257.25	"
605	CH 9060 : CH 9075	69.39	24.50	15.00	0.70	257.25	"
606	CH 9075 : CH 9090	66.64	24.50	15.00	0.70	257.25	"
607	CH 9090 : CH 9105	65.20	24.50	15.00	0.70	257.25	"
608	CH 9105 : CH 9120	65.51	24.50	15.00	0.70	257.25	"
609	CH 9120 : CH 9135	66.33	24.50	15.00	0.70	257.25	"
610	CH 9135 : CH 9150	67.38	24.50	15.00	0.70	257.25	"
611	CH 9150 : CH 9165	68.89	24.50	15.00	0.70	257.25	"
612	CH 9165 : CH 9180	72.09	24.50	15.00	0.70	257.25	"
613	CH 9180 : CH 9195	76.78	24.50	15.00	0.70	257.25	"
614	CH 9195 : CH 9210	80.56	24.50	15.00	0.70	257.25	"
615	CH 9210 : CH 9225	84.22	24.50	15.00	0.70	257.25	"

Sl.No	Chainage	Desilting details					Remarks
		W (m)	Wd	L (m)		De-Silting Quantity (m3)	
616	CH 9225 : CH 9240	87.33	24.50	15.00	0.70	257.25	"
617	CH 9240 : CH 9255	88.77	24.50	15.00	0.70	257.25	"
618	CH 9255 : CH 9270	90.25	24.50	15.00	0.70	257.25	"
619	CH 9270 : CH 9285	93.18	24.50	15.00	0.70	257.25	"
620	CH 9285 : CH 9300	95.57	24.50	15.00	0.70	257.25	"
621	CH 9300 : CH 9315	95.92	24.50	15.00	0.70	257.25	"
622	CH 9315 : CH 9330	95.65	24.50	15.00	0.70	257.25	"
623	CH 9330 : CH 9345	95.95	24.50	15.00	0.70	257.25	"
624	CH 9345 : CH 9360	93.67	24.50	15.00	0.70	257.25	"
625	CH 9360 : CH 9375	86.92	24.50	15.00	0.70	257.25	"
626	CH 9375 : CH 9390	91.45	24.50	15.00	0.70	257.25	"
627	CH 9390 : CH 9405	99.38	24.50	15.00	0.70	257.25	"
628	CH 9405 : CH 9420	96.29	24.50	15.00	0.70	257.25	"
629	CH 9420 : CH 9435	90.94	24.50	15.00	0.70	257.25	"
630	CH 9435 : CH 9450	88.15	24.50	15.00	0.70	257.25	"
631	CH 9450 : CH 9465	88.64	24.50	15.00	0.70	257.25	"
632	CH 9465 : CH 9480	87.56	24.50	15.00	0.70	257.25	"
633	CH 9480 : CH 9495	83.71	24.50	15.00	0.70	257.25	"
634	CH 9495 : CH 9510	77.89	24.50	15.00	0.70	257.25	"
635	CH 9510 : CH 9525	72.00	24.50	15.00	0.70	257.25	"
636	CH 9525 : CH 9540	66.20	24.50	15.00	0.70	257.25	"
637	CH 9540 : CH 9555	60.62	24.50	15.00	0.70	257.25	"
638	CH 9555 : CH 9570	54.40	24.50	15.00	0.70	257.25	"
639	CH 9570 : CH 9585	47.16	24.50	15.00	0.70	257.25	"
640	CH 9585 : CH 9600	41.04	24.50	15.00	0.70	257.25	"
641	CH 9600 : CH 9615	44.41	24.50	15.00	0.70	257.25	"
642	CH 9615 : CH 9630	60.63	24.50	15.00	0.70	257.25	"
643	CH 9630 : CH 9645	79.97	24.50	15.00	0.50	183.75	"
644	CH 9645 : CH 9660	90.19	24.50	15.00	0.50	183.75	"
645	CH 9660 : CH 9675	93.14	24.50	15.00	0.50	183.75	"
646	CH 9675 : CH 9690	97.81	24.50	15.00	0.50	183.75	"
647	CH 9690 : CH 9705	103.96	24.50	15.00	0.50	183.75	"
648	CH 9705 : CH 9720	111.06	24.50	15.00	0.50	183.75	"
649	CH 9720 : CH 9735	118.45	24.50	15.00	0.50	183.75	"
650	CH 9735 : CH 9750	123.13	24.50	15.00	0.50	183.75	"
651	CH 9750 : CH 9765	123.42	24.50	15.00	0.50	183.75	"
652	CH 9765 : CH 9780	122.01	24.50	15.00	0.50	183.75	"
653	CH 9780 : CH 9795	121.36	24.50	15.00	0.50	183.75	"
654	CH 9795 : CH 9810	121.07	24.50	15.00	0.50	183.75	"
655	CH 9810 : CH 9825	123.94	24.50	15.00	0.50	183.75	"
656	CH 9825 : CH 9840	129.23	24.50	15.00	0.50	183.75	"
657	CH 9840 : CH 9855	133.05	24.50	15.00	0.50	183.75	"
658	CH 9855 : CH 9870	135.95	24.50	15.00	0.50	183.75	"
659	CH 9870 : CH 9885	138.70	24.50	15.00	0.50	183.75	"
660	CH 9885 : CH 9900	142.48	24.50	15.00	0.50	183.75	"
661	CH 9900 : CH 9915	147.10	24.50	15.00	0.50	183.75	"
662	CH 9915 : CH 9930	154.03	24.50	15.00	0.50	183.75	"
663	CH 9930 : CH 9945	163.78	24.50	15.00	0.50	183.75	"
664	CH 9945 : CH 9960	198.86	24.50	15.00	0.50	183.75	"
665	CH 9960 : CH 9975	230.46	24.50	15.00	0.50	183.75	"
666	CH 9975 : CH 9990	234.72	24.50	15.00	0.50	183.75	"
667	CH 9990 : CH 10005	238.51	24.50	15.00	0.50	183.75	"
668	CH 10005 : CH 10020	241.81	24.50	15.00	0.50	183.75	"
669	CH 10020 : CH 10035	246.76	24.50	15.00	0.50	183.75	"
670	CH 10035 : CH 10050	243.21	24.50	15.00	0.50	183.75	"
671	CH 10050 : CH 10065	238.80	24.50	15.00	0.50	183.75	"

Sl.No	Chainage	Desilting details					Remarks
		W (m)	Wd	L (m)		De-Silting Quantity (m3)	
672	CH 10065 : CH 10080	244.57	24.50	15.00	0.50	183.75	"
673	CH 10080 : CH 10095	252.73	24.50	15.00	0.50	183.75	"
674	CH 10095 : CH 10110	259.00	24.50	15.00	0.50	183.75	"
675	CH 10110 : CH 10125	252.45	24.50	15.00	0.50	183.75	"
676	CH 10125 : CH 10140	228.10	24.50	15.00	0.50	183.75	"
677	CH 10140 : CH 10155	195.06	24.50	15.00	0.50	183.75	"
678	CH 10155 : CH 10170	172.57	24.50	15.00	0.50	183.75	"
679	CH 10170 : CH 10185	169.73	24.50	15.00	0.50	183.75	"
680	CH 10185 : CH 10200	177.30	24.50	15.00	0.50	183.75	"
681	CH 10200 : CH 10215	183.86	24.50	15.00	0.50	183.75	"
682	CH 10215 : CH 10230	187.13	24.50	15.00	0.50	183.75	"
683	CH 10230 : CH 10245	190.89	24.50	15.00	0.50	183.75	"
684	CH 10245 : CH 10260	193.99	24.50	15.00	0.50	183.75	"
685	CH 10260 : CH 10275	197.61	24.50	15.00	0.50	183.75	"
686	CH 10275 : CH 10290	203.15	24.50	15.00	0.50	183.75	"
687	CH 10290 : CH 10305	208.94	24.50	15.00	0.50	183.75	"
688	CH 10305 : CH 10320	214.11	24.50	15.00	0.50	183.75	"
689	CH 10320 : CH 10335	219.04	24.50	15.00	0.50	183.75	"
690	CH 10335 : CH 10350	223.37	24.50	15.00	0.50	183.75	"
691	CH 10350 : CH 10365	226.63	24.50	15.00	0.50	183.75	"
692	CH 10365 : CH 10380	229.60	24.50	15.00	0.50	183.75	"
693	CH 10380 : CH 10395	232.94	24.50	15.00	0.50	183.75	"
694	CH 10395 : CH 10410	236.24	24.50	15.00	0.50	183.75	"
695	CH 10410 : CH 10425	236.76	24.50	15.00	0.50	183.75	"
696	CH 10425 : CH 10440	235.76	24.50	15.00	0.50	183.75	"
697	CH 10440 : CH 10455	236.06	24.50	15.00	0.50	183.75	"
698	CH 10455 : CH 10470	237.04	24.50	15.00	0.50	183.75	"
699	CH 10470 : CH 10485	237.68	24.50	15.00	0.50	183.75	"
700	CH 10485 : CH 10500	236.91	24.50	15.00	0.50	183.75	"
701	CH 10500 : CH 10515	235.75	24.50	15.00	0.50	183.75	"
702	CH 10515 : CH 10530	232.99	24.50	15.00	0.50	183.75	"
703	CH 10530 : CH 10545	229.15	24.50	15.00	0.50	183.75	"
704	CH 10545 : CH 10560	225.20	24.50	15.00	0.50	183.75	"
705	CH 10560 : CH 10575	219.98	24.50	15.00	0.50	183.75	"
706	CH 10575 : CH 10590	219.61	24.50	15.00	0.50	183.75	"
707	CH 10590 : CH 10605	222.04	24.50	15.00	0.50	183.75	"
708	CH 10605 : CH 10620	223.67	24.50	15.00	0.50	183.75	"
709	CH 10620 : CH 10635	227.85	24.50	15.00	0.50	183.75	"
710	CH 10635 : CH 10650	232.74	24.50	15.00	0.50	183.75	"
711	CH 10650 : CH 10665	238.00	24.50	15.00	0.50	183.75	"
712	CH 10665 : CH 10680	241.35	24.50	15.00	0.50	183.75	"
713	CH 10680 : CH 10695	240.98	24.50	15.00	0.50	183.75	"
714	CH 10695 : CH 10710	239.69	24.50	15.00	0.50	183.75	"
715	CH 10710 : CH 10725	239.54	24.50	15.00	0.50	183.75	"
716	CH 10725 : CH 10740	240.78	24.50	15.00	0.50	183.75	"
717	CH 10740 : CH 10755	242.50	24.50	15.00	0.50	183.75	"
718	CH 10755 : CH 10770	244.55	24.50	15.00	0.50	183.75	"
719	CH 10770 : CH 10785	246.84	24.50	15.00	0.50	183.75	"
720	CH 10785 : CH 10800	246.99	24.50	15.00	0.50	183.75	"
721	CH 10800 : CH 10815	248.20	24.50	15.00	0.50	183.75	"
722	CH 10815 : CH 10830	254.53	24.50	15.00	0.50	183.75	"
723	CH 10830 : CH 10845	260.70	24.50	15.00	0.50	183.75	"
724	CH 10845 : CH 10860	265.08	24.50	15.00	0.50	183.75	"
725	CH 10860 : CH 10875	269.72	24.50	15.00	0.50	183.75	"
726	CH 10875 : CH 10890	274.46	24.50	15.00	0.50	183.75	"
727	CH 10890 : CH 10905	279.27	24.50	15.00	0.50	183.75	"

Sl.No	Chainage	Desilting details					Remarks
		W (m)	Wd	L (m)		De-Silting Quantity (m3)	
728	CH 10905 : CH 10920	284.08	24.50	15.00	0.50	183.75	"
729	CH 10920 : CH 10935	288.46	24.50	15.00	0.50	183.75	"
730	CH 10935 : CH 10950	292.25	24.50	15.00	0.50	183.75	"
731	CH 10950 : CH 10965	295.09	24.50	15.00	0.50	183.75	"
732	CH 10965 : CH 10980	295.35	24.50	15.00	0.50	183.75	"
733	CH 10980 : CH 10995	297.21	24.50	15.00	0.50	183.75	"
734	CH 10995 : CH 11010	302.48	24.50	15.00	0.50	183.75	"
735	CH 11010 : CH 11025	306.20	24.50	15.00	0.50	183.75	"
736	CH 11025 : CH 11040	306.73	24.50	15.00	0.50	183.75	"
737	CH 11040 : CH 11055	305.64	24.50	15.00	0.50	183.75	"
738	CH 11055 : CH 11070	302.00	24.50	15.00	0.50	183.75	"
739	CH 11070 : CH 11085	294.68	24.50	15.00	0.50	183.75	"
740	CH 11085 : CH 11100	288.17	24.50	15.00	0.50	183.75	"
741	CH 11100 : CH 11115	285.42	24.50	15.00	0.50	183.75	"
742	CH 11115 : CH 11130	284.35	24.50	15.00	0.50	183.75	"
743	CH 11130 : CH 11145	159.74	24.50	15.00	0.50	183.75	"
744	CH 11145 : CH 11150	33.88	24.50	5.00	0.50	61.25	"
	Total Quantity					**1,30,545.23**	
745	De-silting quantity of subcanals (26 nos)	3.06		12042.00	0.30	11045.89	
	Grand Total					**1,41,591.12**	

Thevara _ Perandoor Canal							
Sl.No	Chainage	Desilting details					Remarks
		W (m)	Wd (m)	L (m)		De-Silting Quantity (m3)	
1	CH 000 : CH 15	25.30	24.50	15.00	0.70	257.25	w>16.50
2	CH 15 : CH 30	49.30	24.50	15.00	0.70	257.25	"
3	CH 30 : CH 45	67.07	24.50	15.00	0.70	257.25	"
4	CH 45 : CH 60	64.31	24.50	15.00	0.70	257.25	"
5	CH 60 : CH 75	58.34	24.50	15.00	0.70	257.25	"
6	CH 75 : CH 90	53.13	24.50	15.00	0.70	257.25	"
7	CH 90 : CH 105	50.09	24.50	15.00	0.70	257.25	"
8	CH 105 : CH 120	48.44	24.50	15.00	0.70	257.25	"
9	CH 120 : CH 135	47.32	24.50	15.00	0.70	257.25	"
10	CH 135 : CH 150	43.11	24.50	15.00	0.70	257.25	"
11	CH 150 : CH 165	38.61	24.50	15.00	0.70	257.25	"
12	CH 165 : CH 180	37.13	24.50	15.00	0.70	257.25	"
13	CH 180 : CH 195	35.38	24.50	15.00	0.70	257.25	"
14	CH 195 : CH 210	33.55	24.50	15.00	0.70	257.25	"
15	CH 210 : CH 225	35.58	24.50	15.00	0.70	257.25	"
16	CH 225 : CH 240	45.02	24.50	15.00	0.70	257.25	"
17	CH 240 : CH 255	54.70	24.50	15.00	0.70	257.25	"
18	CH 255 : CH 270	61.94	24.50	15.00	0.70	257.25	"
19	CH 270 : CH 285	72.24	24.50	15.00	0.70	257.25	"
20	CH 285 : CH 300	84.74	24.50	15.00	0.70	257.25	"
21	CH 300 : CH 315	97.48	24.50	15.00	0.70	257.25	"
22	CH 315 : CH 330	109.16	24.50	15.00	0.70	257.25	"
23	CH 330 : CH 345	113.84	24.50	15.00	0.70	257.25	"
24	CH 345 : CH 360	110.19	24.50	15.00	0.70	257.25	"
25	CH 360 : CH 375	106.99	24.50	15.00	0.70	257.25	"
26	CH 375 : CH 390	107.36	24.50	15.00	0.70	257.25	"
27	CH 390 : CH 405	105.45	24.50	15.00	0.70	257.25	"
28	CH 405 : CH 420	99.31	24.50	15.00	0.70	257.25	"
29	CH 420 : CH 435	91.69	24.50	15.00	0.70	257.25	"
30	CH 435 : CH 450	82.75	24.50	15.00	0.70	257.25	"
31	CH 450 : CH 465	73.05	24.50	15.00	0.70	257.25	"
32	CH 465 : CH 480	66.41	24.50	15.00	0.70	257.25	"
33	CH 480 : CH 495	64.29	24.50	15.00	0.70	257.25	"
34	CH 495 : CH 510	63.95	24.50	15.00	0.70	257.25	"
35	CH 510 : CH 525	66.68	24.50	15.00	0.70	257.25	"
36	CH 525 : CH 540	72.52	24.50	15.00	0.70	257.25	"
37	CH 540 : CH 555	77.48	24.50	15.00	0.70	257.25	"
38	CH 555 : CH 570	79.59	24.50	15.00	0.70	257.25	"
39	CH 570 : CH 585	79.07	24.50	15.00	0.70	257.25	"
40	CH 585 : CH 600	78.42	24.50	15.00	0.70	257.25	"
41	CH 600 : CH 615	78.58	24.50	15.00	0.70	257.25	"
42	CH 615 : CH 630	77.31	24.50	15.00	0.70	257.25	"
43	CH 630 : CH 645	74.03	24.50	15.00	0.70	257.25	"
44	CH 645 : CH 660	70.41	24.50	15.00	0.70	257.25	"
45	CH 660 : CH 675	66.81	24.50	15.00	0.70	257.25	"
46	CH 675 : CH 690	63.26	24.50	15.00	0.70	257.25	"
47	CH 690 : CH 705	60.14	24.50	15.00	0.70	257.25	"
48	CH 705 : CH 720	57.73	24.50	15.00	0.70	257.25	"
49	CH 720 : CH 735	55.71	24.50	15.00	0.70	257.25	"
50	CH 735 : CH 750	54.23	24.50	15.00	0.70	257.25	"
51	CH 750 : CH 765	53.20	24.50	15.00	0.70	257.25	"
52	CH 765 : CH 780	52.46	24.50	15.00	0.70	257.25	"

Sl.No	Chainage	Desilting details					Remarks
		W (m)	Wd (m)	L (m)		De-Silting Quantity (m3)	
53	CH 780 : CH 795	51.64	24.50	15.00	0.70	257.25	"
54	CH 795 : CH 810	50.61	24.50	15.00	0.70	257.25	"
55	CH 810 : CH 825	50.87	24.50	15.00	0.70	257.25	"
56	CH 825 : CH 840	51.96	24.50	15.00	0.70	257.25	"
57	CH 840 : CH 855	52.91	24.50	15.00	0.70	257.25	"
58	CH 855 : CH 870	54.95	24.50	15.00	0.70	257.25	"
59	CH 870 : CH 885	56.77	24.50	15.00	0.70	257.25	"
60	CH 885 : CH 900	54.49	24.50	15.00	0.70	257.25	"
61	CH 900 : CH 915	49.51	24.50	15.00	0.70	257.25	"
62	CH 915 : CH 930	46.68	24.50	15.00	0.70	257.25	"
63	CH 930 : CH 945	46.08	24.50	15.00	0.70	257.25	"
64	CH 945 : CH 960	46.45	24.50	15.00	0.70	257.25	"
65	CH 960 : CH 975	48.36	24.50	15.00	0.70	257.25	"
66	CH 975 : CH 990	50.81	24.50	15.00	0.70	257.25	"
67	CH 990 : CH 1005	52.51	24.50	15.00	0.70	257.25	"
68	CH 1005 : CH 1020	50.70	24.50	15.00	0.70	257.25	"
69	CH 1020 : CH 1035	45.11	24.50	15.00	0.70	257.25	"
70	CH 1035 : CH 1050	39.05	24.50	15.00	0.70	257.25	"
71	CH 1050 : CH 1065	33.40	24.50	15.00	0.70	257.25	"
72	CH 1065 : CH 1080	30.51	24.50	15.00	0.70	257.25	"
73	CH 1080 : CH 1095	30.80	24.50	15.00	0.70	257.25	"
74	CH 1095 : CH 1110	32.56	24.50	15.00	0.70	257.25	"
75	CH 1110 : CH 1125	32.79	24.50	15.00	0.70	257.25	"
76	CH 1125 : CH 1140	31.07	24.50	15.00	0.70	257.25	"
77	CH 1140 : CH 1155	31.90	24.50	15.00	0.70	257.25	"
78	CH 1155 : CH 1170	39.23	24.50	15.00	0.70	257.25	"
79	CH 1170 : CH 1185	52.13	24.50	15.00	0.70	257.25	"
80	CH 1185 : CH 1200	52.32	24.50	15.00	0.70	257.25	"
81	CH 1200 : CH 1215	49.13	24.50	15.00	0.70	257.25	"
82	CH 1215 : CH 1230	47.09	24.50	15.00	0.70	257.25	"
83	CH 1230 : CH 1245	48.96	24.50	15.00	0.70	257.25	"
84	CH 1245 : CH 1260	54.42	24.50	15.00	0.70	257.25	"
85	CH 1260 : CH 1275	54.95	24.50	15.00	0.70	257.25	"
86	CH 1275 : CH 1290	50.32	24.50	15.00	0.70	257.25	"
87	CH 1290 : CH 1305	48.22	24.50	15.00	0.70	257.25	"
88	CH 1305 : CH 1320	47.20	24.50	15.00	0.70	257.25	"
89	CH 1320 : CH 1335	43.99	24.50	15.00	0.70	257.25	"
90	CH 1335 : CH 1350	39.31	24.50	15.00	0.70	257.25	"
91	CH 1350 : CH 1365	35.56	24.50	15.00	0.70	257.25	"
92	CH 1365 : CH 1380	34.40	24.50	15.00	0.70	257.25	"
93	CH 1380 : CH 1395	35.29	24.50	15.00	0.70	257.25	"
94	CH 1395 : CH 1410	37.35	24.50	15.00	0.70	257.25	"
95	CH 1410 : CH 1425	40.04	24.50	15.00	0.70	257.25	"
96	CH 1425 : CH 1440	43.77	24.50	15.00	0.70	257.25	"
97	CH 1440 : CH 1455	47.00	24.50	15.00	0.70	257.25	"
98	CH 1455 : CH 1470	47.51	24.50	15.00	0.70	257.25	"
99	CH 1470 : CH 1485	46.26	24.50	15.00	0.70	257.25	"
100	CH 1485 : CH 1500	46.62	24.50	15.00	0.70	257.25	"
101	CH 1500 : CH 1515	45.56	24.50	15.00	0.70	257.25	"
102	CH 1515 : CH 1530	42.11	24.50	15.00	0.70	257.25	"
103	CH 1530 : CH 1545	38.74	24.50	15.00	0.70	257.25	"
104	CH 1545 : CH 1560	36.90	24.50	15.00	0.70	257.25	"
105	CH 1560 : CH 1575	36.53	24.50	15.00	0.70	257.25	"
106	CH 1575 : CH 1590	37.47	24.50	15.00	0.70	257.25	"

Sl.No	Chainage	Desilting details					Remarks
		W (m)	Wd (m)	L (m)		De-Silting Quantity (m3)	
107	CH 1590 : CH 1605	42.37	24.50	15.00	0.70	257.25	"
108	CH 1605 : CH 1620	48.95	24.50	15.00	0.70	257.25	"
109	CH 1620 : CH 1635	54.54	24.50	15.00	0.70	257.25	"
110	CH 1635 : CH 1650	58.02	24.50	15.00	0.70	257.25	"
111	CH 1650 : CH 1665	60.78	24.50	15.00	0.70	257.25	"
112	CH 1665 : CH 1680	63.63	24.50	15.00	0.70	257.25	"
113	CH 1680 : CH 1695	67.95	24.50	15.00	0.70	257.25	"
114	CH 1695 : CH 1710	60.83	24.50	15.00	0.70	257.25	"
115	CH 1710 : CH 1725	45.46	24.50	15.00	0.70	257.25	"
116	CH 1725 : CH 1740	36.95	24.50	15.00	0.70	257.25	"
117	CH 1740 : CH 1755	36.28	24.50	15.00	0.70	257.25	"
118	CH 1755 : CH 1770	40.92	24.50	15.00	0.70	257.25	"
119	CH 1770 : CH 1785	40.78	24.50	15.00	0.70	257.25	"
120	CH 1785 : CH 1800	37.79	24.50	15.00	0.70	257.25	"
121	CH 1800 : CH 1815	36.01	24.50	15.00	0.70	257.25	"
122	CH 1815 : CH 1830	34.74	24.50	15.00	0.70	257.25	"
123	CH 1830 : CH 1845	33.26	24.50	15.00	0.70	257.25	"
124	CH 1845 : CH 1860	31.66	24.50	15.00	0.70	257.25	"
125	CH 1860 : CH 1875	31.74	24.50	15.00	0.70	257.25	"
126	CH 1875 : CH 1890	33.71	24.50	15.00	0.70	257.25	"
127	CH 1890 : CH 1905	35.89	24.50	15.00	0.70	257.25	"
128	CH 1905 : CH 1920	33.32	24.50	15.00	0.70	257.25	"
129	CH 1920 : CH 1935	30.38	24.50	15.00	0.70	257.25	"
130	CH 1935 : CH 1950	31.36	24.50	15.00	0.70	257.25	"
131	CH 1950 : CH 1965	30.72	24.50	15.00	0.70	257.25	"
132	CH 1965 : CH 1980	28.36	24.50	15.00	0.70	257.25	"
133	CH 1980 : CH 1995	26.91	24.50	15.00	0.70	257.25	"
134	CH 1995 : CH 2010	27.12	24.50	15.00	0.70	257.25	"
135	CH 2010 : CH 2025	28.12	24.50	15.00	0.70	257.25	"
136	CH 2025 : CH 2040	30.64	24.50	15.00	0.70	257.25	"
137	CH 2040 : CH 2055	32.85	24.50	15.00	0.70	257.25	"
138	CH 2055 : CH 2070	34.69	24.50	15.00	0.70	257.25	"
139	CH 2070 : CH 2085	27.28	24.50	15.00	0.70	257.25	"
140	CH 2085 : CH 2100	17.71	17.71	15.00	0.70	185.95	
141	CH 2100 : CH 2115	16.21	16.21	15.00	0.70	170.16	
142	CH 2115 : CH 2130	14.08	14.08	15.00	0.70	147.86	
143	CH 2130 : CH 2145	14.33	14.33	15.00	0.70	150.49	
144	CH 2145 : CH 2160	16.72	16.72	15.00	0.70	175.51	w>16.50
145	CH 2160 : CH 2175	18.04	18.04	15.00	0.70	189.43	"
146	CH 2175 : CH 2190	17.73	17.73	15.00	0.70	186.21	"
147	CH 2190 : CH 2205	18.18	18.18	15.00	0.70	190.88	"
148	CH 2205 : CH 2220	20.37	20.37	15.00	0.70	213.88	"
149	CH 2220 : CH 2235	22.16	22.16	15.00	0.70	232.72	"
150	CH 2235 : CH 2250	21.40	21.40	15.00	0.70	224.73	"
151	CH 2250 : CH 2265	19.76	19.76	15.00	0.70	207.44	"
152	CH 2265 : CH 2280	19.52	19.52	15.00	0.70	204.91	"
153	CH 2280 : CH 2295	19.57	19.57	15.00	0.70	205.53	"
154	CH 2295 : CH 2310	20.06	20.06	15.00	0.70	210.65	"
155	CH 2310 : CH 2325	20.84	20.84	15.00	0.70	218.80	"
156	CH 2325 : CH 2340	20.73	20.73	15.00	0.70	217.67	"
157	CH 2340 : CH 2355	19.88	19.88	15.00	0.70	208.76	"
158	CH 2355 : CH 2370	19.58	19.58	15.00	0.70	205.62	"
159	CH 2370 : CH 2385	19.32	19.32	15.00	0.70	202.86	"
160	CH 2385 : CH 2400	19.27	19.27	15.00	0.70	202.36	"

Sl.No	Chainage	Desilting details					Remarks
		W (m)	Wd (m)	L (m)		De-Silting Quantity (m3)	
161	CH 2400 : CH 2415	20.64	20.64	15.00	0.70	216.70	"
162	CH 2415 : CH 2430	21.16	21.16	15.00	0.70	222.23	"
163	CH 2430 : CH 2445	21.62	21.62	15.00	0.70	226.97	"
164	CH 2445 : CH 2460	24.05	24.05	15.00	0.70	252.51	"
165	CH 2460 : CH 2475	24.44	24.44	15.00	0.70	256.66	"
166	CH 2475 : CH 2490	24.67	24.50	15.00	0.70	257.25	"
167	CH 2490 : CH 2505	25.07	24.50	15.00	0.70	257.25	"
168	CH 2505 : CH 2520	27.40	24.50	15.00	0.70	257.25	"
169	CH 2520 : CH 2535	23.59	23.59	15.00	0.70	247.71	"
170	CH 2535 : CH 2550	20.26	20.26	15.00	0.70	212.76	"
171	CH 2550 : CH 2565	33.32	24.50	15.00	0.70	257.25	"
172	CH 2565 : CH 2580	37.03	24.50	15.00	0.70	257.25	"
173	CH 2580 : CH 2595	25.38	24.50	15.00	0.70	257.25	"
174	CH 2595 : CH 2610	20.51	20.51	15.00	0.70	215.31	
175	CH 2610 : CH 2625	17.70	17.70	15.00	0.70	185.83	
176	CH 2625 : CH 2640	14.28	14.28	15.00	0.70	149.89	
177	CH 2640 : CH 2655	14.45	14.45	15.00	0.70	151.73	
178	CH 2655 : CH 2670	14.11	14.11	15.00	0.70	148.12	
179	CH 2670 : CH 2685	12.57	12.57	15.00	0.70	131.97	
180	CH 2685 : CH 2700	13.48	13.48	15.00	0.70	141.56	
181	CH 2700 : CH 2715	16.65	16.65	15.00	0.70	174.80	w>16.50
182	CH 2715 : CH 2730	18.48	18.48	15.00	0.70	194.02	
183	CH 2730 : CH 2745	18.93	18.93	15.00	0.70	198.78	
184	CH 2745 : CH 2760	13.93	13.93	15.00	0.70	146.29	
185	CH 2760 : CH 2775	11.35	11.35	15.00	0.70	119.18	
186	CH 2775 : CH 2790	10.78	10.78	15.00	0.70	113.14	
187	CH 2790 : CH 2805	10.53	10.53	15.00	0.70	110.54	
188	CH 2805 : CH 2820	10.65	10.65	15.00	0.70	111.85	
189	CH 2820 : CH 2835	14.76	14.76	15.00	0.70	155.02	
190	CH 2835 : CH 2850	14.04	14.04	15.00	0.70	147.39	
191	CH 2850 : CH 2865	17.50	17.50	15.00	0.70	183.78	
192	CH 2865 : CH 2880	18.65	18.65	15.00	0.70	195.85	
193	CH 2880 : CH 2895	14.25	14.25	15.00	0.70	149.64	
194	CH 2895 : CH 2910	12.74	12.74	15.00	0.70	133.76	
195	CH 2910 : CH 2925	12.40	12.40	15.00	0.70	130.18	
196	CH 2925 : CH 2940	11.22	11.22	15.00	0.70	117.78	
197	CH 2940 : CH 2955	10.75	10.75	15.00	0.70	112.92	
198	CH 2955 : CH 2970	9.02	9.02	15.00	0.70	94.70	
199	CH 2970 : CH 2985	8.01	8.01	15.00	0.70	84.14	
200	CH 2985 : CH 3000	10.35	10.35	15.00	0.70	108.65	
201	CH 3000 : CH 3015	11.84	11.84	15.00	0.70	124.34	
202	CH 3015 : CH 3030	11.67	11.67	15.00	0.70	122.52	
203	CH 3030 : CH 3045	12.09	12.09	15.00	0.70	126.97	
204	CH 3045 : CH 3060	12.91	12.91	15.00	0.70	135.56	
205	CH 3060 : CH 3075	14.78	14.78	15.00	0.70	155.22	
206	CH 3075 : CH 3090	15.54	15.54	15.00	0.70	163.20	
207	CH 3090 : CH 3105	16.50	16.50	15.00	0.70	173.30	
208	CH 3105 : CH 3120	16.63	16.63	15.00	0.70	174.58	
209	CH 3120 : CH 3135	12.09	12.09	15.00	0.70	126.99	
210	CH 3135 : CH 3150	9.09	9.09	15.00	0.70	95.43	
211	CH 3150 : CH 3165	8.41	8.41	15.00	0.70	88.33	
212	CH 3165 : CH 3180	9.40	9.40	15.00	0.70	98.66	
213	CH 3180 : CH 3195	10.06	10.06	15.00	0.70	105.63	
214	CH 3195 : CH 3210	8.90	8.90	15.00	0.70	93.44	

Sl.No	Chainage	Desilting details					Remarks
		W (m)	Wd (m)	L (m)		De-Silting Quantity (m3)	
215	CH 3210 : CH 3225	8.98	8.98	15.00	0.70	94.33	
216	CH 3225 : CH 3240	8.64	8.64	15.00	0.70	90.70	
217	CH 3240 : CH 3255	7.87	7.87	15.00	0.70	82.67	
218	CH 3255 : CH 3270	7.81	7.81	15.00	0.70	81.95	
219	CH 3270 : CH 3285	8.01	8.01	15.00	0.70	84.12	
220	CH 3285 : CH 3300	7.84	7.84	15.00	0.70	82.30	
221	CH 3300 : CH 3315	7.03	7.03	15.00	0.70	73.76	
222	CH 3315 : CH 3330	8.10	8.10	15.00	0.70	85.00	
223	CH 3330 : CH 3345	8.34	8.34	15.00	0.70	87.56	
224	CH 3345 : CH 3360	6.83	6.83	15.00	0.70	71.76	
225	CH 3360 : CH 3375	6.75	6.75	15.00	0.70	70.87	
226	CH 3375 : CH 3390	6.64	6.64	15.00	0.70	69.67	
227	CH 3390 : CH 3405	6.33	6.33	15.00	0.70	66.50	
228	CH 3405 : CH 3420	5.61	5.61	15.00	0.70	58.87	
229	CH 3420 : CH 3435	5.12	5.12	15.00	0.70	53.73	
230	CH 3435 : CH 3450	5.37	5.37	15.00	0.70	56.35	
231	CH 3450 : CH 3465	6.42	6.42	15.00	0.70	67.43	
232	CH 3465 : CH 3480	8.10	8.10	15.00	0.70	85.01	
233	CH 3480 : CH 3495	7.58	7.58	15.00	0.70	79.61	
234	CH 3495 : CH 3510	6.35	6.35	15.00	0.70	66.63	
235	CH 3510 : CH 3525	6.81	6.81	15.00	0.70	71.49	
236	CH 3525 : CH 3540	7.53	7.53	15.00	0.70	79.04	
237	CH 3540 : CH 3555	8.74	8.74	15.00	0.70	91.81	
238	CH 3555 : CH 3570	9.85	9.85	15.00	0.70	103.38	
239	CH 3570 : CH 3585	9.93	9.93	15.00	0.70	104.31	
240	CH 3585 : CH 3600	9.54	9.54	15.00	0.70	100.13	
241	CH 3600 : CH 3615	9.25	9.25	15.00	0.70	97.16	
242	CH 3615 : CH 3630	8.82	8.82	15.00	0.70	92.57	
243	CH 3630 : CH 3645	8.05	8.05	15.00	0.70	84.54	
244	CH 3645 : CH 3660	7.15	7.15	15.00	0.70	75.11	
245	CH 3660 : CH 3675	6.84	6.84	15.00	0.70	71.82	
246	CH 3675 : CH 3690	7.42	7.42	15.00	0.70	77.94	
247	CH 3690 : CH 3705	8.08	8.08	15.00	0.70	84.89	
248	CH 3705 : CH 3720	7.25	7.25	15.00	0.70	76.17	
249	CH 3720 : CH 3735	6.23	6.23	15.00	0.70	65.45	
250	CH 3735 : CH 3750	6.56	6.56	15.00	0.70	68.86	
251	CH 3750 : CH 3765	7.00	7.00	15.00	0.70	73.49	
252	CH 3765 : CH 3780	7.69	7.69	15.00	0.70	80.72	
253	CH 3780 : CH 3795	8.25	8.25	15.00	0.70	86.58	
254	CH 3795 : CH 3810	8.27	8.27	15.00	0.70	86.78	
255	CH 3810 : CH 3825	7.31	7.31	15.00	0.70	76.80	
256	CH 3825 : CH 3840	6.18	6.18	15.00	0.70	64.91	
257	CH 3840 : CH 3855	6.11	6.11	15.00	0.70	64.19	
258	CH 3855 : CH 3870	6.26	6.26	15.00	0.70	65.72	
259	CH 3870 : CH 3885	6.45	6.45	15.00	0.70	67.68	
260	CH 3885 : CH 3900	6.82	6.82	15.00	0.70	71.60	
261	CH 3900 : CH 3915	6.56	6.56	15.00	0.70	68.91	
262	CH 3915 : CH 3930	5.92	5.92	15.00	0.70	62.13	
263	CH 3930 : CH 3945	5.32	5.32	15.00	0.70	55.86	
264	CH 3945 : CH 3960	4.98	4.98	15.00	0.70	52.28	
265	CH 3960 : CH 3975	4.83	4.83	15.00	0.70	50.68	
266	CH 3975 : CH 3990	4.71	4.71	15.00	0.70	49.45	
267	CH 3990 : CH 4005	4.93	4.93	15.00	0.70	51.77	
268	CH 4005 : CH 4020	5.45	5.45	15.00	0.70	57.18	

Sl.No	Chainage	Desilting details					Remarks
		W (m)	Wd (m)	L (m)		De-Silting Quantity (m3)	
269	CH 4020 : CH 4035	6.32	6.32	15.00	0.70	66.41	
270	CH 4035 : CH 4050	6.45	6.45	15.00	0.70	67.71	
271	CH 4050 : CH 4065	5.89	5.89	15.00	0.70	61.82	
272	CH 4065 : CH 4080	5.64	5.64	15.00	0.70	59.24	
273	CH 4080 : CH 4095	5.47	5.47	15.00	0.70	57.39	
274	CH 4095 : CH 4110	5.93	5.93	15.00	0.70	62.24	
275	CH 4110 : CH 4125	6.63	6.63	15.00	0.70	69.61	
276	CH 4125 : CH 4140	6.74	6.74	15.00	0.70	70.82	
277	CH 4140 : CH 4155	6.23	6.23	15.00	0.70	65.37	
278	CH 4155 : CH 4170	5.77	5.77	15.00	0.70	60.57	
279	CH 4170 : CH 4185	6.39	6.39	15.00	0.70	67.14	
280	CH 4185 : CH 4200	7.00	7.00	15.00	0.70	73.55	
281	CH 4200 : CH 4215	6.87	6.87	15.00	0.70	72.15	
282	CH 4215 : CH 4230	6.83	6.83	15.00	0.70	71.68	
283	CH 4230 : CH 4245	6.68	6.68	15.00	0.70	70.13	
284	CH 4245 : CH 4260	6.43	6.43	15.00	0.70	67.51	
285	CH 4260 : CH 4275	6.76	6.76	15.00	0.70	71.01	
286	CH 4275 : CH 4290	6.42	6.42	15.00	0.70	67.43	
287	CH 4290 : CH 4305	5.95	5.95	15.00	0.70	62.44	
288	CH 4305 : CH 4320	6.98	6.98	15.00	0.70	73.31	
289	CH 4320 : CH 4335	7.69	7.69	15.00	0.70	80.73	
290	CH 4335 : CH 4350	6.98	6.98	15.00	0.70	73.33	
291	CH 4350 : CH 4365	6.14	6.14	15.00	0.70	64.49	
292	CH 4365 : CH 4380	6.07	6.07	15.00	0.70	63.74	
293	CH 4380 : CH 4395	6.95	6.95	15.00	0.70	72.92	
294	CH 4395 : CH 4410	8.02	8.02	15.00	0.70	84.24	
295	CH 4410 : CH 4425	8.78	8.78	15.00	0.70	92.15	
296	CH 4425 : CH 4440	9.32	9.32	15.00	0.70	97.81	
297	CH 4440 : CH 4455	9.26	9.26	15.00	0.70	97.28	
298	CH 4455 : CH 4470	8.84	8.84	15.00	0.70	92.80	
299	CH 4470 : CH 4485	8.61	8.61	15.00	0.70	90.45	
300	CH 4485 : CH 4500	8.78	8.78	15.00	0.70	92.24	
301	CH 4500 : CH 4515	8.92	8.92	15.00	0.70	93.69	
302	CH 4515 : CH 4530	8.75	8.75	15.00	0.70	91.89	
303	CH 4530 : CH 4545	8.83	8.83	15.00	0.70	92.76	
304	CH 4545 : CH 4560	8.90	8.90	15.00	0.70	93.43	
305	CH 4560 : CH 4575	8.68	8.68	15.00	0.70	91.13	
306	CH 4575 : CH 4590	8.36	8.36	15.00	0.70	87.76	
307	CH 4590 : CH 4605	8.04	8.04	15.00	0.70	84.41	
308	CH 4605 : CH 4620	7.92	7.92	15.00	0.70	83.12	
309	CH 4620 : CH 4635	8.07	8.07	15.00	0.70	84.77	
310	CH 4635 : CH 4650	7.72	7.72	15.00	0.70	81.02	
311	CH 4650 : CH 4665	6.81	6.81	15.00	0.70	71.46	
312	CH 4665 : CH 4680	7.05	7.05	15.00	0.70	73.97	
313	CH 4680 : CH 4695	7.61	7.61	15.00	0.70	79.89	
314	CH 4695 : CH 4710	7.41	7.41	15.00	0.70	77.77	
315	CH 4710 : CH 4725	7.13	7.13	15.00	0.70	74.88	
316	CH 4725 : CH 4740	7.14	7.14	15.00	0.70	74.95	
317	CH 4740 : CH 4755	7.57	7.57	15.00	0.70	79.53	
318	CH 4755 : CH 4770	7.65	7.65	15.00	0.70	80.34	
319	CH 4770 : CH 4785	7.29	7.29	15.00	0.70	76.58	
320	CH 4785 : CH 4800	7.02	7.02	15.00	0.70	73.70	
321	CH 4800 : CH 4815	6.54	6.54	15.00	0.70	68.66	
322	CH 4815 : CH 4830	6.31	6.31	15.00	0.70	66.21	

Sl.No	Chainage	Desilting details					Remarks
		W (m)	Wd (m)	L (m)		De-Silting Quantity (m3)	
323	CH 4830 : CH 4845	6.78	6.78	15.00	0.70	71.16	
324	CH 4845 : CH 4860	6.68	6.68	15.00	0.70	70.19	
325	CH 4860 : CH 4875	6.36	6.36	15.00	0.70	66.81	
326	CH 4875 : CH 4890	6.76	6.76	15.00	0.70	70.97	
327	CH 4890 : CH 4905	7.13	7.13	15.00	0.70	74.88	
328	CH 4905 : CH 4920	7.32	7.32	15.00	0.70	76.87	
329	CH 4920 : CH 4935	7.18	7.18	15.00	0.70	75.36	
330	CH 4935 : CH 4950	6.69	6.69	15.00	0.70	70.25	
331	CH 4950 : CH 4965	6.54	6.54	15.00	0.70	68.66	
332	CH 4965 : CH 4980	7.39	7.39	15.00	0.70	77.57	
333	CH 4980 : CH 4995	8.02	8.02	15.00	0.70	84.26	
334	CH 4995 : CH 5010	8.08	8.08	15.00	0.70	84.85	
335	CH 5010 : CH 5025	8.36	8.36	15.00	0.70	87.74	
336	CH 5025 : CH 5040	8.62	8.62	15.00	0.70	90.53	
337	CH 5040 : CH 5055	8.79	8.79	15.00	0.70	92.26	
338	CH 5055 : CH 5070	8.92	8.92	15.00	0.70	93.62	
339	CH 5070 : CH 5085	9.09	9.09	15.00	0.70	95.42	
340	CH 5085 : CH 5100	9.22	9.22	15.00	0.70	96.83	
341	CH 5100 : CH 5115	9.37	9.37	15.00	0.70	98.37	
342	CH 5115 : CH 5130	9.41	9.41	15.00	0.70	98.79	
343	CH 5130 : CH 5145	9.32	9.32	15.00	0.70	97.90	
344	CH 5145 : CH 5160	9.22	9.22	15.00	0.70	96.76	
345	CH 5160 : CH 5175	9.19	9.19	15.00	0.70	96.45	
346	CH 5175 : CH 5190	9.32	9.32	15.00	0.70	97.81	
347	CH 5190 : CH 5205	9.49	9.49	15.00	0.70	99.69	
348	CH 5205 : CH 5220	9.60	9.60	15.00	0.70	100.83	
349	CH 5220 : CH 5235	8.10	8.10	15.00	0.70	85.03	
350	CH 5235 : CH 5250	6.71	6.71	15.00	0.70	70.45	
351	CH 5250 : CH 5265	7.14	7.14	15.00	0.70	74.99	
352	CH 5265 : CH 5280	7.18	7.18	15.00	0.70	75.40	
353	CH 5280 : CH 5295	6.97	6.97	15.00	0.70	73.15	
354	CH 5295 : CH 5310	7.30	7.30	15.00	0.70	76.64	
355	CH 5310 : CH 5325	7.88	7.88	15.00	0.70	82.71	
356	CH 5325 : CH 5340	2.32	2.32	15.00	0.70	24.36	
357	CH 5340 : CH 5355	0.00	0.00	15.00	0.70	0.00	
358	CH 5355 : CH 5370	0.00	0.00	15.00	0.70	0.00	
359	CH 5370 : CH 5385	0.95	0.95	15.00	0.70	9.95	
360	CH 5385 : CH 5400	4.54	4.54	15.00	0.70	47.63	
361	CH 5400 : CH 5415	7.70	7.70	15.00	0.70	80.88	
362	CH 5415 : CH 5430	8.25	8.25	15.00	0.70	86.57	
363	CH 5430 : CH 5445	8.35	8.35	15.00	0.70	87.63	
364	CH 5445 : CH 5460	8.18	8.18	15.00	0.70	85.90	
365	CH 5460 : CH 5475	7.34	7.34	15.00	0.70	77.02	
366	CH 5475 : CH 5490	5.82	5.82	15.00	0.70	61.06	
367	CH 5490 : CH 5505	5.48	5.48	15.00	0.70	57.50	
368	CH 5505 : CH 5520	6.62	6.62	15.00	0.70	69.51	
369	CH 5520 : CH 5535	7.28	7.28	15.00	0.70	76.42	
370	CH 5535 : CH 5550	7.38	7.38	15.00	0.70	77.53	
371	CH 5550 : CH 5565	7.31	7.31	15.00	0.70	76.74	
372	CH 5565 : CH 5580	8.20	8.20	15.00	0.70	86.15	
373	CH 5580 : CH 5595	10.06	10.06	15.00	0.70	105.61	
374	CH 5595 : CH 5610	7.62	7.62	15.00	0.70	80.00	
375	CH 5610 : CH 5625	5.97	5.97	15.00	0.70	62.65	
376	CH 5625 : CH 5640	6.14	6.14	15.00	0.70	64.48	

Sl.No	Chainage	Desilting details					Remarks
		W (m)	Wd (m)	L (m)		De-Silting Quantity (m3)	
377	CH 5640 : CH 5655	6.30	6.30	15.00	0.70	66.18	
378	CH 5655 : CH 5670	6.28	6.28	15.00	0.70	65.97	
379	CH 5670 : CH 5685	6.11	6.11	15.00	0.70	64.19	
380	CH 5685 : CH 5700	6.12	6.12	15.00	0.70	64.23	
381	CH 5700 : CH 5715	6.34	6.34	15.00	0.70	66.53	
382	CH 5715 : CH 5730	6.63	6.63	15.00	0.70	69.59	
383	CH 5730 : CH 5745	6.44	6.44	15.00	0.70	67.58	
384	CH 5745 : CH 5760	5.24	5.24	15.00	0.70	54.99	
385	CH 5760 : CH 5775	7.81	7.81	15.00	0.70	82.01	
386	CH 5775 : CH 5790	11.50	11.50	15.00	0.70	120.73	
387	CH 5790 : CH 5805	13.57	13.57	15.00	0.70	142.43	
388	CH 5805 : CH 5820	12.29	12.29	15.00	0.70	129.03	
389	CH 5820 : CH 5835	8.53	8.53	15.00	0.70	89.59	
390	CH 5835 : CH 5850	8.22	8.22	15.00	0.70	86.30	
391	CH 5850 : CH 5865	8.20	8.20	15.00	0.70	86.06	
392	CH 5865 : CH 5880	9.04	9.04	15.00	0.70	94.91	
393	CH 5880 : CH 5895	9.71	9.71	15.00	0.70	101.91	
394	CH 5895 : CH 5910	9.57	9.57	15.00	0.70	100.53	
395	CH 5910 : CH 5925	9.72	9.72	15.00	0.70	102.11	
396	CH 5925 : CH 5940	10.35	10.35	15.00	0.70	108.69	
397	CH 5940 : CH 5955	11.47	11.47	15.00	0.70	120.40	
398	CH 5955 : CH 5970	13.47	13.47	15.00	0.70	141.46	
399	CH 5970 : CH 5985	15.60	15.60	15.00	0.70	163.79	
400	CH 5985 : CH 6000	15.20	15.20	15.00	0.70	159.64	
401	CH 6000 : CH 6015	14.13	14.13	15.00	0.70	148.41	
402	CH 6015 : CH 6030	14.17	14.17	15.00	0.70	148.81	
403	CH 6030 : CH 6045	14.01	14.01	15.00	0.70	147.15	
404	CH 6045 : CH 6060	13.66	13.66	15.00	0.70	143.44	
405	CH 6060 : CH 6075	13.25	13.25	15.00	0.70	139.12	
406	CH 6075 : CH 6090	13.57	13.57	15.00	0.70	142.50	
407	CH 6090 : CH 6105	13.88	13.88	15.00	0.70	145.71	
408	CH 6105 : CH 6120	12.96	12.96	15.00	0.70	136.11	
409	CH 6120 : CH 6135	12.17	12.17	15.00	0.70	127.79	
410	CH 6135 : CH 6150	13.63	13.63	15.00	0.70	143.13	
411	CH 6150 : CH 6165	14.95	14.95	15.00	0.70	157.01	
412	CH 6165 : CH 6180	14.19	14.19	15.00	0.70	148.97	
413	CH 6180 : CH 6195	12.51	12.51	15.00	0.70	131.32	
414	CH 6195 : CH 6210	11.53	11.53	15.00	0.70	121.02	
415	CH 6210 : CH 6225	12.16	12.16	15.00	0.70	127.70	
416	CH 6225 : CH 6240	13.12	13.12	15.00	0.70	137.79	
417	CH 6240 : CH 6255	12.42	12.42	15.00	0.70	130.40	
418	CH 6255 : CH 6270	11.27	11.27	15.00	0.70	118.34	
419	CH 6270 : CH 6285	11.67	11.67	15.00	0.70	122.55	
420	CH 6285 : CH 6300	12.68	12.68	15.00	0.70	133.19	
421	CH 6300 : CH 6315	14.28	14.28	15.00	0.70	149.90	
422	CH 6315 : CH 6330	15.78	15.78	15.00	0.70	165.66	w>16.50
423	CH 6330 : CH 6345	16.77	16.77	15.00	0.70	176.04	"
424	CH 6345 : CH 6360	17.47	17.47	15.00	0.70	183.41	"
425	CH 6360 : CH 6375	17.47	17.47	15.00	0.70	183.45	"
426	CH 6375 : CH 6390	17.02	17.02	15.00	0.70	178.66	
427	CH 6390 : CH 6405	16.52	16.52	15.00	0.70	173.42	
428	CH 6405 : CH 6420	16.02	16.02	15.00	0.70	168.18	
429	CH 6420 : CH 6435	15.52	15.52	15.00	0.70	162.95	
430	CH 6435 : CH 6450	15.02	15.02	15.00	0.70	157.71	

Sl.No	Chainage	Desilting details					Remarks
		W (m)	Wd (m)	L (m)		De-Silting Quantity (m3)	
431	CH 6450 : CH 6465	14.52	14.52	15.00	0.70	152.47	
432	CH 6465 : CH 6480	14.02	14.02	15.00	0.70	147.24	
433	CH 6480 : CH 6495	13.42	13.42	15.00	0.70	140.90	
434	CH 6495 : CH 6510	12.66	12.66	15.00	0.70	132.88	
435	CH 6510 : CH 6525	10.60	10.60	15.00	0.70	111.28	
436	CH 6525 : CH 6540	8.11	8.11	15.00	0.70	85.20	
437	CH 6540 : CH 6555	9.15	9.15	15.00	0.70	96.08	
438	CH 6555 : CH 6570	12.23	12.23	15.00	0.70	128.46	
439	CH 6570 : CH 6585	13.65	13.65	15.00	0.70	143.28	
440	CH 6585 : CH 6600	12.07	12.07	15.00	0.70	126.72	
441	CH 6600 : CH 6615	9.66	9.66	15.00	0.70	101.44	
442	CH 6615 : CH 6630	10.45	10.45	15.00	0.70	109.77	
443	CH 6630 : CH 6645	12.03	12.03	15.00	0.70	126.27	
444	CH 6645 : CH 6660	12.55	12.55	15.00	0.70	131.82	
445	CH 6660 : CH 6675	11.94	11.94	15.00	0.70	125.32	
446	CH 6675 : CH 6690	11.22	11.22	15.00	0.70	117.76	
447	CH 6690 : CH 6705	11.59	11.59	15.00	0.70	121.68	
448	CH 6705 : CH 6720	12.79	12.79	15.00	0.70	134.26	
449	CH 6720 : CH 6735	14.62	14.62	15.00	0.70	153.52	
450	CH 6735 : CH 6750	16.25	16.25	15.00	0.70	170.59	
451	CH 6750 : CH 6765	16.50	16.50	15.00	0.70	173.23	
452	CH 6765 : CH 6780	16.17	16.17	15.00	0.70	169.81	
453	CH 6780 : CH 6795	16.44	16.44	15.00	0.70	172.65	
454	CH 6795 : CH 6810	16.26	16.26	15.00	0.70	170.69	
455	CH 6810 : CH 6825	15.94	15.94	15.00	0.70	167.40	
456	CH 6825 : CH 6840	15.12	15.12	15.00	0.70	158.74	
457	CH 6840 : CH 6855	13.27	13.27	15.00	0.70	139.34	
458	CH 6855 : CH 6870	12.05	12.05	15.00	0.70	126.51	
459	CH 6870 : CH 6885	12.69	12.69	15.00	0.70	133.21	
460	CH 6885 : CH 6900	14.78	14.78	15.00	0.70	155.14	
461	CH 6900 : CH 6915	16.45	16.45	15.00	0.70	172.77	w>16.50
462	CH 6915 : CH 6930	17.34	17.34	15.00	0.70	182.04	"
463	CH 6930 : CH 6945	17.34	17.34	15.00	0.70	182.09	
464	CH 6945 : CH 6960	16.51	16.51	15.00	0.70	173.36	
465	CH 6960 : CH 6975	16.19	16.19	15.00	0.70	170.03	
466	CH 6975 : CH 6990	15.71	15.71	15.00	0.70	164.94	
467	CH 6990 : CH 7005	15.27	15.27	15.00	0.70	160.29	
468	CH 7005 : CH 7020	15.55	15.55	15.00	0.70	163.25	
469	CH 7020 : CH 7035	15.88	15.88	15.00	0.70	166.75	
470	CH 7035 : CH 7050	15.46	15.46	15.00	0.70	162.30	
471	CH 7050 : CH 7065	14.85	14.85	15.00	0.70	155.94	
472	CH 7065 : CH 7080	14.42	14.42	15.00	0.70	151.42	
473	CH 7080 : CH 7095	13.98	13.98	15.00	0.70	146.74	
474	CH 7095 : CH 7110	13.53	13.53	15.00	0.70	142.09	
475	CH 7110 : CH 7125	13.19	13.19	15.00	0.70	138.51	
476	CH 7125 : CH 7140	13.57	13.57	15.00	0.70	142.52	
477	CH 7140 : CH 7155	14.41	14.41	15.00	0.70	151.26	
478	CH 7155 : CH 7170	13.49	13.49	15.00	0.70	141.68	
479	CH 7170 : CH 7185	12.33	12.33	15.00	0.70	129.46	
480	CH 7185 : CH 7200	13.29	13.29	15.00	0.70	139.52	
481	CH 7200 : CH 7215	13.72	13.72	15.00	0.70	144.01	
482	CH 7215 : CH 7230	12.95	12.95	15.00	0.70	135.99	
483	CH 7230 : CH 7245	12.27	12.27	15.00	0.70	128.82	
484	CH 7245 : CH 7260	13.08	13.08	15.00	0.70	137.32	

Sl.No	Chainage	Desilting details					Remarks
		W (m)	Wd (m)	L (m)		De-Silting Quantity (m3)	
485	CH 7260 : CH 7275	14.51	14.51	15.00	0.70	152.37	
486	CH 7275 : CH 7290	14.67	14.67	15.00	0.70	154.02	
487	CH 7290 : CH 7305	14.26	14.26	15.00	0.70	149.74	
488	CH 7305 : CH 7320	14.12	14.12	15.00	0.70	148.21	
489	CH 7320 : CH 7335	14.71	14.71	15.00	0.70	154.49	
490	CH 7335 : CH 7350	14.97	14.97	15.00	0.70	157.20	
491	CH 7350 : CH 7365	14.37	14.37	15.00	0.70	150.93	
492	CH 7365 : CH 7380	13.36	13.36	15.00	0.70	140.25	
493	CH 7380 : CH 7395	12.52	12.52	15.00	0.70	131.49	
494	CH 7395 : CH 7410	12.69	12.69	15.00	0.70	133.21	
495	CH 7410 : CH 7425	13.70	13.70	15.00	0.70	143.81	
496	CH 7425 : CH 7440	14.91	14.91	15.00	0.70	156.52	
497	CH 7440 : CH 7455	16.15	16.15	15.00	0.70	169.56	w>16.50
498	CH 7455 : CH 7470	16.80	16.80	15.00	0.70	176.40	"
499	CH 7470 : CH 7485	16.65	16.65	15.00	0.70	174.84	
500	CH 7485 : CH 7500	16.31	16.31	15.00	0.70	171.24	
501	CH 7500 : CH 7515	15.96	15.96	15.00	0.70	167.57	
502	CH 7515 : CH 7530	15.61	15.61	15.00	0.70	163.86	
503	CH 7530 : CH 7545	14.73	14.73	15.00	0.70	154.66	
504	CH 7545 : CH 7560	13.38	13.38	15.00	0.70	140.47	
505	CH 7560 : CH 7575	12.11	12.11	15.00	0.70	127.12	
506	CH 7575 : CH 7590	11.49	11.49	15.00	0.70	120.68	
507	CH 7590 : CH 7605	12.20	12.20	15.00	0.70	128.11	
508	CH 7605 : CH 7620	12.94	12.94	15.00	0.70	135.82	
509	CH 7620 : CH 7635	12.98	12.98	15.00	0.70	136.31	
510	CH 7635 : CH 7650	13.01	13.01	15.00	0.70	136.56	
511	CH 7650 : CH 7665	12.91	12.91	15.00	0.70	135.52	
512	CH 7665 : CH 7680	12.81	12.81	15.00	0.70	134.54	
513	CH 7680 : CH 7695	13.15	13.15	15.00	0.70	138.06	
514	CH 7695 : CH 7710	14.53	14.53	15.00	0.70	152.60	
515	CH 7710 : CH 7725	15.87	15.87	15.00	0.70	166.64	
516	CH 7725 : CH 7740	15.26	15.26	15.00	0.70	160.21	
517	CH 7740 : CH 7755	15.53	15.53	15.00	0.70	163.11	w>16.50
518	CH 7755 : CH 7770	16.74	16.74	15.00	0.70	175.81	"
519	CH 7770 : CH 7785	16.81	16.81	15.00	0.70	176.48	"
520	CH 7785 : CH 7800	16.86	16.86	15.00	0.70	177.07	"
521	CH 7800 : CH 7815	16.99	16.99	15.00	0.70	178.39	"
522	CH 7815 : CH 7830	17.05	17.05	15.00	0.70	179.05	
523	CH 7830 : CH 7845	16.07	16.07	15.00	0.70	168.70	
524	CH 7845 : CH 7860	15.76	15.76	15.00	0.70	165.45	w>16.50
525	CH 7860 : CH 7875	16.49	16.49	15.00	0.70	173.11	
526	CH 7875 : CH 7890	16.45	16.45	15.00	0.70	172.71	
527	CH 7890 : CH 7905	16.03	16.03	15.00	0.70	168.29	
528	CH 7905 : CH 7920	15.50	15.50	15.00	0.70	162.71	
529	CH 7920 : CH 7935	15.07	15.07	15.00	0.70	158.21	
530	CH 7935 : CH 7950	14.83	14.83	15.00	0.70	155.75	
531	CH 7950 : CH 7965	14.66	14.66	15.00	0.70	153.96	
532	CH 7965 : CH 7980	14.53	14.53	15.00	0.70	152.58	
533	CH 7980 : CH 7995	14.44	14.44	15.00	0.70	151.59	
534	CH 7995 : CH 8010	14.34	14.34	15.00	0.70	150.56	
535	CH 8010 : CH 8025	14.34	14.34	15.00	0.70	150.55	
536	CH 8025 : CH 8040	13.63	13.63	15.00	0.70	143.14	
537	CH 8040 : CH 8055	13.29	13.29	15.00	0.70	139.50	
538	CH 8055 : CH 8070	13.62	13.62	15.00	0.70	143.02	

Sl.No	Chainage	Desilting details					Remarks
		W (m)	Wd (m)	L (m)		De-Silting Quantity (m3)	
539	CH 8070 : CH 8085	14.04	14.04	15.00	0.70	147.41	
540	CH 8085 : CH 8100	14.36	14.36	15.00	0.70	150.80	
541	CH 8100 : CH 8115	13.96	13.96	15.00	0.70	146.58	
542	CH 8115 : CH 8130	15.05	15.05	15.00	0.70	157.99	
543	CH 8130 : CH 8145	15.96	15.96	15.00	0.70	167.55	
544	CH 8145 : CH 8160	15.62	15.62	15.00	0.70	163.96	
545	CH 8160 : CH 8175	16.04	16.04	15.00	0.70	168.39	w>16.50
546	CH 8175 : CH 8190	16.83	16.83	15.00	0.70	176.66	"
547	CH 8190 : CH 8205	17.19	17.19	15.00	0.70	180.48	"
548	CH 8205 : CH 8220	17.10	17.10	15.00	0.70	179.53	"
549	CH 8220 : CH 8235	17.24	17.24	15.00	0.70	181.01	"
550	CH 8235 : CH 8250	17.38	17.38	15.00	0.70	182.44	"
551	CH 8250 : CH 8265	17.67	17.67	15.00	0.70	185.57	"
552	CH 8265 : CH 8280	17.57	17.57	15.00	0.70	184.49	
553	CH 8280 : CH 8295	16.63	16.63	15.00	0.70	174.63	
554	CH 8295 : CH 8310	15.83	15.83	15.00	0.70	166.23	
555	CH 8310 : CH 8325	15.59	15.59	15.00	0.70	163.67	
556	CH 8325 : CH 8340	15.39	15.39	15.00	0.70	161.55	
557	CH 8340 : CH 8355	15.15	15.15	15.00	0.70	159.09	
558	CH 8355 : CH 8370	13.64	13.64	15.00	0.70	143.21	
559	CH 8370 : CH 8385	12.85	12.85	15.00	0.70	134.95	
560	CH 8385 : CH 8400	14.11	14.11	15.00	0.70	148.14	
561	CH 8400 : CH 8415	14.41	14.41	15.00	0.70	151.29	
562	CH 8415 : CH 8430	14.29	14.29	15.00	0.70	150.00	
563	CH 8430 : CH 8445	14.77	14.77	15.00	0.70	155.09	
564	CH 8445 : CH 8460	14.85	14.85	15.00	0.70	155.97	
565	CH 8460 : CH 8475	14.40	14.40	15.00	0.70	151.16	
566	CH 8475 : CH 8490	13.94	13.94	15.00	0.70	146.41	
567	CH 8490 : CH 8505	13.67	13.67	15.00	0.70	143.52	
568	CH 8505 : CH 8520	13.59	13.59	15.00	0.70	142.71	
569	CH 8520 : CH 8535	13.41	13.41	15.00	0.70	140.76	
570	CH 8535 : CH 8550	13.28	13.28	15.00	0.70	139.43	
571	CH 8550 : CH 8565	13.30	13.30	15.00	0.70	139.69	
572	CH 8565 : CH 8580	13.46	13.46	15.00	0.70	141.28	
573	CH 8580 : CH 8595	13.69	13.69	15.00	0.70	143.72	
574	CH 8595 : CH 8610	13.78	13.78	15.00	0.70	144.68	
575	CH 8610 : CH 8625	13.42	13.42	15.00	0.70	140.90	
576	CH 8625 : CH 8640	13.10	13.10	15.00	0.70	137.56	
577	CH 8640 : CH 8655	13.19	13.19	15.00	0.70	138.49	
578	CH 8655 : CH 8670	13.27	13.27	15.00	0.70	139.35	
579	CH 8670 : CH 8685	13.30	13.30	15.00	0.70	139.68	
580	CH 8685 : CH 8700	13.52	13.52	15.00	0.70	141.94	
581	CH 8700 : CH 8715	14.98	14.98	15.00	0.70	157.31	
582	CH 8715 : CH 8730	16.37	16.37	15.00	0.70	171.90	
583	CH 8730 : CH 8745	16.05	16.05	15.00	0.70	168.49	
584	CH 8745 : CH 8760	15.55	15.55	15.00	0.70	163.31	
585	CH 8760 : CH 8775	15.74	15.74	15.00	0.70	165.24	
586	CH 8775 : CH 8790	16.16	16.16	15.00	0.70	169.63	
587	CH 8790 : CH 8805	15.93	15.93	15.00	0.70	167.28	
588	CH 8805 : CH 8820	15.51	15.51	15.00	0.70	162.82	
589	CH 8820 : CH 8835	15.60	15.60	15.00	0.70	163.82	
590	CH 8835 : CH 8850	15.55	15.55	15.00	0.70	163.27	
591	CH 8850 : CH 8865	16.46	16.46	15.00	0.70	172.88	
592	CH 8865 : CH 8880	16.95	16.95	15.00	0.70	178.02	

Sl.No	Chainage	Desilting details					Remarks
		W (m)	Wd (m)	L (m)		De-Silting Quantity (m3)	
593	CH 8880 : CH 8895	15.71	15.71	15.00	0.70	165.00	
594	CH 8895 : CH 8910	14.94	14.94	15.00	0.70	156.91	
595	CH 8910 : CH 8925	15.24	15.24	15.00	0.70	160.05	
596	CH 8925 : CH 8940	16.05	16.05	15.00	0.70	168.55	w>16.50
597	CH 8940 : CH 8955	16.91	16.91	15.00	0.70	177.56	"
598	CH 8955 : CH 8970	17.66	17.66	15.00	0.70	185.42	"
599	CH 8970 : CH 8985	18.09	18.09	15.00	0.70	189.96	"
600	CH 8985 : CH 9000	18.18	18.18	15.00	0.70	190.84	"
601	CH 9000 : CH 9015	17.97	17.97	15.00	0.70	188.73	"
602	CH 9015 : CH 9030	17.53	17.53	15.00	0.70	184.07	"
603	CH 9030 : CH 9045	19.86	19.86	15.00	0.70	208.54	"
604	CH 9045 : CH 9060	22.06	22.06	15.00	0.70	231.63	"
605	CH 9060 : CH 9075	22.27	22.27	15.00	0.70	233.80	"
606	CH 9075 : CH 9090	22.19	22.19	15.00	0.70	233.04	"
607	CH 9090 : CH 9105	19.34	19.34	15.00	0.70	203.06	"
608	CH 9105 : CH 9120	17.23	17.23	15.00	0.70	180.96	"
609	CH 9120 : CH 9135	17.32	17.32	15.00	0.70	181.81	"
610	CH 9135 : CH 9150	17.43	17.43	15.00	0.70	183.04	"
611	CH 9150 : CH 9165	17.81	17.81	15.00	0.70	187.03	"
612	CH 9165 : CH 9180	18.43	18.43	15.00	0.70	193.53	"
613	CH 9180 : CH 9195	18.86	18.86	15.00	0.70	198.07	"
614	CH 9195 : CH 9210	19.06	19.06	15.00	0.70	200.18	"
615	CH 9210 : CH 9225	19.11	19.11	15.00	0.70	200.62	"
616	CH 9225 : CH 9240	19.03	19.03	15.00	0.70	199.82	"
617	CH 9240 : CH 9255	18.40	18.40	15.00	0.70	193.16	
618	CH 9255 : CH 9270	16.98	16.98	15.00	0.70	178.27	
619	CH 9270 : CH 9285	15.50	15.50	15.00	0.70	162.79	
620	CH 9285 : CH 9300	14.67	14.67	15.00	0.70	154.00	
621	CH 9300 : CH 9315	14.53	14.53	15.00	0.70	152.52	
622	CH 9315 : CH 9330	14.68	14.68	15.00	0.70	154.09	
623	CH 9330 : CH 9345	14.95	14.95	15.00	0.70	156.94	
624	CH 9345 : CH 9360	14.91	14.91	15.00	0.70	156.60	
625	CH 9360 : CH 9375	14.58	14.58	15.00	0.70	153.14	
626	CH 9375 : CH 9390	14.32	14.32	15.00	0.70	150.40	
627	CH 9390 : CH 9405	14.12	14.12	15.00	0.70	148.28	
628	CH 9405 : CH 9420	14.17	14.17	15.00	0.70	148.73	
629	CH 9420 : CH 9435	14.41	14.41	15.00	0.70	151.33	
630	CH 9435 : CH 9450	14.63	14.63	15.00	0.70	153.64	
631	CH 9450 : CH 9465	14.93	14.93	15.00	0.70	156.72	
632	CH 9465 : CH 9480	15.43	15.43	15.00	0.70	161.99	
633	CH 9480 : CH 9495	15.78	15.78	15.00	0.70	165.72	
634	CH 9495 : CH 9510	15.60	15.60	15.00	0.70	163.77	
635	CH 9510 : CH 9525	15.07	15.07	15.00	0.70	158.24	
636	CH 9525 : CH 9540	14.78	14.78	15.00	0.70	155.23	
637	CH 9540 : CH 9555	14.79	14.79	15.00	0.70	155.26	
638	CH 9555 : CH 9570	15.64	15.64	15.00	0.70	164.21	w>16.50
639	CH 9570 : CH 9585	17.45	17.45	15.00	0.70	183.25	"
640	CH 9585 : CH 9600	18.87	18.87	15.00	0.70	198.10	"
641	CH 9600 : CH 9615	18.69	18.69	15.00	0.70	196.23	"
642	CH 9615 : CH 9630	18.03	18.03	15.00	0.70	189.32	"
643	CH 9630 : CH 9645	18.03	18.03	15.00	0.70	189.30	"
644	CH 9645 : CH 9660	18.18	18.18	15.00	0.70	190.92	"
645	CH 9660 : CH 9675	18.18	18.18	15.00	0.70	190.89	"
646	CH 9675 : CH 9690	17.97	17.97	15.00	0.70	188.69	"

Sl.No	Chainage	Desilting details					Remarks
		W (m)	Wd (m)	L (m)		De-Silting Quantity (m3)	
647	CH 9690 : CH 9705	17.74	17.74	15.00	0.70	186.28	"
648	CH 9705 : CH 9720	17.36	17.36	15.00	0.70	182.30	"
649	CH 9720 : CH 9735	17.01	17.01	15.00	0.70	178.62	"
650	CH 9735 : CH 9750	16.94	16.94	15.00	0.70	177.83	"
651	CH 9750 : CH 9765	17.13	17.13	15.00	0.70	179.88	"
652	CH 9765 : CH 9780	17.40	17.40	15.00	0.70	182.66	"
653	CH 9780 : CH 9795	17.84	17.84	15.00	0.70	187.35	"
654	CH 9795 : CH 9810	18.35	18.35	15.00	0.70	192.63	"
655	CH 9810 : CH 9825	18.52	18.52	15.00	0.70	194.50	"
656	CH 9825 : CH 9840	17.69	17.69	15.00	0.70	185.77	"
657	CH 9840 : CH 9855	17.08	17.08	15.00	0.70	179.29	"
658	CH 9855 : CH 9870	16.90	16.90	15.00	0.70	177.50	"
659	CH 9870 : CH 9884.64	30.88	24.50	14.64	0.70	251.01	
	Total Quantity					**1,04,295.23**	
659	De-silting quantity of subcanals (19 nos)	3.32	3.32	10286.00	0.30	10243.93	
	Grand Total					**1,14,539.16**	

Thevara Canal						
Sl.No	Chainage	Desilting details				Remarks
		W (m)	Length (m)	Assumed canal depth (m)		
1	CH 000 : CH 15	21.88	15.00	0.70	229.69	w>16.50
2	CH 15 : CH 30	20.45	15.00	0.70	214.67	"
3	CH 30 : CH 45	19.53	15.00	0.70	205.07	"
4	CH 45 : CH 60	18.94	15.00	0.70	198.87	"
5	CH 60 : CH 75	18.82	15.00	0.70	197.56	"
6	CH 75 : CH 90	17.64	15.00	0.70	185.17	
7	CH 90 : CH 105	16.26	15.00	0.70	170.68	
8	CH 105 : CH 120	15.42	15.00	0.70	161.86	
9	CH 120 : CH 135	14.60	15.00	0.70	153.30	
10	CH 135 : CH 150	15.92	15.00	0.70	167.11	
11	CH 150 : CH 165	18.39	15.00	0.70	193.10	"
12	CH 165 : CH 180	19.32	15.00	0.70	202.86	"
13	CH 180 : CH 195	19.24	15.00	0.70	201.97	"
14	CH 195 : CH 210	19.28	15.00	0.70	202.44	"
15	CH 210 : CH 225	19.18	15.00	0.70	201.39	"
16	CH 225 : CH 240	19.16	15.00	0.70	201.18	"
17	CH 240 : CH 255	19.39	15.00	0.70	203.60	"
18	CH 255 : CH 270	19.52	15.00	0.70	204.91	"
19	CH 270 : CH 285	19.50	15.00	0.70	204.75	"
20	CH 285 : CH 300	19.31	15.00	0.70	202.70	"
21	CH 300 : CH 315	18.93	15.00	0.70	198.77	"
22	CH 315 : CH 330	18.93	15.00	0.70	198.71	"
23	CH 330 : CH 345	19.59	15.00	0.70	205.70	"
24	CH 345 : CH 360	20.02	15.00	0.70	210.16	"
25	CH 360 : CH 375	19.61	15.00	0.70	205.85	"
26	CH 375 : CH 390	18.86	15.00	0.70	198.03	"
27	CH 390 : CH 405	18.40	15.00	0.70	193.15	"
28	CH 405 : CH 420	18.63	15.00	0.70	195.56	"
29	CH 420 : CH 435	18.98	15.00	0.70	199.29	"
30	CH 435 : CH 450	19.22	15.00	0.70	201.81	"
31	CH 450 : CH 465	19.31	15.00	0.70	202.76	"
32	CH 465 : CH 480	19.28	15.00	0.70	202.44	"
33	CH 480 : CH 495	18.86	15.00	0.70	197.98	"
34	CH 495 : CH 510	17.13	15.00	0.70	179.81	
35	CH 510 : CH 525	15.93	15.00	0.70	167.21	
36	CH 525 : CH 540	15.82	15.00	0.70	166.11	
37	CH 540 : CH 555	15.68	15.00	0.70	164.64	
38	CH 555 : CH 570	15.71	15.00	0.70	164.90	
39	CH 570 : CH 585	16.43	15.00	0.70	172.52	
40	CH 585 : CH 600	17.08	15.00	0.70	179.34	"
41	CH 600 : CH 615	16.95	15.00	0.70	177.98	"
42	CH 615 : CH 630	16.24	15.00	0.70	170.47	
43	CH 630 : CH 645	16.04	15.00	0.70	168.42	

Sl.No	Chainage	Desilting details				Remarks
		W (m)	Length (m)	Assumed canal depth (m)		
44	CH 645 : CH 660	16.49	15.00	0.70	173.15	
45	CH 660 : CH 675	16.76	15.00	0.70	175.93	"
46	CH 675 : CH 690	17.06	15.00	0.70	179.08	"
47	CH 690 : CH 705	17.11	15.00	0.70	179.60	"
48	CH 705 : CH 720	15.96	15.00	0.70	167.58	
49	CH 720 : CH 735	14.35	15.00	0.70	150.68	
50	CH 735 : CH 750	13.67	15.00	0.70	143.54	
51	CH 750 : CH 765	13.25	15.00	0.70	139.13	
52	CH 765 : CH 780	14.73	15.00	0.70	154.67	
53	CH 780 : CH 795	17.77	15.00	0.70	186.59	
54	CH 795 : CH 810	18.48	15.00	0.70	194.04	"
55	CH 810 : CH 825	18.31	15.00	0.70	192.20	"
56	CH 825 : CH 840	20.35	15.00	0.70	213.62	"
57	CH 840 : CH 855	19.64	15.00	0.70	206.17	"
58	CH 855 : CH 870	17.96	15.00	0.70	188.58	"
59	CH 870 : CH 885	19.01	15.00	0.70	199.55	"
60	CH 885 : CH 900	19.93	15.00	0.70	209.21	"
61	CH 900 : CH 915	19.61	15.00	0.70	205.91	"
62	CH 915 : CH 930	18.57	15.00	0.70	194.99	"
63	CH 930 : CH 945	18.06	15.00	0.70	189.63	"
64	CH 945 : CH 960	17.62	15.00	0.70	185.01	"
65	CH 960 : CH 975	17.32	15.00	0.70	181.86	"
66	CH 975 : CH 990	16.69	15.00	0.70	175.19	"
67	CH 990 : CH 1005	16.67	15.00	0.70	175.04	"
68	CH 1005 : CH 1020	16.81	15.00	0.70	176.45	"
69	CH 1020 : CH 1035	16.16	15.00	0.70	169.63	
70	CH 1035 : CH 1050	15.45	15.00	0.70	162.23	
71	CH 1050 : CH 1065	15.63	15.00	0.70	164.12	
72	CH 1065 : CH 1080	16.68	15.00	0.70	175.09	
73	CH 1080 : CH 1095	16.88	15.00	0.70	177.19	"
74	CH 1095 : CH 1110	16.97	15.00	0.70	178.19	"
75	CH 1110 : CH 1125	17.12	15.00	0.70	179.71	"
76	CH 1125 : CH 1140	17.31	15.00	0.70	181.76	"
77	CH 1140 : CH 1155	18.14	15.00	0.70	190.47	"
78	CH 1155 : CH 1170	19.76	15.00	0.70	207.48	"
79	CH 1170 : CH 1185	22.05	15.00	0.70	231.53	"
80	CH 1185 : CH 1200	24.05	15.00	0.70	252.47	"
81	CH 1200 : CH 1215	24.94	15.00	0.70	261.82	"
82	CH 1215 : CH 1230	24.70	15.00	0.70	259.30	"
83	CH 1230 : CH 1245	23.92	15.00	0.70	251.11	"
84	CH 1245 : CH 1260	22.67	15.00	0.70	237.98	"
85	CH 1260 : CH 1275	21.68	15.00	0.70	227.59	"
86	CH 1275 : CH 1290	21.09	15.00	0.70	221.39	"
87	CH 1290 : CH 1305	20.37	15.00	0.70	213.89	"

Sl.No	Chainage	Desilting details				Remarks
		W (m)	Length (m)	Assumed canal depth (m)		
88	CH 1305 : CH 1320	19.54	15.00	0.70	205.12	"
89	CH 1320 : CH 1335	18.80	15.00	0.70	197.40	"
90	CH 1335 : CH 1350	18.14	15.00	0.70	190.47	"
91	CH 1350 : CH 1365	17.60	15.00	0.70	184.75	"
92	CH 1365 : CH 1380	17.53	15.00	0.70	184.07	"
93	CH 1380 : CH 1395	17.66	15.00	0.70	185.38	"
94	CH 1395 : CH 1405	17.74	10.00	0.70	124.18	"
	Total Quantity				**17,976.07**	
	De-silting quantity of subcanals (2 nos)	17.25	1288.00	0.30	6665.40	
	Grand Total				**24,641.47**	

Market Canal						
Sl. No	Chainage	Desilting details				Remarks
		W	Length (m)	Assumed canal depth (m)		
1	CH 0 : CH 15	15.46	15.00	0.70	162.33	
2	CH 15 : CH 30	14.00	15.00	0.70	147.00	
3	CH 30 : CH 45	13.97	15.00	0.70	146.63	
4	CH 45 : CH 60	14.07	15.00	0.70	147.74	
5	CH 60 : CH 75	14.01	15.00	0.70	147.11	
6	CH 75 : CH 90	15.03	15.00	0.70	157.82	
7	CH 90 : CH 105	15.84	15.00	0.70	166.32	
8	CH 105 : CH 120	13.75	15.00	0.70	144.38	
9	CH 120 : CH 135	12.18	15.00	0.70	127.84	
10	CH 135 : CH 150	12.32	15.00	0.70	129.36	
11	CH 150 : CH 165	12.32	15.00	0.70	129.36	
12	CH 165 : CH 180	12.37	15.00	0.70	129.89	
13	CH 180 : CH 195	12.31	15.00	0.70	129.20	
14	CH 195 : CH 210	12.37	15.00	0.70	129.89	
15	CH 210 : CH 225	12.78	15.00	0.70	134.19	
16	CH 225 : CH 240	13.08	15.00	0.70	137.34	
17	CH 240 : CH 255	13.14	15.00	0.70	137.97	
18	CH 255 : CH 270	13.07	15.00	0.70	137.24	
19	CH 270 : CH 285	13.11	15.00	0.70	137.66	
20	CH 285 : CH 300	13.30	15.00	0.70	139.60	
21	CH 300 : CH 315	19.94	15.00	0.70	209.34	
22	CH 315 : CH 330	31.56	15.00	0.70	331.33	w>16.50
23	CH 330 : CH 345	31.88	15.00	0.70	334.74	"
24	CH 345 : CH 360	27.46	15.00	0.70	288.28	"
25	CH 360 : CH 375	15.27	15.00	0.70	160.28	
26	CH 375 : CH 390	7.65	15.00	0.70	80.27	
27	CH 390 : CH 405	7.52	15.00	0.70	78.91	
28	CH 405 : CH 420	7.39	15.00	0.70	77.54	
29	CH 420 : CH 435	7.26	15.00	0.70	76.23	
30	CH 435 : CH 450	7.19	15.00	0.70	75.50	
31	CH 450 : CH 465	7.15	15.00	0.70	75.08	
32	CH 465 : CH 480	7.12	15.00	0.70	74.71	
33	CH 480 : CH 495	7.11	15.00	0.70	74.66	
34	CH 495 : CH 510	7.11	15.00	0.70	74.66	
35	CH 510 : CH 525	7.04	15.00	0.70	73.92	
36	CH 525 : CH 540	6.92	15.00	0.70	72.66	
37	CH 540 : CH 555	6.83	15.00	0.70	71.72	
38	CH 555 : CH 570	6.94	15.00	0.70	72.87	

Sl. No	Chainage	Desilting details				Remarks
		W	Length (m)	Assumed canal depth (m)		
39	CH 570 : CH 585	7.01	15.00	0.70	73.61	
40	CH 585 : CH 600	7.14	15.00	0.70	74.97	
41	CH 600 : CH 615	7.30	15.00	0.70	76.65	
42	CH 615 : CH 630	7.52	15.00	0.70	78.96	
43	CH 630 : CH 645	7.72	15.00	0.70	81.06	
44	CH 645 : CH 660	7.74	15.00	0.70	81.27	
45	CH 660 : CH 664	5.90	4.00	0.70	16.52	
					5,604.53	
	De-silting quantity of subcanals (2 nos)	1.43	2407.00	0.30	1028.99	
	Total Quantity				**6,633.53**	

Edapally Canal									
Sl.No	Chainage	W (m)	L (m)	Cutting and dredging details					Remarks
				Proposed canal width (m)		Total Required Quantity (m3)	De-Silting Quantity (m3)	Balance Cutting Quantity to be required (m3)	
1	CH 000 : CH 15	13.23	15.00	16.50	1.20	297.00	138.88	158.12	
2	CH 15 : CH 30	11.77	15.00	16.50	1.20	297.00	123.57	173.43	
3	CH 30 : CH 45	9.03	15.00	16.50	1.20	297.00	94.83	202.17	
4	CH 45 : CH 60	7.05	15.00	16.50	1.20	297.00	74.03	222.98	
5	CH 60 : CH 75	7.48	15.00	16.50	1.20	297.00	78.51	218.50	
6	CH 75 : CH 90	6.53	15.00	16.50	1.20	297.00	68.51	228.49	
7	CH 90 : CH 105	7.00	15.00	16.50	1.20	297.00	73.50	223.50	
8	CH 105 : CH 120	7.45	15.00	16.50	1.20	297.00	78.23	218.78	
9	CH 120 : CH 135	7.10	15.00	16.50	1.20	297.00	74.59	222.42	
10	CH 135 : CH 150	7.70	15.00	16.50	1.20	297.00	80.80	216.20	
11	CH 150 : CH 165	9.37	15.00	16.50	1.20	297.00	98.39	198.62	
12	CH 165 : CH 180	10.35	15.00	16.50	1.20	297.00	108.68	188.33	
13	CH 180 : CH 195	7.66	15.00	16.50	1.20	297.00	80.43	216.57	
14	CH 195 : CH 210	7.09	15.00	16.50	1.20	297.00	74.39	222.61	
15	CH 210 : CH 225	7.60	15.00	16.50	1.20	297.00	79.77	217.24	
16	CH 225 : CH 240	7.16	15.00	16.50	1.20	297.00	75.13	221.87	
17	CH 240 : CH 255	10.36	15.00	16.50	1.20	297.00	108.73	188.27	
18	CH 255 : CH 270	15.50	15.00	16.50	1.20	297.00	162.75	134.25	
19	CH 270 : CH 285	11.10	15.00	16.50	1.20	297.00	116.55	180.45	
20	CH 285 : CH 300	6.23	15.00	16.50	1.20	297.00	65.36	231.64	
21	CH 300 : CH 315	5.99	15.00	16.50	1.20	297.00	62.90	234.11	
22	CH 315 : CH 330	6.34	15.00	16.50	1.20	297.00	66.52	230.48	
23	CH 330 : CH 345	6.13	15.00	16.50	1.20	297.00	64.31	232.69	
24	CH 345 : CH 360	6.33	15.00	16.50	1.20	297.00	66.47	230.54	
25	CH 360 : CH 375	6.18	15.00	16.50	1.20	297.00	64.84	232.16	
26	CH 375 : CH 390	6.15	15.00	16.50	1.20	297.00	64.58	232.43	
27	CH 390 : CH 405	7.20	15.00	16.50	1.20	297.00	75.60	221.40	
28	CH 405 : CH 420	8.22	15.00	16.50	1.20	297.00	86.28	210.73	
29	CH 420 : CH 435	8.50	15.00	16.50	1.20	297.00	89.25	207.75	
30	CH 435 : CH 450	10.90	15.00	16.50	1.20	297.00	114.40	182.60	
31	CH 450 : CH 465	12.14	15.00	16.50	1.20	297.00	127.42	169.58	
32	CH 465 : CH 480	11.42	15.00	16.50	1.20	297.00	119.91	177.09	
33	CH 480 : CH 495	11.09	15.00	16.50	1.20	297.00	116.39	180.61	
34	CH 495 : CH 510	11.19	15.00	16.50	1.20	297.00	117.53	179.47	
35	CH 510 : CH 525	10.05	15.00	16.50	1.20	297.00	105.53	191.48	
36	CH 525 : CH 540	9.34	15.00	16.50	1.20	297.00	98.07	198.93	
37	CH 540 : CH 555	9.59	15.00	16.50	1.20	297.00	100.64	196.36	
38	CH 555 : CH 570	10.22	15.00	16.50	1.20	297.00	107.31	189.69	
39	CH 570 : CH 585	10.95	15.00	16.50	1.20	297.00	114.94	182.06	
40	CH 585 : CH 600	11.08	15.00	16.50	1.20	297.00	116.34	180.66	
41	CH 600 : CH 615	11.85	15.00	16.50	1.20	297.00	124.43	172.58	
42	CH 615 : CH 630	12.96	15.00	16.50	1.20	297.00	136.03	160.97	
43	CH 630 : CH 645	13.09	15.00	16.50	1.20	297.00	137.39	159.61	
44	CH 645 : CH 660	12.91	15.00	16.50	1.20	297.00	135.56	161.45	
45	CH 660 : CH 675	13.17	15.00	16.50	1.20	297.00	138.23	158.77	
46	CH 675 : CH 690	12.87	15.00	16.50	1.20	297.00	135.14	161.87	
47	CH 690 : CH 705	11.70	15.00	16.50	1.20	297.00	122.85	174.15	
48	CH 705 : CH 720	9.48	15.00	16.50	1.20	297.00	99.49	197.51	
49	CH 720 : CH 735	8.01	15.00	16.50	1.20	297.00	84.05	212.95	
50	CH 735 : CH 750	7.84	15.00	16.50	1.20	297.00	82.27	214.73	
51	CH 750 : CH 765	7.40	15.00	16.50	1.20	297.00	77.65	219.35	
52	CH 765 : CH 780	7.52	15.00	16.50	1.20	297.00	78.96	218.04	
53	CH 780 : CH 795	8.07	15.00	16.50	1.20	297.00	84.68	212.32	
54	CH 795 : CH 810	7.85	15.00	16.50	1.20	297.00	82.37	214.63	
55	CH 810 : CH 825	8.02	15.00	16.50	1.20	297.00	84.21	212.79	
56	CH 825 : CH 840	8.67	15.00	16.50	1.20	297.00	90.98	206.02	
57	CH 840 : CH 855	10.20	15.00	16.50	1.20	297.00	107.07	189.94	

Sl.No	Chainage	W (m)	L (m)	Cutting and dredging details					Remarks
				Proposed canal width (m)		Total Required Quantity (m3)	De-Silting Quantity (m3)	Balance Cutting Quantity to be required (m3)	
58	CH 855 : CH 870	10.98	15.00	16.50	1.20	297.00	115.24	181.76	
59	CH 870 : CH 885	10.03	15.00	16.50	1.20	297.00	105.32	191.69	
60	CH 885 : CH 900	9.30	15.00	16.50	1.20	297.00	97.60	199.40	
61	CH 900 : CH 915	9.51	15.00	16.50	1.20	297.00	99.89	197.11	
62	CH 915 : CH 930	8.28	15.00	16.50	1.20	297.00	86.89	210.11	
63	CH 930 : CH 945	8.61	15.00	16.50	1.20	297.00	90.41	206.60	
64	CH 945 : CH 960	8.59	15.00	16.50	1.20	297.00	90.20	206.81	
65	CH 960 : CH 975	8.02	15.00	16.50	1.20	297.00	84.16	212.84	
66	CH 975 : CH 990	8.52	15.00	16.50	1.20	297.00	89.46	207.54	
67	CH 990 : CH 1005	7.90	15.00	16.50	1.20	297.00	82.95	214.05	
68	CH 1005 : CH 1020	7.89	15.00	16.50	1.20	297.00	82.85	214.16	
69	CH 1020 : CH 1035	8.88	15.00	16.50	1.20	297.00	93.24	203.76	
70	CH 1035 : CH 1050	9.49	15.00	16.50	1.20	297.00	99.59	197.41	
71	CH 1050 : CH 1065	9.94	15.00	16.50	1.20	297.00	104.37	192.63	
72	CH 1065 : CH 1080	10.33	15.00	16.50	1.20	297.00	108.47	188.54	
73	CH 1080 : CH 1095	11.34	15.00	16.50	1.20	297.00	119.02	177.98	
74	CH 1095 : CH 1110	15.86	15.00	16.50	1.20	297.00	166.57	130.44	
75	CH 1110 : CH 1125	17.77	15.00	16.50	1.20	0.00	186.59	0.00	w>16.50
76	CH 1125 : CH 1140	17.54	15.00	16.50	1.20	0.00	184.12	0.00	"
77	CH 1140 : CH 1155	15.42	15.00	16.50	1.20	297.00	161.91	135.09	
78	CH 1155 : CH 1170	13.81	15.00	16.50	1.20	297.00	144.95	152.05	
79	CH 1170 : CH 1185	13.28	15.00	16.50	1.20	297.00	139.39	157.61	
80	CH 1185 : CH 1200	13.41	15.00	16.50	1.20	297.00	140.75	156.25	
81	CH 1200 : CH 1215	12.93	15.00	16.50	1.20	297.00	135.77	161.24	
82	CH 1215 : CH 1230	11.16	15.00	16.50	1.20	297.00	117.13	179.87	
83	CH 1230 : CH 1245	10.45	15.00	16.50	1.20	297.00	109.67	187.33	
84	CH 1245 : CH 1260	11.16	15.00	16.50	1.20	297.00	117.18	179.82	
85	CH 1260 : CH 1275	11.61	15.00	16.50	1.20	297.00	121.85	175.15	
86	CH 1275 : CH 1290	10.93	15.00	16.50	1.20	297.00	114.71	182.29	
87	CH 1290 : CH 1305	10.02	15.00	16.50	1.20	297.00	105.21	191.79	
88	CH 1305 : CH 1320	10.29	15.00	16.50	1.20	297.00	108.05	188.96	
89	CH 1320 : CH 1335	10.70	15.00	16.50	1.20	297.00	112.39	184.62	
90	CH 1335 : CH 1350	10.21	15.00	16.50	1.20	297.00	107.15	189.85	
91	CH 1350 : CH 1365	10.37	15.00	16.50	1.20	297.00	108.83	188.17	
92	CH 1365 : CH 1380	10.53	15.00	16.50	1.20	297.00	110.51	186.49	
93	CH 1380 : CH 1395	10.78	15.00	16.50	1.20	297.00	113.14	183.86	
94	CH 1395 : CH 1410	11.38	15.00	16.50	1.20	297.00	119.49	177.51	
95	CH 1410 : CH 1425	11.66	15.00	16.50	1.20	297.00	122.43	174.57	
96	CH 1425 : CH 1440	10.70	15.00	16.50	1.20	297.00	112.30	184.70	
97	CH 1440 : CH 1455	10.47	15.00	16.50	1.20	297.00	109.94	187.07	
98	CH 1455 : CH 1470	10.51	15.00	16.50	1.20	297.00	110.39	186.61	
99	CH 1470 : CH 1485	9.81	15.00	16.50	1.20	297.00	102.95	194.05	
100	CH 1485 : CH 1500	11.20	15.00	16.50	1.20	297.00	117.55	179.45	
101	CH 1500 : CH 1515	12.11	15.00	16.50	1.20	297.00	127.10	169.90	
102	CH 1515 : CH 1530	9.78	15.00	16.50	1.20	297.00	102.69	194.31	
103	CH 1530 : CH 1545	8.09	15.00	16.50	1.20	297.00	84.89	212.11	
104	CH 1545 : CH 1560	8.93	15.00	16.50	1.20	297.00	93.77	203.24	
105	CH 1560 : CH 1575	9.06	15.00	16.50	1.20	297.00	95.13	201.87	
106	CH 1575 : CH 1590	8.52	15.00	16.50	1.20	297.00	89.46	207.54	
107	CH 1590 : CH 1605	8.64	15.00	16.50	1.20	297.00	90.67	206.33	
108	CH 1605 : CH 1620	8.82	15.00	16.50	1.20	297.00	92.61	204.39	
109	CH 1620 : CH 1635	8.80	15.00	16.50	1.20	297.00	92.40	204.60	
110	CH 1635 : CH 1650	9.73	15.00	16.50	1.20	297.00	102.11	194.89	
111	CH 1650 : CH 1665	10.85	15.00	16.50	1.20	297.00	113.87	183.13	
112	CH 1665 : CH 1680	11.92	15.00	16.50	1.20	297.00	125.16	171.84	
113	CH 1680 : CH 1695	12.03	15.00	16.50	1.20	297.00	126.32	170.69	
114	CH 1695 : CH 1710	10.11	15.00	16.50	1.20	297.00	106.10	190.90	
115	CH 1710 : CH 1725	9.90	15.00	16.50	1.20	297.00	103.95	193.05	

Sl.No	Chainage			Cutting and dredging details					Remarks
		W (m)	L (m)	Proposed canal width (m)		Total Required Quantity (m3)	De-Silting Quantity (m3)	Balance Cutting Quantity to be required (m3)	
116	CH 1725 : CH 1740	10.28	15.00	16.50	1.20	297.00	107.94	189.06	
117	CH 1740 : CH 1755	11.46	15.00	16.50	1.20	297.00	120.28	176.72	
118	CH 1755 : CH 1770	12.49	15.00	16.50	1.20	297.00	131.15	165.86	
119	CH 1770 : CH 1785	12.31	15.00	16.50	1.20	297.00	129.29	167.71	
120	CH 1785 : CH 1800	10.82	15.00	16.50	1.20	297.00	113.61	183.39	
121	CH 1800 : CH 1815	9.97	15.00	16.50	1.20	297.00	104.69	192.32	
122	CH 1815 : CH 1830	10.55	15.00	16.50	1.20	297.00	110.72	186.28	
123	CH 1830 : CH 1845	11.51	15.00	16.50	1.20	297.00	120.86	176.15	
124	CH 1845 : CH 1860	12.45	15.00	16.50	1.20	297.00	130.67	166.33	
125	CH 1860 : CH 1875	13.00	15.00	16.50	1.20	297.00	136.47	160.54	
126	CH 1875 : CH 1890	12.24	15.00	16.50	1.20	297.00	128.49	168.52	
127	CH 1890 : CH 1905	12.64	15.00	16.50	1.20	297.00	132.67	164.33	
128	CH 1905 : CH 1920	13.14	15.00	16.50	1.20	297.00	138.01	159.00	
129	CH 1920 : CH 1935	11.43	15.00	16.50	1.20	297.00	119.96	177.04	
130	CH 1935 : CH 1950	10.81	15.00	16.50	1.20	297.00	113.51	183.50	
131	CH 1950 : CH 1965	10.95	15.00	16.50	1.20	297.00	114.98	182.03	
132	CH 1965 : CH 1980	11.11	15.00	16.50	1.20	297.00	116.60	180.40	
133	CH 1980 : CH 1995	10.90	15.00	16.50	1.20	297.00	114.40	182.60	
134	CH 1995 : CH 2010	10.81	15.00	16.50	1.20	297.00	113.51	183.50	
135	CH 2010 : CH 2025	11.08	15.00	16.50	1.20	297.00	116.34	180.66	
136	CH 2025 : CH 2040	12.10	15.00	16.50	1.20	297.00	127.09	169.92	
137	CH 2040 : CH 2055	12.90	15.00	16.50	1.20	297.00	135.40	161.60	
138	CH 2055 : CH 2070	14.67	15.00	16.50	1.20	297.00	153.98	143.02	
139	CH 2070 : CH 2085	15.97	15.00	16.50	1.20	297.00	167.69	129.32	
140	CH 2085 : CH 2100	17.78	15.00	16.50	1.20	0.00	186.64	0.00	w>16.50
141	CH 2100 : CH 2115	20.81	15.00	16.50	1.20	0.00	215.25	0.00	"
142	CH 2115 : CH 2130	22.87	15.00	16.50	1.20	0.00	215.25	0.00	"
143	CH 2130 : CH 2145	19.57	15.00	16.50	1.20	0.00	205.43	0.00	"
144	CH 2145 : CH 2160	18.09	15.00	16.50	1.20	0.00	189.89	0.00	"
145	CH 2160 : CH 2175	19.51	15.00	16.50	1.20	0.00	204.86	0.00	"
146	CH 2175 : CH 2190	18.27	15.00	16.50	1.20	297.00	191.78	0.00	
147	CH 2190 : CH 2205	15.24	15.00	16.50	1.20	297.00	160.02	136.98	
148	CH 2205 : CH 2220	14.93	15.00	16.50	1.20	297.00	156.71	140.29	
149	CH 2220 : CH 2235	17.56	15.00	16.50	1.20	0.00	184.33	0.00	
150	CH 2235 : CH 2250	19.12	15.00	16.50	1.20	0.00	200.71	0.00	w>16.50
151	CH 2250 : CH 2265	19.14	15.00	16.50	1.20	0.00	200.97	0.00	"
152	CH 2265 : CH 2280	18.58	15.00	16.50	1.20	0.00	195.04	0.00	"
153	CH 2280 : CH 2295	17.33	15.00	16.50	1.20	0.00	181.91	0.00	"
154	CH 2295 : CH 2310	16.48	15.00	16.50	1.20	297.00	172.99	124.01	
155	CH 2310 : CH 2325	16.09	15.00	16.50	1.20	297.00	168.89	128.11	
156	CH 2325 : CH 2340	15.56	15.00	16.50	1.20	297.00	163.38	133.62	
157	CH 2340 : CH 2355	14.61	15.00	16.50	1.20	297.00	153.35	143.65	
158	CH 2355 : CH 2370	14.45	15.00	16.50	1.20	297.00	151.67	145.33	
159	CH 2370 : CH 2385	17.04	15.00	16.50	1.20	0.00	178.87	0.00	
160	CH 2385 : CH 2400	18.02	15.00	16.50	1.20	0.00	189.21	0.00	w>16.50
161	CH 2400 : CH 2415	16.43	15.00	16.50	1.20	297.00	172.46	124.54	
162	CH 2415 : CH 2430	17.03	15.00	16.50	1.20	0.00	178.82	0.00	w>16.50
163	CH 2430 : CH 2445	18.88	15.00	16.50	1.20	0.00	198.19	0.00	"
164	CH 2445 : CH 2460	20.09	15.00	16.50	1.20	0.00	210.89	0.00	"
165	CH 2460 : CH 2475	22.07	15.00	16.50	1.20	0.00	215.25	0.00	"
166	CH 2475 : CH 2490	23.83	15.00	16.50	1.20	0.00	215.25	0.00	"
167	CH 2490 : CH 2505	21.91	15.00	16.50	1.20	0.00	215.25	0.00	"
168	CH 2505 : CH 2520	17.51	15.00	16.50	1.20	0.00	183.86	0.00	
169	CH 2520 : CH 2535	14.88	15.00	16.50	1.20	297.00	156.24	140.76	
170	CH 2535 : CH 2550	15.12	15.00	16.50	1.20	297.00	158.76	138.24	
171	CH 2550 : CH 2565	16.16	15.00	16.50	1.20	297.00	169.68	127.32	
172	CH 2565 : CH 2580	16.15	15.00	16.50	1.20	297.00	169.52	127.48	
173	CH 2580 : CH 2595	16.19	15.00	16.50	1.20	297.00	170.00	127.01	

Sl.No	Chainage	W (m)	L (m)	Cutting and dredging details					Remarks
				Proposed canal width (m)		Total Required Quantity (m3)	De-Silting Quantity (m3)	Balance Cutting Quantity to be required (m3)	
174	CH 2595 : CH 2610	16.63	15.00	16.50	1.20	0.00	174.62	0.00	w>16.50
175	CH 2610 : CH 2625	16.39	15.00	16.50	1.20	297.00	172.10	124.91	
176	CH 2625 : CH 2640	15.49	15.00	16.50	1.20	297.00	162.59	134.41	
177	CH 2640 : CH 2655	14.30	15.00	16.50	1.20	297.00	150.10	146.90	
178	CH 2655 : CH 2670	13.43	15.00	16.50	1.20	297.00	141.02	155.99	
179	CH 2670 : CH 2685	13.02	15.00	16.50	1.20	297.00	136.66	160.34	
180	CH 2685 : CH 2700	13.88	15.00	16.50	1.20	297.00	145.69	151.31	
181	CH 2700 : CH 2715	15.69	15.00	16.50	1.20	297.00	164.75	132.26	
182	CH 2715 : CH 2730	14.14	15.00	16.50	1.20	297.00	148.44	148.57	
183	CH 2730 : CH 2745	15.03	15.00	16.50	1.20	297.00	157.76	139.24	
184	CH 2745 : CH 2760	15.31	15.00	16.50	1.20	297.00	160.76	136.25	
185	CH 2760 : CH 2775	15.21	15.00	16.50	1.20	297.00	159.71	137.30	
186	CH 2775 : CH 2790	14.04	15.00	16.50	1.20	297.00	147.42	149.58	
187	CH 2790 : CH 2805	12.42	15.00	16.50	1.20	297.00	130.41	166.59	
188	CH 2805 : CH 2820	10.88	15.00	16.50	1.20	297.00	114.24	182.76	
189	CH 2820 : CH 2835	10.10	15.00	16.50	1.20	297.00	106.00	191.00	
190	CH 2835 : CH 2850	10.33	15.00	16.50	1.20	297.00	108.47	188.54	
191	CH 2850 : CH 2865	12.26	15.00	16.50	1.20	297.00	128.68	168.32	
192	CH 2865 : CH 2880	14.00	15.00	16.50	1.20	297.00	147.00	150.00	
193	CH 2880 : CH 2895	14.48	15.00	16.50	1.20	297.00	151.99	145.01	
194	CH 2895 : CH 2910	13.57	15.00	16.50	1.20	297.00	142.43	154.57	
195	CH 2910 : CH 2925	11.74	15.00	16.50	1.20	297.00	123.27	173.73	
196	CH 2925 : CH 2940	11.56	15.00	16.50	1.20	297.00	121.38	175.62	
197	CH 2940 : CH 2955	11.94	15.00	16.50	1.20	297.00	125.32	171.68	
198	CH 2955 : CH 2970	11.76	15.00	16.50	1.20	297.00	123.43	173.57	
199	CH 2970 : CH 2985	12.58	15.00	16.50	1.20	297.00	132.09	164.91	
200	CH 2985 : CH 3000	14.59	15.00	16.50	1.20	297.00	153.20	143.81	
201	CH 3000 : CH 3015	16.45	15.00	16.50	1.20	297.00	172.67	124.33	
202	CH 3015 : CH 3030	16.85	15.00	16.50	1.20	0.00	176.93	0.00	
203	CH 3030 : CH 3045	14.84	15.00	16.50	1.20	297.00	155.77	141.23	
204	CH 3045 : CH 3060	12.84	15.00	16.50	1.20	297.00	134.77	162.23	
205	CH 3060 : CH 3075	12.22	15.00	16.50	1.20	297.00	128.26	168.74	
206	CH 3075 : CH 3090	11.99	15.00	16.50	1.20	297.00	125.84	171.16	
207	CH 3090 : CH 3105	12.13	15.00	16.50	1.20	297.00	127.37	169.64	
208	CH 3105 : CH 3120	12.55	15.00	16.50	1.20	297.00	131.78	165.23	
209	CH 3120 : CH 3135	12.58	15.00	16.50	1.20	297.00	132.04	164.96	
210	CH 3135 : CH 3150	12.59	15.00	16.50	1.20	297.00	132.14	164.86	
211	CH 3150 : CH 3165	13.15	15.00	16.50	1.20	297.00	138.08	158.93	
212	CH 3165 : CH 3180	13.51	15.00	16.50	1.20	297.00	141.86	155.15	
213	CH 3180 : CH 3195	12.72	15.00	16.50	1.20	297.00	133.51	163.49	
214	CH 3195 : CH 3210	11.55	15.00	16.50	1.20	297.00	121.28	175.73	
215	CH 3210 : CH 3225	10.43	15.00	16.50	1.20	297.00	109.46	187.54	
216	CH 3225 : CH 3240	9.67	15.00	16.50	1.20	297.00	101.48	195.52	
217	CH 3240 : CH 3255	10.30	15.00	16.50	1.20	297.00	108.15	188.85	
218	CH 3255 : CH 3270	11.37	15.00	16.50	1.20	297.00	119.39	177.62	
219	CH 3270 : CH 3285	11.84	15.00	16.50	1.20	297.00	124.27	172.73	
220	CH 3285 : CH 3300	13.00	15.00	16.50	1.20	297.00	136.45	160.55	
221	CH 3300 : CH 3315	15.11	15.00	16.50	1.20	297.00	158.60	138.40	
222	CH 3315 : CH 3330	16.70	15.00	16.50	1.20	0.00	175.30	0.00	
223	CH 3330 : CH 3345	17.48	15.00	16.50	1.20	0.00	183.49	0.00	w>16.50
224	CH 3345 : CH 3360	17.48	15.00	16.50	1.20	0.00	183.49	0.00	"
225	CH 3360 : CH 3375	17.61	15.00	16.50	1.20	0.00	184.85	0.00	"
226	CH 3375 : CH 3390	17.83	15.00	16.50	1.20	0.00	187.22	0.00	"
227	CH 3390 : CH 3405	17.41	15.00	16.50	1.20	0.00	182.81	0.00	"
228	CH 3405 : CH 3420	16.78	15.00	16.50	1.20	0.00	176.14	0.00	"
229	CH 3420 : CH 3435	16.43	15.00	16.50	1.20	297.00	172.46	124.54	
230	CH 3435 : CH 3450	16.14	15.00	16.50	1.20	297.00	169.47	127.53	
231	CH 3450 : CH 3465	15.82	15.00	16.50	1.20	297.00	166.11	130.89	

Sl.No	Chainage	W (m)	L (m)	Cutting and dredging details					Remarks
				Proposed canal width (m)		Total Required Quantity (m3)	De-Silting Quantity (m3)	Balance Cutting Quantity to be required (m3)	
232	CH 3465 : CH 3480	15.48	15.00	16.50	1.20	297.00	162.54	134.46	
233	CH 3480 : CH 3495	16.36	15.00	16.50	1.20	297.00	171.78	125.22	
234	CH 3495 : CH 3510	17.95	15.00	16.50	1.20	0.00	188.42	0.00	w>16.50
235	CH 3510 : CH 3525	16.15	15.00	16.50	1.20	297.00	169.52	127.48	
236	CH 3525 : CH 3540	12.70	15.00	16.50	1.20	297.00	133.39	163.62	
237	CH 3540 : CH 3555	12.96	15.00	16.50	1.20	297.00	136.03	160.97	
238	CH 3555 : CH 3570	13.25	15.00	16.50	1.20	297.00	139.07	157.93	
239	CH 3570 : CH 3585	13.11	15.00	16.50	1.20	297.00	137.66	159.35	
240	CH 3585 : CH 3600	12.96	15.00	16.50	1.20	297.00	136.03	160.97	
241	CH 3600 : CH 3615	12.06	15.00	16.50	1.20	297.00	126.63	170.37	
242	CH 3615 : CH 3630	10.60	15.00	16.50	1.20	297.00	111.25	185.75	
243	CH 3630 : CH 3645	10.15	15.00	16.50	1.20	297.00	106.58	190.43	
244	CH 3645 : CH 3660	10.47	15.00	16.50	1.20	297.00	109.88	187.12	
245	CH 3660 : CH 3675	10.49	15.00	16.50	1.20	297.00	110.15	186.86	
246	CH 3675 : CH 3690	10.51	15.00	16.50	1.20	297.00	110.36	186.65	
247	CH 3690 : CH 3705	10.79	15.00	16.50	1.20	297.00	113.30	183.71	
248	CH 3705 : CH 3720	10.80	15.00	16.50	1.20	297.00	113.35	183.65	
249	CH 3720 : CH 3735	10.66	15.00	16.50	1.20	297.00	111.88	185.12	
250	CH 3735 : CH 3750	11.16	15.00	16.50	1.20	297.00	117.13	179.87	
251	CH 3750 : CH 3765	12.29	15.00	16.50	1.20	297.00	128.99	168.01	
252	CH 3765 : CH 3780	13.55	15.00	16.50	1.20	297.00	142.28	154.73	
253	CH 3780 : CH 3795	14.78	15.00	16.50	1.20	297.00	155.14	141.86	
254	CH 3795 : CH 3810	15.25	15.00	16.50	1.20	297.00	160.07	136.93	
255	CH 3810 : CH 3825	15.28	15.00	16.50	1.20	297.00	160.39	136.61	
256	CH 3825 : CH 3840	16.19	15.00	16.50	1.20	297.00	170.00	127.01	
257	CH 3840 : CH 3855	16.21	15.00	16.50	1.20	297.00	170.15	126.85	
258	CH 3855 : CH 3870	15.55	15.00	16.50	1.20	297.00	163.22	133.78	
259	CH 3870 : CH 3885	16.23	15.00	16.50	1.20	297.00	170.42	126.59	
260	CH 3885 : CH 3900	18.01	15.00	16.50	1.20	0.00	189.05	0.00	w>16.50
261	CH 3900 : CH 3915	18.96	15.00	16.50	1.20	0.00	199.08	0.00	"
262	CH 3915 : CH 3930	17.60	15.00	16.50	1.20	0.00	184.80	0.00	"
263	CH 3930 : CH 3945	15.32	15.00	16.50	1.20	297.00	160.86	136.14	
264	CH 3945 : CH 3960	12.50	15.00	16.50	1.20	297.00	131.20	165.80	
265	CH 3960 : CH 3975	11.19	15.00	16.50	1.20	297.00	117.50	179.51	
266	CH 3975 : CH 3990	12.06	15.00	16.50	1.20	297.00	126.63	170.37	
267	CH 3990 : CH 4005	12.14	15.00	16.50	1.20	297.00	127.47	169.53	
268	CH 4005 : CH 4020	11.43	15.00	16.50	1.20	297.00	120.02	176.99	
269	CH 4020 : CH 4035	12.75	15.00	16.50	1.20	297.00	133.82	163.18	
270	CH 4035 : CH 4050	14.87	15.00	16.50	1.20	297.00	156.08	140.92	
271	CH 4050 : CH 4065	13.54	15.00	16.50	1.20	297.00	142.12	154.88	
272	CH 4065 : CH 4080	11.47	15.00	16.50	1.20	297.00	120.44	176.57	
273	CH 4080 : CH 4095	11.10	15.00	16.50	1.20	297.00	116.55	180.45	
274	CH 4095 : CH 4110	11.08	15.00	16.50	1.20	297.00	116.29	180.71	
275	CH 4110 : CH 4125	11.90	15.00	16.50	1.20	297.00	124.95	172.05	
276	CH 4125 : CH 4140	13.29	15.00	16.50	1.20	297.00	139.58	157.42	
277	CH 4140 : CH 4155	13.21	15.00	16.50	1.20	297.00	138.65	158.35	
278	CH 4155 : CH 4170	13.47	15.00	16.50	1.20	297.00	141.44	155.57	
279	CH 4170 : CH 4185	15.62	15.00	16.50	1.20	297.00	163.96	133.04	
280	CH 4185 : CH 4200	16.55	15.00	16.50	1.20	0.00	173.72	0.00	
281	CH 4200 : CH 4215	15.38	15.00	16.50	1.20	297.00	161.49	135.51	
282	CH 4215 : CH 4230	14.59	15.00	16.50	1.20	297.00	153.16	143.84	
283	CH 4230 : CH 4245	15.63	15.00	16.50	1.20	297.00	164.12	132.89	
284	CH 4245 : CH 4260	15.79	15.00	16.50	1.20	297.00	165.74	131.26	
285	CH 4260 : CH 4275	14.36	15.00	16.50	1.20	297.00	150.78	146.22	
286	CH 4275 : CH 4290	14.04	15.00	16.50	1.20	297.00	147.42	149.58	
287	CH 4290 : CH 4305	15.22	15.00	16.50	1.20	297.00	159.81	137.19	
288	CH 4305 : CH 4320	15.99	15.00	16.50	1.20	297.00	167.84	129.16	
289	CH 4320 : CH 4335	16.46	15.00	16.50	1.20	297.00	172.78	124.22	

Sl.No	Chainage	W (m)	L (m)	Cutting and dredging details					Remarks
				Proposed canal width (m)		Total Required Quantity (m3)	De-Silting Quantity (m3)	Balance Cutting Quantity to be required (m3)	
290	CH 4335 : CH 4350	16.61	15.00	16.50	1.20	0.00	174.41	0.00	w>16.50
291	CH 4350 : CH 4365	16.24	15.00	16.50	1.20	297.00	170.52	126.48	
292	CH 4365 : CH 4380	15.61	15.00	16.50	1.20	297.00	163.85	133.15	
293	CH 4380 : CH 4395	15.51	15.00	16.50	1.20	297.00	162.80	134.20	
294	CH 4395 : CH 4410	15.94	15.00	16.50	1.20	297.00	167.32	129.68	
295	CH 4410 : CH 4425	16.59	15.00	16.50	1.20	297.00	174.20	122.81	
296	CH 4425 : CH 4440	17.44	15.00	16.50	1.20	0.00	183.07	0.00	w>16.50
297	CH 4440 : CH 4455	17.54	15.00	16.50	1.20	0.00	184.12	0.00	w>16.50
298	CH 4455 : CH 4470	17.14	15.00	16.50	1.20	0.00	179.97	0.00	w>16.50
299	CH 4470 : CH 4485	16.41	15.00	16.50	1.20	297.00	172.25	124.75	
300	CH 4485 : CH 4500	14.86	15.00	16.50	1.20	297.00	155.98	141.02	
301	CH 4500 : CH 4515	13.95	15.00	16.50	1.20	297.00	146.42	150.58	
302	CH 4515 : CH 4530	14.84	15.00	16.50	1.20	297.00	155.77	141.23	
303	CH 4530 : CH 4545	16.83	15.00	16.50	1.20	0.00	176.66	0.00	
304	CH 4545 : CH 4560	17.80	15.00	16.50	1.20	0.00	186.90	0.00	w>16.50
305	CH 4560 : CH 4575	18.79	15.00	16.50	1.20	0.00	197.30	0.00	"
306	CH 4575 : CH 4590	20.27	15.00	16.50	1.20	0.00	212.78	0.00	"
307	CH 4590 : CH 4605	20.30	15.00	16.50	1.20	0.00	213.15	0.00	"
308	CH 4605 : CH 4620	18.32	15.00	16.50	1.20	0.00	192.31	0.00	"
309	CH 4620 : CH 4635	16.56	15.00	16.50	1.20	0.00	173.88	0.00	"
310	CH 4635 : CH 4650	16.27	15.00	16.50	1.20	297.00	170.84	126.17	
311	CH 4650 : CH 4665	16.08	15.00	16.50	1.20	297.00	168.84	128.16	
312	CH 4665 : CH 4680	15.60	15.00	16.50	1.20	297.00	163.80	133.20	
313	CH 4680 : CH 4695	15.84	15.00	16.50	1.20	297.00	166.32	130.68	
314	CH 4695 : CH 4710	16.23	15.00	16.50	1.20	297.00	170.36	126.64	
315	CH 4710 : CH 4725	14.75	15.00	16.50	1.20	297.00	154.82	142.18	
316	CH 4725 : CH 4740	13.93	15.00	16.50	1.20	297.00	146.21	150.79	
317	CH 4740 : CH 4755	14.79	15.00	16.50	1.20	297.00	155.24	141.76	
318	CH 4755 : CH 4770	16.01	15.00	16.50	1.20	297.00	168.11	128.90	
319	CH 4770 : CH 4785	17.51	15.00	16.50	1.20	0.00	183.86	0.00	w>16.50
320	CH 4785 : CH 4800	18.52	15.00	16.50	1.20	0.00	194.46	0.00	"
321	CH 4800 : CH 4815	18.23	15.00	16.50	1.20	0.00	191.42	0.00	"
322	CH 4815 : CH 4830	17.31	15.00	16.50	1.20	0.00	181.76	0.00	"
323	CH 4830 : CH 4845	16.87	15.00	16.50	1.20	0.00	177.14	0.00	"
324	CH 4845 : CH 4860	17.34	15.00	16.50	1.20	0.00	182.02	0.00	"
325	CH 4860 : CH 4875	18.09	15.00	16.50	1.20	0.00	189.95	0.00	"
326	CH 4875 : CH 4890	18.39	15.00	16.50	1.20	0.00	193.10	0.00	"
327	CH 4890 : CH 4905	18.77	15.00	16.50	1.20	0.00	197.03	0.00	"
328	CH 4905 : CH 4920	20.20	15.00	16.50	1.20	0.00	212.05	0.00	"
329	CH 4920 : CH 4935	21.75	15.00	16.50	1.20	0.00	215.25	0.00	"
330	CH 4935 : CH 4950	22.27	15.00	16.50	1.20	0.00	215.25	0.00	"
331	CH 4950 : CH 4965	22.30	15.00	16.50	1.20	0.00	215.25	0.00	"
332	CH 4965 : CH 4980	20.87	15.00	16.50	1.20	0.00	215.25	0.00	"
333	CH 4980 : CH 4995	18.84	15.00	16.50	1.20	0.00	197.82	0.00	"
334	CH 4995 : CH 5010	17.98	15.00	16.50	1.20	0.00	188.74	0.00	"
335	CH 5010 : CH 5025	17.67	15.00	16.50	1.20	0.00	185.54	0.00	"
336	CH 5025 : CH 5040	17.17	15.00	16.50	1.20	0.00	180.23	0.00	"
337	CH 5040 : CH 5055	16.63	15.00	16.50	1.20	0.00	174.62	0.00	"
338	CH 5055 : CH 5070	16.90	15.00	16.50	1.20	0.00	177.45	0.00	"
339	CH 5070 : CH 5085	17.59	15.00	16.50	1.20	0.00	184.64	0.00	"
340	CH 5085 : CH 5100	16.83	15.00	16.50	1.20	0.00	176.72	0.00	
341	CH 5100 : CH 5115	15.15	15.00	16.50	1.20	297.00	159.02	137.98	
342	CH 5115 : CH 5130	14.79	15.00	16.50	1.20	297.00	155.24	141.76	
343	CH 5130 : CH 5145	16.74	15.00	16.50	1.20	0.00	175.72	0.00	
344	CH 5145 : CH 5160	18.01	15.00	16.50	1.20	0.00	189.11	0.00	w>16.50
345	CH 5160 : CH 5175	16.69	15.00	16.50	1.20	0.00	175.25	0.00	"
346	CH 5175 : CH 5190	15.60	15.00	16.50	1.20	297.00	163.75	133.25	
347	CH 5190 : CH 5205	16.85	15.00	16.50	1.20	0.00	176.93	0.00	

Sl.No	Chainage	W (m)	L (m)	Cutting and dredging details					Remarks
				Proposed canal width (m)		Total Required Quantity (m3)	De-Silting Quantity (m3)	Balance Cutting Quantity to be required (m3)	
348	CH 5205 : CH 5220	19.46	15.00	16.50	1.20	0.00	204.28	0.00	w>16.50
349	CH 5220 : CH 5235	21.14	15.00	16.50	1.20	0.00	215.25	0.00	"
350	CH 5235 : CH 5250	21.47	15.00	16.50	1.20	0.00	215.25	0.00	"
351	CH 5250 : CH 5265	21.01	15.00	16.50	1.20	0.00	215.25	0.00	"
352	CH 5265 : CH 5280	21.10	15.00	16.50	1.20	0.00	215.25	0.00	"
353	CH 5280 : CH 5295	21.56	15.00	16.50	1.20	0.00	215.25	0.00	"
354	CH 5295 : CH 5310	21.95	15.00	16.50	1.20	0.00	215.25	0.00	"
355	CH 5310 : CH 5325	22.46	15.00	16.50	1.20	0.00	215.25	0.00	"
356	CH 5325 : CH 5340	22.89	15.00	16.50	1.20	0.00	215.25	0.00	"
357	CH 5340 : CH 5355	23.02	15.00	16.50	1.20	0.00	215.25	0.00	"
358	CH 5355 : CH 5370	22.53	15.00	16.50	1.20	0.00	215.25	0.00	"
359	CH 5370 : CH 5385	21.61	15.00	16.50	1.20	0.00	215.25	0.00	"
360	CH 5385 : CH 5400	20.63	15.00	16.50	1.20	0.00	215.25	0.00	"
361	CH 5400 : CH 5415	19.51	15.00	16.50	1.20	0.00	204.80	0.00	"
362	CH 5415 : CH 5430	19.63	15.00	16.50	1.20	0.00	206.06	0.00	"
363	CH 5430 : CH 5445	20.56	15.00	16.50	1.20	0.00	215.25	0.00	"
364	CH 5445 : CH 5460	22.15	15.00	16.50	1.20	0.00	215.25	0.00	"
365	CH 5460 : CH 5475	23.23	15.00	16.50	1.20	0.00	215.25	0.00	"
366	CH 5475 : CH 5490	24.26	15.00	16.50	1.20	0.00	215.25	0.00	"
367	CH 5490 : CH 5505	25.36	15.00	16.50	1.20	0.00	215.25	0.00	"
368	CH 5505 : CH 5520	24.80	15.00	16.50	1.20	0.00	215.25	0.00	"
369	CH 5520 : CH 5535	24.03	15.00	16.50	1.20	0.00	215.25	0.00	"
370	CH 5535 : CH 5550	22.43	15.00	16.50	1.20	0.00	215.25	0.00	"
371	CH 5550 : CH 5565	21.20	15.00	16.50	1.20	0.00	215.25	0.00	"
372	CH 5565 : CH 5580	19.71	15.00	16.50	1.20	0.00	206.96	0.00	"
373	CH 5580 : CH 5595	17.97	15.00	16.50	1.20	0.00	188.69	0.00	"
374	CH 5595 : CH 5610	18.82	15.00	16.50	1.20	0.00	197.61	0.00	"
375	CH 5610 : CH 5625	19.44	15.00	16.50	1.20	0.00	204.12	0.00	"
376	CH 5625 : CH 5640	19.72	15.00	16.50	1.20	0.00	207.01	0.00	"
377	CH 5640 : CH 5655	20.09	15.00	16.50	1.20	0.00	210.89	0.00	"
378	CH 5655 : CH 5670	19.79	15.00	16.50	1.20	0.00	207.80	0.00	"
379	CH 5670 : CH 5685	20.42	15.00	16.50	1.20	0.00	214.41	0.00	"
380	CH 5685 : CH 5700	22.00	15.00	16.50	1.20	0.00	215.25	0.00	"
381	CH 5700 : CH 5715	22.98	15.00	16.50	1.20	0.00	215.25	0.00	"
382	CH 5715 : CH 5730	22.80	15.00	16.50	1.20	0.00	215.25	0.00	"
383	CH 5730 : CH 5745	22.42	15.00	16.50	1.20	0.00	215.25	0.00	"
384	CH 5745 : CH 5760	21.82	15.00	16.50	1.20	0.00	215.25	0.00	"
385	CH 5760 : CH 5775	21.64	15.00	16.50	1.20	0.00	215.25	0.00	"
386	CH 5775 : CH 5790	22.17	15.00	16.50	1.20	0.00	215.25	0.00	"
387	CH 5790 : CH 5805	23.21	15.00	16.50	1.20	0.00	215.25	0.00	"
388	CH 5805 : CH 5820	24.07	15.00	16.50	1.20	0.00	215.25	0.00	"
389	CH 5820 : CH 5835	23.64	15.00	16.50	1.20	0.00	215.25	0.00	"
390	CH 5835 : CH 5850	22.26	15.00	16.50	1.20	0.00	215.25	0.00	"
391	CH 5850 : CH 5865	21.71	15.00	16.50	1.20	0.00	215.25	0.00	"
392	CH 5865 : CH 5880	21.52	15.00	16.50	1.20	0.00	215.25	0.00	"
393	CH 5880 : CH 5895	19.64	15.00	16.50	1.20	0.00	206.17	0.00	"
394	CH 5895 : CH 5910	16.91	15.00	16.50	1.20	0.00	177.50	0.00	
395	CH 5910 : CH 5925	15.24	15.00	16.50	1.20	297.00	160.02	136.98	
396	CH 5925 : CH 5940	16.85	15.00	16.50	1.20	0.00	176.87	0.00	
397	CH 5940 : CH 5955	21.03	15.00	16.50	1.20	0.00	215.25	0.00	w>16.50
398	CH 5955 : CH 5970	22.96	15.00	16.50	1.20	0.00	215.25	0.00	"
399	CH 5970 : CH 5985	24.13	15.00	16.50	1.20	0.00	215.25	0.00	"
400	CH 5985 : CH 6000	25.55	15.00	16.50	1.20	0.00	215.25	0.00	"
401	CH 6000 : CH 6015	25.51	15.00	16.50	1.20	0.00	215.25	0.00	"
402	CH 6015 : CH 6030	26.13	15.00	16.50	1.20	0.00	215.25	0.00	"
403	CH 6030 : CH 6045	27.31	15.00	16.50	1.20	0.00	215.25	0.00	"
404	CH 6045 : CH 6060	27.38	15.00	16.50	1.20	0.00	215.25	0.00	"
405	CH 6060 : CH 6075	26.16	15.00	16.50	1.20	0.00	215.25	0.00	"

Sl.No	Chainage			Cutting and dredging details					Remarks
		W (m)	L (m)	Proposed canal width (m)		Total Required Quantity (m3)	De-Silting Quantity (m3)	Balance Cutting Quantity to be required (m3)	
406	CH 6075 : CH 6090	25.36	15.00	16.50	1.20	0.00	215.25	0.00	"
407	CH 6090 : CH 6105	26.30	15.00	16.50	1.20	0.00	215.25	0.00	"
408	CH 6105 : CH 6120	28.11	15.00	16.50	1.20	0.00	215.25	0.00	"
409	CH 6120 : CH 6135	31.04	15.00	16.50	1.20	0.00	215.25	0.00	"
410	CH 6135 : CH 6150	33.51	15.00	16.50	1.20	0.00	215.25	0.00	"
411	CH 6150 : CH 6165	32.16	15.00	16.50	1.20	0.00	215.25	0.00	"
412	CH 6165 : CH 6180	28.96	15.00	16.50	1.20	0.00	215.25	0.00	"
413	CH 6180 : CH 6195	27.98	15.00	16.50	1.20	0.00	215.25	0.00	"
414	CH 6195 : CH 6210	27.60	15.00	16.50	1.20	0.00	215.25	0.00	"
415	CH 6210 : CH 6225	25.18	15.00	16.50	1.20	0.00	215.25	0.00	"
416	CH 6225 : CH 6240	22.73	15.00	16.50	1.20	0.00	215.25	0.00	"
417	CH 6240 : CH 6255	21.03	15.00	16.50	1.20	0.00	215.25	0.00	"
418	CH 6255 : CH 6270	20.45	15.00	16.50	1.20	0.00	214.73	0.00	"
419	CH 6270 : CH 6285	21.39	15.00	16.50	1.20	0.00	215.25	0.00	"
420	CH 6285 : CH 6300	22.92	15.00	16.50	1.20	0.00	215.25	0.00	"
421	CH 6300 : CH 6315	25.16	15.00	16.50	1.20	0.00	215.25	0.00	"
422	CH 6315 : CH 6330	26.96	15.00	16.50	1.20	0.00	215.25	0.00	"
423	CH 6330 : CH 6345	26.18	15.00	16.50	1.20	0.00	215.25	0.00	"
424	CH 6345 : CH 6360	25.20	15.00	16.50	1.20	0.00	215.25	0.00	"
425	CH 6360 : CH 6375	25.44	15.00	16.50	1.20	0.00	215.25	0.00	"
426	CH 6375 : CH 6390	25.64	15.00	16.50	1.20	0.00	215.25	0.00	"
427	CH 6390 : CH 6405	26.70	15.00	16.50	1.20	0.00	215.25	0.00	"
428	CH 6405 : CH 6420	28.20	15.00	16.50	1.20	0.00	215.25	0.00	"
429	CH 6420 : CH 6435	29.18	15.00	16.50	1.20	0.00	215.25	0.00	"
430	CH 6435 : CH 6450	27.85	15.00	16.50	1.20	0.00	215.25	0.00	"
431	CH 6450 : CH 6465	25.68	15.00	16.50	1.20	0.00	215.25	0.00	"
432	CH 6465 : CH 6480	27.81	15.00	16.50	1.20	0.00	215.25	0.00	"
433	CH 6480 : CH 6495	30.65	15.00	16.50	1.20	0.00	215.25	0.00	"
434	CH 6495 : CH 6510	31.33	15.00	16.50	1.20	0.00	215.25	0.00	"
435	CH 6510 : CH 6525	30.77	15.00	16.50	1.20	0.00	215.25	0.00	"
436	CH 6525 : CH 6540	25.96	15.00	16.50	1.20	0.00	215.25	0.00	"
437	CH 6540 : CH 6555	20.33	15.00	16.50	1.20	0.00	213.41	0.00	"
438	CH 6555 : CH 6570	17.77	15.00	16.50	1.20	0.00	186.53	0.00	"
439	CH 6570 : CH 6585	17.22	15.00	16.50	1.20	0.00	180.81	0.00	"
440	CH 6585 : CH 6600	18.54	15.00	16.50	1.20	0.00	194.67	0.00	"
441	CH 6600 : CH 6615	21.38	15.00	16.50	1.20	0.00	215.25	0.00	"
442	CH 6615 : CH 6630	23.41	15.00	16.50	1.20	0.00	215.25	0.00	"
443	CH 6630 : CH 6645	24.06	15.00	16.50	1.20	0.00	215.25	0.00	"
444	CH 6645 : CH 6660	24.69	15.00	16.50	1.20	0.00	215.25	0.00	"
445	CH 6660 : CH 6675	24.29	15.00	16.50	1.20	0.00	215.25	0.00	"
446	CH 6675 : CH 6690	22.91	15.00	16.50	1.20	0.00	215.25	0.00	"
447	CH 6690 : CH 6705	22.32	15.00	16.50	1.20	0.00	215.25	0.00	"
448	CH 6705 : CH 6720	22.58	15.00	16.50	1.20	0.00	215.25	0.00	"
449	CH 6720 : CH 6735	22.88	15.00	16.50	1.20	0.00	215.25	0.00	"
450	CH 6735 : CH 6750	24.92	15.00	16.50	1.20	0.00	215.25	0.00	"
451	CH 6750 : CH 6765	27.08	15.00	16.50	1.20	0.00	215.25	0.00	"
452	CH 6765 : CH 6780	27.70	15.00	16.50	1.20	0.00	215.25	0.00	"
453	CH 6780 : CH 6795	25.98	15.00	16.50	1.20	0.00	215.25	0.00	"
454	CH 6795 : CH 6810	25.43	15.00	16.50	1.20	0.00	215.25	0.00	"
455	CH 6810 : CH 6825	28.13	15.00	16.50	1.20	0.00	215.25	0.00	"
456	CH 6825 : CH 6840	30.28	15.00	16.50	1.20	0.00	215.25	0.00	"
457	CH 6840 : CH 6855	31.35	15.00	16.50	1.20	0.00	215.25	0.00	"
458	CH 6855 : CH 6870	30.16	15.00	16.50	1.20	0.00	215.25	0.00	"
459	CH 6870 : CH 6885	29.32	15.00	16.50	1.20	0.00	215.25	0.00	"
460	CH 6885 : CH 6900	30.99	15.00	16.50	1.20	0.00	215.25	0.00	"
461	CH 6900 : CH 6915	33.40	15.00	16.50	1.20	0.00	215.25	0.00	"
462	CH 6915 : CH 6930	34.06	15.00	16.50	1.20	0.00	215.25	0.00	"
463	CH 6930 : CH 6945	32.19	15.00	16.50	1.20	0.00	215.25	0.00	"

Sl.No	Chainage			Cutting and dredging details					Remarks
		W (m)	L (m)	Proposed canal width (m)		Total Required Quantity (m3)	De-Silting Quantity (m3)	Balance Cutting Quantity to be required (m3)	
464	CH 6945 : CH 6960	29.79	15.00	16.50	1.20	0.00	215.25	0.00	"
465	CH 6960 : CH 6975	28.41	15.00	16.50	1.20	0.00	215.25	0.00	"
466	CH 6975 : CH 6990	27.25	15.00	16.50	1.20	0.00	215.25	0.00	"
467	CH 6990 : CH 7005	26.02	15.00	16.50	1.20	0.00	215.25	0.00	"
468	CH 7005 : CH 7020	26.37	15.00	16.50	1.20	0.00	215.25	0.00	"
469	CH 7020 : CH 7035	26.18	15.00	16.50	1.20	0.00	215.25	0.00	"
470	CH 7035 : CH 7050	25.02	15.00	16.50	1.20	0.00	215.25	0.00	"
471	CH 7050 : CH 7065	24.90	15.00	16.50	1.20	0.00	215.25	0.00	"
472	CH 7065 : CH 7080	24.07	15.00	16.50	1.20	0.00	215.25	0.00	"
473	CH 7080 : CH 7095	22.65	15.00	16.50	1.20	0.00	215.25	0.00	"
474	CH 7095 : CH 7110	21.07	15.00	16.50	1.20	0.00	215.25	0.00	"
475	CH 7110 : CH 7125	24.43	15.00	16.50	1.20	0.00	215.25	0.00	"
476	CH 7125 : CH 7140	31.75	15.00	16.50	1.20	0.00	215.25	0.00	"
477	CH 7140 : CH 7155	36.44	15.00	16.50	1.20	0.00	215.25	0.00	"
478	CH 7155 : CH 7170	40.43	15.00	16.50	1.20	0.00	215.25	0.00	"
479	CH 7170 : CH 7185	38.78	15.00	16.50	1.20	0.00	215.25	0.00	"
480	CH 7185 : CH 7200	35.19	15.00	16.50	1.20	0.00	215.25	0.00	"
481	CH 7200 : CH 7215	33.31	15.00	16.50	1.20	0.00	215.25	0.00	"
482	CH 7215 : CH 7230	30.07	15.00	16.50	1.20	0.00	215.25	0.00	"
483	CH 7230 : CH 7245	28.86	15.00	16.50	1.20	0.00	215.25	0.00	"
484	CH 7245 : CH 7260	25.38	15.00	16.50	1.20	0.00	215.25	0.00	"
485	CH 7260 : CH 7275	23.07	15.00	16.50	1.20	0.00	215.25	0.00	"
486	CH 7275 : CH 7290	25.23	15.00	16.50	1.20	0.00	215.25	0.00	"
487	CH 7290 : CH 7305	27.32	15.00	16.50	1.20	0.00	215.25	0.00	"
488	CH 7305 : CH 7320	29.60	15.00	16.50	1.20	0.00	215.25	0.00	"
489	CH 7320 : CH 7335	31.18	15.00	16.50	1.20	0.00	215.25	0.00	"
490	CH 7335 : CH 7350	31.90	15.00	16.50	1.20	0.00	215.25	0.00	"
491	CH 7350 : CH 7365	32.63	15.00	16.50	1.20	0.00	215.25	0.00	"
492	CH 7365 : CH 7380	33.60	15.00	16.50	1.20	0.00	215.25	0.00	"
493	CH 7380 : CH 7395	33.81	15.00	16.50	1.20	0.00	215.25	0.00	"
494	CH 7395 : CH 7410	32.98	15.00	16.50	1.20	0.00	215.25	0.00	"
495	CH 7410 : CH 7425	32.10	15.00	16.50	1.20	0.00	215.25	0.00	"
496	CH 7425 : CH 7440	31.62	15.00	16.50	1.20	0.00	215.25	0.00	"
497	CH 7440 : CH 7455	31.66	15.00	16.50	1.20	0.00	215.25	0.00	"
498	CH 7455 : CH 7470	31.95	15.00	16.50	1.20	0.00	215.25	0.00	"
499	CH 7470 : CH 7485	32.38	15.00	16.50	1.20	0.00	215.25	0.00	"
500	CH 7485 : CH 7500	32.82	15.00	16.50	1.20	0.00	215.25	0.00	"
501	CH 7500 : CH 7515	33.93	15.00	16.50	1.20	0.00	215.25	0.00	"
502	CH 7515 : CH 7530	36.05	15.00	16.50	1.20	0.00	215.25	0.00	"
503	CH 7530 : CH 7545	37.49	15.00	16.50	1.20	0.00	215.25	0.00	"
504	CH 7545 : CH 7560	37.40	15.00	16.50	1.20	0.00	215.25	0.00	"
505	CH 7560 : CH 7575	37.17	15.00	16.50	1.20	0.00	215.25	0.00	"
506	CH 7575 : CH 7590	36.05	15.00	16.50	1.20	0.00	215.25	0.00	"
507	CH 7590 : CH 7605	34.35	15.00	16.50	1.20	0.00	215.25	0.00	"
508	CH 7605 : CH 7620	33.28	15.00	16.50	1.20	0.00	215.25	0.00	"
509	CH 7620 : CH 7635	32.58	15.00	16.50	1.20	0.00	215.25	0.00	"
510	CH 7635 : CH 7650	30.59	15.00	16.50	1.20	0.00	215.25	0.00	"
511	CH 7650 : CH 7665	28.09	15.00	16.50	1.20	0.00	215.25	0.00	"
512	CH 7665 : CH 7680	27.23	15.00	16.50	1.20	0.00	215.25	0.00	"
513	CH 7680 : CH 7695	29.32	15.00	16.50	1.20	0.00	215.25	0.00	"
514	CH 7695 : CH 7710	34.59	15.00	16.50	1.20	0.00	215.25	0.00	"
515	CH 7710 : CH 7725	39.65	15.00	16.50	1.20	0.00	215.25	0.00	"
516	CH 7725 : CH 7740	40.30	15.00	16.50	1.20	0.00	215.25	0.00	"
517	CH 7740 : CH 7755	35.88	15.00	16.50	1.20	0.00	215.25	0.00	"
518	CH 7755 : CH 7770	31.74	15.00	16.50	1.20	0.00	215.25	0.00	"
519	CH 7770 : CH 7785	30.17	15.00	16.50	1.20	0.00	215.25	0.00	"
520	CH 7785 : CH 7800	28.29	15.00	16.50	1.20	0.00	215.25	0.00	"
521	CH 7800 : CH 7815	26.49	15.00	16.50	1.20	0.00	215.25	0.00	"

Sl.No	Chainage			Cutting and dredging details					Remarks
		W (m)	L (m)	Proposed canal width (m)		Total Required Quantity (m3)	De-Silting Quantity (m3)	Balance Cutting Quantity to be required (m3)	
522	CH 7815 : CH 7830	27.25	15.00	16.50	1.20	0.00	215.25	0.00	"
523	CH 7830 : CH 7845	30.46	15.00	16.50	1.20	0.00	215.25	0.00	"
524	CH 7845 : CH 7860	33.49	15.00	16.50	1.20	0.00	215.25	0.00	"
525	CH 7860 : CH 7875	34.32	15.00	16.50	1.20	0.00	215.25	0.00	"
526	CH 7875 : CH 7890	35.31	15.00	16.50	1.20	0.00	215.25	0.00	"
527	CH 7890 : CH 7905	37.48	15.00	16.50	1.20	0.00	215.25	0.00	"
528	CH 7905 : CH 7920	37.60	15.00	16.50	1.20	0.00	215.25	0.00	"
529	CH 7920 : CH 7935	35.09	15.00	16.50	1.20	0.00	215.25	0.00	"
530	CH 7935 : CH 7950	31.74	15.00	16.50	1.20	0.00	215.25	0.00	"
531	CH 7950 : CH 7965	29.69	15.00	16.50	1.20	0.00	215.25	0.00	"
532	CH 7965 : CH 7980	28.84	15.00	16.50	1.20	0.00	215.25	0.00	"
533	CH 7980 : CH 7995	27.60	15.00	16.50	1.20	0.00	215.25	0.00	"
534	CH 7995 : CH 8010	26.35	15.00	16.50	1.20	0.00	215.25	0.00	"
535	CH 8010 : CH 8025	26.52	15.00	16.50	1.20	0.00	215.25	0.00	"
536	CH 8025 : CH 8040	28.13	15.00	16.50	1.20	0.00	215.25	0.00	"
537	CH 8040 : CH 8055	28.86	15.00	16.50	1.20	0.00	215.25	0.00	"
538	CH 8055 : CH 8070	28.56	15.00	16.50	1.20	0.00	215.25	0.00	"
539	CH 8070 : CH 8085	27.95	15.00	16.50	1.20	0.00	215.25	0.00	"
540	CH 8085 : CH 8100	27.15	15.00	16.50	1.20	0.00	215.25	0.00	"
541	CH 8100 : CH 8115	26.84	15.00	16.50	1.20	0.00	215.25	0.00	"
542	CH 8115 : CH 8130	27.19	15.00	16.50	1.20	0.00	215.25	0.00	"
543	CH 8130 : CH 8145	28.29	15.00	16.50	1.20	0.00	215.25	0.00	"
544	CH 8145 : CH 8160	30.64	15.00	16.50	1.20	0.00	215.25	0.00	"
545	CH 8160 : CH 8175	32.75	15.00	16.50	1.20	0.00	215.25	0.00	"
546	CH 8175 : CH 8190	32.74	15.00	16.50	1.20	0.00	215.25	0.00	"
547	CH 8190 : CH 8205	31.49	15.00	16.50	1.20	0.00	215.25	0.00	"
548	CH 8205 : CH 8220	30.26	15.00	16.50	1.20	0.00	215.25	0.00	"
549	CH 8220 : CH 8235	29.95	15.00	16.50	1.20	0.00	215.25	0.00	"
550	CH 8235 : CH 8250	32.06	15.00	16.50	1.20	0.00	215.25	0.00	"
551	CH 8250 : CH 8265	33.65	15.00	16.50	1.20	0.00	215.25	0.00	"
552	CH 8265 : CH 8280	33.13	15.00	16.50	1.20	0.00	215.25	0.00	"
553	CH 8280 : CH 8295	33.43	15.00	16.50	1.20	0.00	215.25	0.00	"
554	CH 8295 : CH 8310	33.12	15.00	16.50	1.20	0.00	215.25	0.00	"
555	CH 8310 : CH 8325	31.11	15.00	16.50	1.20	0.00	215.25	0.00	"
556	CH 8325 : CH 8340	30.83	15.00	16.50	1.20	0.00	215.25	0.00	"
557	CH 8340 : CH 8355	35.54	15.00	16.50	1.20	0.00	215.25	0.00	"
558	CH 8355 : CH 8370	43.52	15.00	16.50	1.20	0.00	215.25	0.00	"
559	CH 8370 : CH 8385	54.40	15.00	16.50	1.20	0.00	215.25	0.00	"
560	CH 8385 : CH 8400	59.05	15.00	16.50	1.20	0.00	215.25	0.00	"
561	CH 8400 : CH 8415	54.58	15.00	16.50	1.20	0.00	215.25	0.00	"
562	CH 8415 : CH 8430	53.32	15.00	16.50	1.20	0.00	215.25	0.00	"
563	CH 8430 : CH 8445	55.61	15.00	16.50	1.20	0.00	215.25	0.00	"
564	CH 8445 : CH 8460	55.62	15.00	16.50	1.20	0.00	215.25	0.00	"
565	CH 8460 : CH 8475	55.62	15.00	16.50	1.20	0.00	215.25	0.00	"
566	CH 8475 : CH 8490	58.77	15.00	16.50	1.20	0.00	215.25	0.00	"
567	CH 8490 : CH 8505	62.18	15.00	16.50	1.20	0.00	215.25	0.00	"
568	CH 8505 : CH 8520	62.69	15.00	16.50	1.20	0.00	215.25	0.00	"
569	CH 8520 : CH 8535	59.54	15.00	16.50	1.20	0.00	215.25	0.00	"
570	CH 8535 : CH 8550	56.89	15.00	16.50	1.20	0.00	215.25	0.00	"
571	CH 8550 : CH 8565	55.98	15.00	16.50	1.20	0.00	215.25	0.00	"
572	CH 8565 : CH 8580	54.77	15.00	16.50	1.20	0.00	215.25	0.00	"
573	CH 8580 : CH 8595	54.40	15.00	16.50	1.20	0.00	215.25	0.00	"
574	CH 8595 : CH 8610	55.37	15.00	16.50	1.20	0.00	215.25	0.00	"
575	CH 8610 : CH 8625	56.34	15.00	16.50	1.20	0.00	215.25	0.00	"
576	CH 8625 : CH 8640	57.13	15.00	16.50	1.20	0.00	215.25	0.00	"
577	CH 8640 : CH 8655	55.99	15.00	16.50	1.20	0.00	215.25	0.00	"
578	CH 8655 : CH 8670	52.77	15.00	16.50	1.20	0.00	215.25	0.00	"
579	CH 8670 : CH 8685	52.29	15.00	16.50	1.20	0.00	215.25	0.00	"

Sl.No	Chainage			Cutting and dredging details					Remarks
		W (m)	L (m)	Proposed canal width (m)		Total Required Quantity (m3)	De-Silting Quantity (m3)	Balance Cutting Quantity to be required (m3)	
580	CH 8685 : CH 8700	54.38	15.00	16.50	1.20	0.00	215.25	0.00	"
581	CH 8700 : CH 8715	56.59	15.00	16.50	1.20	0.00	215.25	0.00	"
582	CH 8715 : CH 8730	57.65	15.00	16.50	1.20	0.00	215.25	0.00	"
583	CH 8730 : CH 8745	60.41	15.00	16.50	1.20	0.00	215.25	0.00	"
584	CH 8745 : CH 8760	72.49	15.00	16.50	1.20	0.00	215.25	0.00	"
585	CH 8760 : CH 8775	104.23	15.00	16.50	1.20	0.00	215.25	0.00	"
586	CH 8775 : CH 8790	151.67	15.00	16.50	1.20	0.00	215.25	0.00	"
587	CH 8790 : CH 8805	170.85	15.00	16.50	1.20	0.00	215.25	0.00	"
588	CH 8805 : CH 8820	123.65	15.00	16.50	1.20	0.00	215.25	0.00	"
589	CH 8820 : CH 8835	85.75	15.00	16.50	1.20	0.00	215.25	0.00	"
590	CH 8835 : CH 8850	77.10	15.00	16.50	1.20	0.00	215.25	0.00	"
591	CH 8850 : CH 8865	75.48	15.00	16.50	1.20	0.00	215.25	0.00	"
592	CH 8865 : CH 8880	76.00	15.00	16.50	1.20	0.00	215.25	0.00	"
593	CH 8880 : CH 8895	76.90	15.00	16.50	1.20	0.00	215.25	0.00	"
594	CH 8895 : CH 8910	75.81	15.00	16.50	1.20	0.00	215.25	0.00	"
595	CH 8910 : CH 8925	73.30	15.00	16.50	1.20	0.00	215.25	0.00	"
596	CH 8925 : CH 8940	71.93	15.00	16.50	1.20	0.00	215.25	0.00	"
597	CH 8940 : CH 8955	69.95	15.00	16.50	1.20	0.00	215.25	0.00	"
598	CH 8955 : CH 8970	66.09	15.00	16.50	1.20	0.00	215.25	0.00	"
599	CH 8970 : CH 8985	59.97	15.00	16.50	1.20	0.00	215.25	0.00	"
600	CH 8985 : CH 9000	54.43	15.00	16.50	1.20	0.00	215.25	0.00	"
601	CH 9000 : CH 9015	57.70	15.00	16.50	1.20	0.00	215.25	0.00	"
602	CH 9015 : CH 9030	67.51	15.00	16.50	1.20	0.00	215.25	0.00	"
603	CH 9030 : CH 9045	81.22	15.00	16.50	1.20	0.00	215.25	0.00	"
604	CH 9045 : CH 9060	109.44	15.00	16.50	1.20	0.00	215.25	0.00	"
605	CH 9060 : CH 9075	130.75	15.00	16.50	1.20	0.00	215.25	0.00	"
606	CH 9075 : CH 9090	134.15	15.00	16.50	1.20	0.00	215.25	0.00	"
607	CH 9090 : CH 9105	135.61	15.00	16.50	1.20	0.00	215.25	0.00	"
608	CH 9105 : CH 9120	137.19	15.00	16.50	1.20	0.00	215.25	0.00	"
609	CH 9120 : CH 9135	119.75	15.00	16.50	1.20	0.00	215.25	0.00	"
610	CH 9135 : CH 9150	90.99	15.00	16.50	1.20	0.00	215.25	0.00	"
611	CH 9150 : CH 9165	76.87	15.00	16.50	1.20	0.00	215.25	0.00	"
612	CH 9165 : CH 9180	69.45	15.00	16.50	1.20	0.00	215.25	0.00	"
613	CH 9180 : CH 9195	65.55	15.00	16.50	1.20	0.00	215.25	0.00	"
614	CH 9195 : CH 9210	63.63	15.00	16.50	1.20	0.00	215.25	0.00	"
615	CH 9210 : CH 9225	61.47	15.00	16.50	1.20	0.00	215.25	0.00	"
616	CH 9225 : CH 9240	58.99	15.00	16.50	1.20	0.00	215.25	0.00	"
617	CH 9240 : CH 9255	57.22	15.00	16.50	1.20	0.00	215.25	0.00	"
618	CH 9255 : CH 9270	57.36	15.00	16.50	1.20	0.00	215.25	0.00	"
619	CH 9270 : CH 9285	54.06	15.00	16.50	1.20	0.00	215.25	0.00	"
620	CH 9285 : CH 9300	50.88	15.00	16.50	1.20	0.00	215.25	0.00	"
621	CH 9300 : CH 9315	52.38	15.00	16.50	1.20	0.00	215.25	0.00	"
622	CH 9315 : CH 9330	53.14	15.00	16.50	1.20	0.00	215.25	0.00	"
623	CH 9330 : CH 9345	53.63	15.00	16.50	1.20	0.00	215.25	0.00	"
624	CH 9345 : CH 9360	53.80	15.00	16.50	1.20	0.00	215.25	0.00	"
625	CH 9360 : CH 9375	53.55	15.00	16.50	1.20	0.00	215.25	0.00	"
626	CH 9375 : CH 9390	52.78	15.00	16.50	1.20	0.00	215.25	0.00	"
627	CH 9390 : CH 9405	51.34	15.00	16.50	1.20	0.00	215.25	0.00	"
628	CH 9405 : CH 9420	51.09	15.00	16.50	1.20	0.00	215.25	0.00	"
629	CH 9420 : CH 9435	53.12	15.00	16.50	1.20	0.00	215.25	0.00	"
630	CH 9435 : CH 9450	56.15	15.00	16.50	1.20	0.00	215.25	0.00	"
631	CH 9450 : CH 9465	57.10	15.00	16.50	1.20	0.00	215.25	0.00	"
632	CH 9465 : CH 9480	55.42	15.00	16.50	1.20	0.00	215.25	0.00	"
633	CH 9480 : CH 9495	51.78	15.00	16.50	1.20	0.00	215.25	0.00	"
634	CH 9495 : CH 9510	48.21	15.00	16.50	1.20	0.00	215.25	0.00	"
635	CH 9510 : CH 9525	46.71	15.00	16.50	1.20	0.00	215.25	0.00	"
636	CH 9525 : CH 9540	47.83	15.00	16.50	1.20	0.00	215.25	0.00	"
637	CH 9540 : CH 9555	49.60	15.00	16.50	1.20	0.00	215.25	0.00	"

Sl.No	Chainage			Cutting and dredging details					Remarks
		W (m)	L (m)	Proposed canal width (m)		Total Required Quantity (m3)	De-Silting Quantity (m3)	Balance Cutting Quantity to be required (m3)	
638	CH 9555 : CH 9570	49.72	15.00	16.50	1.20	0.00	215.25	0.00	"
639	CH 9570 : CH 9585	49.51	15.00	16.50	1.20	0.00	215.25	0.00	"
640	CH 9585 : CH 9600	50.16	15.00	16.50	1.20	0.00	215.25	0.00	"
641	CH 9600 : CH 9615	51.15	15.00	16.50	1.20	0.00	215.25	0.00	"
642	CH 9615 : CH 9630	51.80	15.00	16.50	1.20	0.00	215.25	0.00	"
643	CH 9630 : CH 9645	52.38	15.00	16.50	1.20	0.00	215.25	0.00	"
644	CH 9645 : CH 9660	52.92	15.00	16.50	1.20	0.00	215.25	0.00	"
645	CH 9660 : CH 9675	53.42	15.00	16.50	1.20	0.00	215.25	0.00	"
646	CH 9675 : CH 9690	53.90	15.00	16.50	1.20	0.00	215.25	0.00	"
647	CH 9690 : CH 9705	54.16	15.00	16.50	1.20	0.00	215.25	0.00	"
648	CH 9705 : CH 9720	53.65	15.00	16.50	1.20	0.00	215.25	0.00	"
649	CH 9720 : CH 9735	52.49	15.00	16.50	1.20	0.00	215.25	0.00	"
650	CH 9735 : CH 9750	51.68	15.00	16.50	1.20	0.00	215.25	0.00	"
651	CH 9750 : CH 9765	51.52	15.00	16.50	1.20	0.00	215.25	0.00	"
652	CH 9765 : CH 9780	52.07	15.00	16.50	1.20	0.00	215.25	0.00	"
653	CH 9780 : CH 9795	52.24	15.00	16.50	1.20	0.00	215.25	0.00	"
654	CH 9795 : CH 9810	50.76	15.00	16.50	1.20	0.00	215.25	0.00	"
655	CH 9810 : CH 9825	48.37	15.00	16.50	1.20	0.00	215.25	0.00	"
656	CH 9825 : CH 9840	47.51	15.00	16.50	1.20	0.00	215.25	0.00	"
657	CH 9840 : CH 9855	49.73	15.00	16.50	1.20	0.00	215.25	0.00	"
658	CH 9855 : CH 9870	53.46	15.00	16.50	1.20	0.00	215.25	0.00	"
659	CH 9870 : CH 9885	56.92	15.00	16.50	1.20	0.00	215.25	0.00	"
660	CH 9885 : CH 9900	58.96	15.00	16.50	1.20	0.00	215.25	0.00	"
661	CH 9900 : CH 9915	57.04	15.00	16.50	1.20	0.00	215.25	0.00	"
662	CH 9915 : CH 9930	56.69	15.00	16.50	1.20	0.00	215.25	0.00	"
663	CH 9930 : CH 9945	56.62	15.00	16.50	1.20	0.00	215.25	0.00	"
664	CH 9945 : CH 9960	53.61	15.00	16.50	1.20	0.00	215.25	0.00	"
665	CH 9960 : CH 9975	53.16	15.00	16.50	1.20	0.00	215.25	0.00	"
666	CH 9975 : CH 9990	57.48	15.00	16.50	1.20	0.00	215.25	0.00	"
667	CH 9990 : CH 10005	60.38	15.00	16.50	1.20	0.00	215.25	0.00	"
668	CH 10005 : CH 10020	61.92	15.00	16.50	1.20	0.00	215.25	0.00	"
669	CH 10020 : CH 10035	64.26	15.00	16.50	1.20	0.00	215.25	0.00	"
670	CH 10035 : CH 10050	65.02	15.00	16.50	1.20	0.00	215.25	0.00	"
671	CH 10050 : CH 10065	62.78	15.00	16.50	1.20	0.00	215.25	0.00	"
672	CH 10065 : CH 10080	60.81	15.00	16.50	1.20	0.00	215.25	0.00	"
673	CH 10080 : CH 10095	57.15	15.00	16.50	1.20	0.00	215.25	0.00	"
674	CH 10095 : CH 10110	51.61	15.00	16.50	1.20	0.00	215.25	0.00	"
675	CH 10110 : CH 10125	47.21	15.00	16.50	1.20	0.00	215.25	0.00	"
676	CH 10125 : CH 10140	45.93	15.00	16.50	1.20	0.00	215.25	0.00	"
677	CH 10140 : CH 10155	46.08	15.00	16.50	1.20	0.00	215.25	0.00	"
678	CH 10155 : CH 10170	46.44	15.00	16.50	1.20	0.00	215.25	0.00	"
679	CH 10170 : CH 10185	48.74	15.00	16.50	1.20	0.00	215.25	0.00	"
680	CH 10185 : CH 10200	51.79	15.00	16.50	1.20	0.00	215.25	0.00	"
681	CH 10200 : CH 10215	54.59	15.00	16.50	1.20	0.00	215.25	0.00	"
682	CH 10215 : CH 10230	56.04	15.00	16.50	1.20	0.00	215.25	0.00	"
683	CH 10230 : CH 10245	56.17	15.00	16.50	1.20	0.00	215.25	0.00	"
684	CH 10245 : CH 10260	57.95	15.00	16.50	1.20	0.00	215.25	0.00	"
685	CH 10260 : CH 10275	55.06	15.00	16.50	1.20	0.00	215.25	0.00	"
686	CH 10275 : CH 10290	52.91	15.00	16.50	1.20	0.00	215.25	0.00	"
687	CH 10290 : CH 10305	54.13	15.00	16.50	1.20	0.00	215.25	0.00	"
688	CH 10305 : CH 10320	52.86	15.00	16.50	1.20	0.00	215.25	0.00	"
689	CH 10320 : CH 10335	52.69	15.00	16.50	1.20	0.00	215.25	0.00	"
690	CH 10335 : CH 10350	51.89	15.00	16.50	1.20	0.00	215.25	0.00	"
691	CH 10350 : CH 10365	52.13	15.00	16.50	1.20	0.00	215.25	0.00	"
692	CH 10365 : CH 10380	53.94	15.00	16.50	1.20	0.00	215.25	0.00	"
693	CH 10380 : CH 10395	54.60	15.00	16.50	1.20	0.00	215.25	0.00	"
694	CH 10395 : CH 10410	54.10	15.00	16.50	1.20	0.00	215.25	0.00	"
695	CH 10410 : CH 10425	51.91	15.00	16.50	1.20	0.00	215.25	0.00	"

Sl.No	Chainage			Cutting and dredging details					Remarks
		W (m)	L (m)	Proposed canal width (m)		Total Required Quantity (m3)	De-Silting Quantity (m3)	Balance Cutting Quantity to be required (m3)	
696	CH 10425 : CH 10440	51.34	15.00	16.50	1.20	0.00	215.25	0.00	"
697	CH 10440 : CH 10455	52.68	15.00	16.50	1.20	0.00	215.25	0.00	"
698	CH 10455 : CH 10470	53.79	15.00	16.50	1.20	0.00	215.25	0.00	"
699	CH 10470 : CH 10485	55.46	15.00	16.50	1.20	0.00	215.25	0.00	"
700	CH 10485 : CH 10500	55.82	15.00	16.50	1.20	0.00	215.25	0.00	"
701	CH 10500 : CH 10515	55.04	15.00	16.50	1.20	0.00	215.25	0.00	"
702	CH 10515 : CH 10530	55.55	15.00	16.50	1.20	0.00	215.25	0.00	"
703	CH 10530 : CH 10545	55.62	15.00	16.50	1.20	0.00	215.25	0.00	"

Sl.No	Chainage			Cutting and dredging details					Remarks
		W (m)	L (m)	Proposed canal width (m)		Total Required Quantity (m3)	De-Silting Quantity (m3)	Balance Cutting Quantity to be required (m3)	
704	CH 10545 : CH 10560	55.13	15.00	16.50	1.20	0.00	215.25	0.00	"
705	CH 10560 : CH 10575	59.01	15.00	16.50	1.20	0.00	215.25	0.00	"
706	CH 10575 : CH 10590	59.79	15.00	16.50	1.20	0.00	215.25	0.00	"
707	CH 10590 : CH 10605	55.46	15.00	16.50	1.20	0.00	215.25	0.00	"
708	CH 10605 : CH 10620	55.63	15.00	16.50	1.20	0.00	215.25	0.00	"
709	CH 10620 : CH 10635	57.68	15.00	16.50	1.20	0.00	215.25	0.00	"
710	CH 10635 : CH 10650	57.25	15.00	16.50	1.20	0.00	215.25	0.00	"
711	CH 10650 : CH 10665	56.52	15.00	16.50	1.20	0.00	215.25	0.00	"
712	CH 10665 : CH 10680	56.77	15.00	16.50	1.20	0.00	215.25	0.00	"
713	CH 10680 : CH 10695	58.15	15.00	16.50	1.20	0.00	215.25	0.00	"
714	CH 10695 : CH 10710	60.01	15.00	16.50	1.20	0.00	215.25	0.00	"
715	CH 10710 : CH 10725	60.64	15.00	16.50	1.20	0.00	215.25	0.00	"
716	CH 10725 : CH 10740	61.17	15.00	16.50	1.20	0.00	215.25	0.00	"
717	CH 10740 : CH 10755	62.15	15.00	16.50	1.20	0.00	215.25	0.00	"
718	CH 10755 : CH 10770	59.80	15.00	16.50	1.20	0.00	215.25	0.00	"
719	CH 10770 : CH 10785	58.50	15.00	16.50	1.20	0.00	215.25	0.00	"
720	CH 10785 : CH 10800	60.70	15.00	16.50	1.20	0.00	215.25	0.00	"
721	CH 10800 : CH 10815	62.81	15.00	16.50	1.20	0.00	215.25	0.00	"
722	CH 10815 : CH 10830	66.72	15.00	16.50	1.20	0.00	215.25	0.00	"
723	CH 10830 : CH 10845	68.60	15.00	16.50	1.20	0.00	215.25	0.00	"
724	CH 10845 : CH 10860	66.62	15.00	16.50	1.20	0.00	215.25	0.00	"
725	CH 10860 : CH 10875	65.68	15.00	16.50	1.20	0.00	215.25	0.00	"
726	CH 10875 : CH 10890	64.89	15.00	16.50	1.20	0.00	215.25	0.00	"
727	CH 10890 : CH 10905	63.02	15.00	16.50	1.20	0.00	215.25	0.00	"
728	CH 10905 : CH 10920	62.80	15.00	16.50	1.20	0.00	215.25	0.00	"
729	CH 10920 : CH 10935	63.22	15.00	16.50	1.20	0.00	215.25	0.00	"
730	CH 10935 : CH 10950	64.11	15.00	16.50	1.20	0.00	215.25	0.00	"
731	CH 10950 : CH 10965	68.17	15.00	16.50	1.20	0.00	215.25	0.00	"
732	CH 10965 : CH 10980	76.45	15.00	16.50	1.20	0.00	215.25	0.00	"
733	CH 10980 : CH 10995	88.04	15.00	16.50	1.20	0.00	215.25	0.00	"
734	CH 10995 : CH 11010	94.56	15.00	16.50	1.20	0.00	215.25	0.00	"
735	CH 11010 : CH 11025	95.31	15.00	16.50	1.20	0.00	215.25	0.00	"
736	CH 11025 : CH 11040	99.38	15.00	16.50	1.20	0.00	215.25	0.00	"
737	CH 11040 : CH 11055	106.00	15.00	16.50	1.20	0.00	215.25	0.00	"
738	CH 11055 : CH 11070	112.14	15.00	16.50	1.20	0.00	215.25	0.00	"
739	CH 11070 : CH 11085	99.65	15.00	16.50	1.20	0.00	215.25	0.00	"
740	CH 11085 : CH 11100	77.99	15.00	16.50	1.20	0.00	215.25	0.00	"
741	CH 11100 : CH 11115	65.67	15.00	16.50	1.20	0.00	215.25	0.00	"
742	CH 11115 : CH 11130	51.92	15.00	16.50	1.20	0.00	215.25	0.00	"
743	CH 11130 : CH 11145	43.00	15.00	16.50	1.20	0.00	215.25	0.00	"
744	CH 11145 : CH 11160	40.66	15.00	16.50	1.20	0.00	215.25	0.00	"
745	CH 11160 : CH 11175	41.17	15.00	16.50	1.20	0.00	215.25	0.00	"
746	CH 11175 : CH 11190	47.27	15.00	16.50	1.20	0.00	215.25	0.00	"
747	CH 11190 : CH 11205	55.83	15.00	16.50	1.20	0.00	215.25	0.00	"
748	CH 11205 : CH 11220	64.05	15.00	16.50	1.20	0.00	215.25	0.00	"
749	CH 11220 : CH 11231	80.60	11.00	16.50	1.20	0.00	157.85	0.00	"
	Total Quantity							**46,768.34**	

Chilavanoor Canal									
Sl.No	Chainage		Cutting and dredging details						Remarks
		W (m)	L (m)	Proposed canal width (m)		Total Required Quantity (m3)	De-Silting Quantity (m3)	Net Cutting Quantity to be required (m3)	
1	CH 0 : CH 15	51.29	15	16.5	1.2	0.00	538.49	0.00	w>16.50
2	CH 15 : CH 30	42.05	15	16.5	1.2	0.00	441.49	0.00	"
3	CH 30 : CH 45	29.99	15	16.5	1.2	0.00	314.93	0.00	"
4	CH 45 : CH 60	22.39	15	16.5	1.2	0.00	235.11	0.00	"
5	CH 60 : CH 75	20.58	15	16.5	1.2	0.00	216.05	0.00	"
6	CH 75 : CH 90	21.77	15	16.5	1.2	0.00	228.63	0.00	"
7	CH 90 : CH 105	23.82	15	16.5	1.2	0.00	250.16	0.00	"
8	CH 105 : CH 120	25.31	15	16.5	1.2	0.00	265.74	0.00	"
9	CH 120 : CH 135	27.15	15	16.5	1.2	0.00	285.10	0.00	"
10	CH 135 : CH 150	29.08	15	16.5	1.2	0.00	305.29	0.00	"
11	CH 150 : CH 165	30.42	15	16.5	1.2	0.00	319.38	0.00	"
12	CH 165 : CH 180	29.31	15	16.5	1.2	0.00	307.73	0.00	"
13	CH 180 : CH 195	24.12	15	16.5	1.2	0.00	253.29	0.00	"
14	CH 195 : CH 210	18.15	15	16.5	1.2	0.00	190.60	0.00	
15	CH 210 : CH 225	16.50	15	16.5	1.2	0.00	173.23	0.00	
16	CH 225 : CH 240	16.93	15	16.5	1.2	0.00	177.79	0.00	"
17	CH 240 : CH 255	17.00	15	16.5	1.2	0.00	178.45	0.00	"
18	CH 255 : CH 270	17.07	15	16.5	1.2	0.00	179.27	0.00	"
19	CH 270 : CH 285	18.97	15	16.5	1.2	0.00	199.21	0.00	"
20	CH 285 : CH 300	20.54	15	16.5	1.2	0.00	215.64	0.00	"
21	CH 300 : CH 315	19.79	15	16.5	1.2	0.00	207.78	0.00	"
22	CH 315 : CH 330	19.15	15	16.5	1.2	0.00	201.12	0.00	"
23	CH 330 : CH 345	20.83	15	16.5	1.2	0.00	218.69	0.00	"
24	CH 345 : CH 360	22.09	15	16.5	1.2	0.00	231.90	0.00	"
25	CH 360 : CH 375	17.48	15	16.5	1.2	0.00	183.51	0.00	
26	CH 375 : CH 390	13.66	15	16.5	1.2	297.00	143.38	153.62	
27	CH 390 : CH 405	11.85	15	16.5	1.2	297.00	124.47	172.53	
28	CH 405 : CH 420	17.18	15	16.5	1.2	0.00	180.35	0.00	
29	CH 420 : CH 435	18.56	15	16.5	1.2	0.00	194.88	0.00	"
30	CH 435 : CH 450	18.85	15	16.5	1.2	0.00	197.97	0.00	"
31	CH 450 : CH 465	19.43	15	16.5	1.2	0.00	203.96	0.00	"
32	CH 465 : CH 480	20.37	15	16.5	1.2	0.00	213.91	0.00	"
33	CH 480 : CH 495	20.83	15	16.5	1.2	0.00	218.66	0.00	"
34	CH 495 : CH 510	18.48	15	16.5	1.2	0.00	194.05	0.00	"
35	CH 510 : CH 525	19.74	15	16.5	1.2	0.00	207.30	0.00	"
36	CH 525 : CH 540	26.37	15	16.5	1.2	0.00	276.85	0.00	"
37	CH 540 : CH 555	29.15	15	16.5	1.2	0.00	306.12	0.00	"
38	CH 555 : CH 570	28.47	15	16.5	1.2	0.00	298.91	0.00	"
39	CH 570 : CH 585	27.46	15	16.5	1.2	0.00	288.29	0.00	"
40	CH 585 : CH 600	26.20	15	16.5	1.2	0.00	275.06	0.00	"
41	CH 600 : CH 615	24.68	15	16.5	1.2	0.00	259.13	0.00	"
42	CH 615 : CH 630	24.59	15	16.5	1.2	0.00	258.20	0.00	"
43	CH 630 : CH 645	24.35	15	16.5	1.2	0.00	255.70	0.00	"
44	CH 645 : CH 660	22.08	15	16.5	1.2	0.00	231.85	0.00	"
45	CH 660 : CH 675	18.79	15	16.5	1.2	0.00	197.30	0.00	"
46	CH 675 : CH 690	16.30	15	16.5	1.2	297.00	171.17	125.83	
47	CH 690 : CH 705	15.60	15	16.5	1.2	297.00	163.85	133.15	
48	CH 705 : CH 720	14.02	15	16.5	1.2	297.00	147.20	149.80	
49	CH 720 : CH 735	13.23	15	16.5	1.2	297.00	138.92	158.09	
50	CH 735 : CH 750	14.39	15	16.5	1.2	297.00	151.08	145.92	
51	CH 750 : CH 765	15.36	15	16.5	1.2	297.00	161.25	135.75	
52	CH 765 : CH 780	15.37	15	16.5	1.2	297.00	161.37	135.63	
53	CH 780 : CH 795	15.51	15	16.5	1.2	297.00	162.88	134.12	
54	CH 795 : CH 810	15.68	15	16.5	1.2	297.00	164.62	132.38	
55	CH 810 : CH 825	15.58	15	16.5	1.2	297.00	163.63	133.37	
56	CH 825 : CH 840	15.47	15	16.5	1.2	297.00	162.45	134.55	
57	CH 840 : CH 855	15.38	15	16.5	1.2	297.00	161.46	135.54	

Sl.No	Chainage		Cutting and dredging details						Remarks
		W (m)	L (m)	Proposed canal width (m)		Total Required Quantity (m3)	De-Silting Quantity (m3)	Net Cutting Quantity to be required (m3)	
58	CH 855 : CH 870	15.73	15	16.5	1.2	297.00	165.14	131.86	
59	CH 870 : CH 885	16.75	15	16.5	1.2	0.00	175.89	0.00	
60	CH 885 : CH 900	17.08	15	16.5	1.2	0.00	179.30	0.00	"
61	CH 900 : CH 915	16.25	15	16.5	1.2	297.00	170.64	126.36	
62	CH 915 : CH 930	15.66	15	16.5	1.2	297.00	164.45	132.55	
63	CH 930 : CH 945	15.54	15	16.5	1.2	297.00	163.19	133.81	
64	CH 945 : CH 960	17.53	15	16.5	1.2	0.00	184.11	0.00	
65	CH 960 : CH 975	19.95	15	16.5	1.2	0.00	209.46	0.00	"
66	CH 975 : CH 990	18.49	15	16.5	1.2	0.00	194.15	0.00	"
67	CH 990 : CH 1005	15.62	15	16.5	1.2	297.00	164.04	132.96	
68	CH 1005 : CH 1020	13.86	15	16.5	1.2	297.00	145.54	151.46	
69	CH 1020 : CH 1035	13.52	15	16.5	1.2	297.00	141.93	155.07	
70	CH 1035 : CH 1050	14.22	15	16.5	1.2	297.00	149.31	147.69	
71	CH 1050 : CH 1065	14.35	15	16.5	1.2	297.00	150.64	146.36	
72	CH 1065 : CH 1080	13.77	15	16.5	1.2	297.00	144.61	152.39	
73	CH 1080 : CH 1095	13.04	15	16.5	1.2	297.00	136.91	160.09	
74	CH 1095 : CH 1110	12.50	15	16.5	1.2	297.00	131.22	165.78	
75	CH 1110 : CH 1125	12.02	15	16.5	1.2	297.00	126.25	170.75	
76	CH 1125 : CH 1140	11.41	15	16.5	1.2	297.00	119.83	177.17	
77	CH 1140 : CH 1155	11.46	15	16.5	1.2	297.00	120.28	176.72	
78	CH 1155 : CH 1170	12.60	15	16.5	1.2	297.00	132.26	164.74	
79	CH 1170 : CH 1185	14.03	15	16.5	1.2	297.00	147.33	149.67	
80	CH 1185 : CH 1200	15.37	15	16.5	1.2	297.00	161.40	135.60	
81	CH 1200 : CH 1215	16.89	15	16.5	1.2	0.00	177.31	0.00	
82	CH 1215 : CH 1230	17.82	15	16.5	1.2	0.00	187.16	0.00	"
83	CH 1230 : CH 1245	16.72	15	16.5	1.2	0.00	175.58	0.00	
84	CH 1245 : CH 1260	15.29	15	16.5	1.2	297.00	160.59	136.41	
85	CH 1260 : CH 1275	14.23	15	16.5	1.2	297.00	149.41	147.59	
86	CH 1275 : CH 1290	13.40	15	16.5	1.2	297.00	140.73	156.27	
87	CH 1290 : CH 1305	13.59	15	16.5	1.2	297.00	142.70	154.30	
88	CH 1305 : CH 1320	14.40	15	16.5	1.2	297.00	151.18	145.82	
89	CH 1320 : CH 1335	16.36	15	16.5	1.2	297.00	171.73	125.27	
90	CH 1335 : CH 1350	20.22	15	16.5	1.2	0.00	212.31	0.00	"
91	CH 1350 : CH 1365	18.57	15	16.5	1.2	0.00	195.03	0.00	
92	CH 1365 : CH 1380	12.24	15	16.5	1.2	297.00	128.51	168.49	
93	CH 1380 : CH 1395	9.83	15	16.5	1.2	297.00	103.18	193.82	
94	CH 1395 : CH 1410	9.42	15	16.5	1.2	297.00	98.88	198.12	
95	CH 1410 : CH 1425	9.92	15	16.5	1.2	297.00	104.18	192.82	
96	CH 1425 : CH 1440	11.30	15	16.5	1.2	297.00	118.61	178.39	
97	CH 1440 : CH 1455	11.56	15	16.5	1.2	297.00	121.39	175.61	
98	CH 1455 : CH 1470	10.54	15	16.5	1.2	297.00	110.63	186.37	
99	CH 1470 : CH 1485	9.35	15	16.5	1.2	297.00	98.15	198.85	
100	CH 1485 : CH 1500	8.96	15	16.5	1.2	297.00	94.09	202.91	
101	CH 1500 : CH 1515	8.98	15	16.5	1.2	297.00	94.32	202.68	
102	CH 1515 : CH 1530	9.77	15	16.5	1.2	297.00	102.62	194.38	
103	CH 1530 : CH 1545	10.74	15	16.5	1.2	297.00	112.81	184.19	
104	CH 1545 : CH 1560	11.20	15	16.5	1.2	297.00	117.59	179.41	
105	CH 1560 : CH 1575	12.88	15	16.5	1.2	297.00	135.23	161.77	
106	CH 1575 : CH 1590	14.52	15	16.5	1.2	297.00	152.49	144.51	
107	CH 1590 : CH 1605	15.35	15	16.5	1.2	297.00	161.17	135.83	
108	CH 1605 : CH 1620	16.03	15	16.5	1.2	297.00	168.34	128.66	
109	CH 1620 : CH 1635	16.47	15	16.5	1.2	297.00	172.94	124.06	
110	CH 1635 : CH 1650	16.31	15	16.5	1.2	297.00	171.28	125.72	
111	CH 1650 : CH 1665	15.26	15	16.5	1.2	297.00	160.19	136.81	
112	CH 1665 : CH 1680	13.84	15	16.5	1.2	297.00	145.33	151.67	
113	CH 1680 : CH 1695	12.98	15	16.5	1.2	297.00	136.32	160.68	
114	CH 1695 : CH 1710	12.51	15	16.5	1.2	297.00	131.37	165.63	
115	CH 1710 : CH 1725	11.53	15	16.5	1.2	297.00	121.05	175.95	

Sl.No	Chainage		Cutting and dredging details						Remarks
		W (m)	L (m)	Proposed canal width (m)		Total Required Quantity (m3)	De-Silting Quantity (m3)	Net Cutting Quantity to be required (m3)	
116	CH 1725 : CH 1740	11.12	15	16.5	1.2	297.00	116.80	180.20	
117	CH 1740 : CH 1755	11.51	15	16.5	1.2	297.00	120.81	176.19	
118	CH 1755 : CH 1770	11.41	15	16.5	1.2	297.00	119.75	177.25	
119	CH 1770 : CH 1785	11.59	15	16.5	1.2	297.00	121.71	175.29	
120	CH 1785 : CH 1800	12.29	15	16.5	1.2	297.00	129.00	168.00	
121	CH 1800 : CH 1815	12.42	15	16.5	1.2	297.00	130.39	166.61	
122	CH 1815 : CH 1830	12.06	15	16.5	1.2	297.00	126.63	170.37	
123	CH 1830 : CH 1845	11.43	15	16.5	1.2	297.00	120.04	176.96	
124	CH 1845 : CH 1860	10.59	15	16.5	1.2	297.00	111.22	185.78	
125	CH 1860 : CH 1875	10.04	15	16.5	1.2	297.00	105.44	191.56	
126	CH 1875 : CH 1890	9.13	15	16.5	1.2	297.00	95.84	201.16	
127	CH 1890 : CH 1905	8.62	15	16.5	1.2	297.00	90.48	206.52	
128	CH 1905 : CH 1920	8.70	15	16.5	1.2	297.00	91.32	205.68	
129	CH 1920 : CH 1935	8.62	15	16.5	1.2	297.00	90.47	206.53	
130	CH 1935 : CH 1950	8.78	15	16.5	1.2	297.00	92.15	204.85	
131	CH 1950 : CH 1965	8.96	15	16.5	1.2	297.00	94.07	202.93	
132	CH 1965 : CH 1980	8.99	15	16.5	1.2	297.00	94.42	202.58	
133	CH 1980 : CH 1995	8.47	15	16.5	1.2	297.00	88.98	208.02	
134	CH 1995 : CH 2010	7.58	15	16.5	1.2	297.00	79.61	217.39	
135	CH 2010 : CH 2025	6.69	15	16.5	1.2	297.00	70.27	226.73	
136	CH 2025 : CH 2040	5.97	15	16.5	1.2	297.00	62.65	234.35	
137	CH 2040 : CH 2055	6.11	15	16.5	1.2	297.00	64.14	232.86	
138	CH 2055 : CH 2070	6.74	15	16.5	1.2	297.00	70.74	226.26	
139	CH 2070 : CH 2085	6.53	15	16.5	1.2	297.00	68.59	228.41	
140	CH 2085 : CH 2100	6.19	15	16.5	1.2	297.00	65.04	231.96	
141	CH 2100 : CH 2115	6.26	15	16.5	1.2	297.00	65.72	231.28	
142	CH 2115 : CH 2130	6.03	15	16.5	1.2	297.00	63.36	233.64	
143	CH 2130 : CH 2145	5.52	15	16.5	1.2	297.00	57.92	239.08	
144	CH 2145 : CH 2160	5.50	15	16.5	1.2	297.00	57.79	239.21	
145	CH 2160 : CH 2175	5.46	15	16.5	1.2	297.00	57.34	239.66	
146	CH 2175 : CH 2190	5.18	15	16.5	1.2	297.00	54.42	242.58	
147	CH 2190 : CH 2205	5.72	15	16.5	1.2	297.00	60.01	236.99	
148	CH 2205 : CH 2220	6.07	15	16.5	1.2	297.00	63.76	233.24	
149	CH 2220 : CH 2235	6.03	15	16.5	1.2	297.00	63.35	233.65	
150	CH 2235 : CH 2250	5.28	15	16.5	1.2	297.00	55.39	241.61	
151	CH 2250 : CH 2265	5.47	15	16.5	1.2	297.00	57.44	239.57	
152	CH 2265 : CH 2280	6.25	15	16.5	1.2	297.00	65.60	231.40	
153	CH 2280 : CH 2295	5.53	15	16.5	1.2	297.00	58.10	238.90	
154	CH 2295 : CH 2310	5.72	15	16.5	1.2	297.00	60.08	236.92	
155	CH 2310 : CH 2325	6.14	15	16.5	1.2	297.00	64.49	232.51	
156	CH 2325 : CH 2340	6.11	15	16.5	1.2	297.00	64.18	232.82	
157	CH 2340 : CH 2355	6.42	15	16.5	1.2	297.00	67.37	229.63	
158	CH 2355 : CH 2370	5.67	15	16.5	1.2	297.00	59.52	237.48	
159	CH 2370 : CH 2385	4.56	15	16.5	1.2	297.00	47.91	249.09	
160	CH 2385 : CH 2400	4.53	15	16.5	1.2	297.00	47.58	249.42	
161	CH 2400 : CH 2415	5.10	15	16.5	1.2	297.00	53.57	243.43	
162	CH 2415 : CH 2430	5.10	15	16.5	1.2	297.00	53.57	243.43	
163	CH 2430 : CH 2445	4.43	15	16.5	1.2	297.00	46.47	250.53	
164	CH 2445 : CH 2460	4.71	15	16.5	1.2	297.00	49.44	247.56	
165	CH 2460 : CH 2475	5.03	15	16.5	1.2	297.00	52.76	244.24	
166	CH 2475 : CH 2490	4.51	15	16.5	1.2	297.00	47.31	249.69	
167	CH 2490 : CH 2505	4.42	15	16.5	1.2	297.00	46.37	250.63	
168	CH 2505 : CH 2520	5.17	15	16.5	1.2	297.00	54.32	242.68	
169	CH 2520 : CH 2535	5.41	15	16.5	1.2	297.00	56.83	240.17	
170	CH 2535 : CH 2550	4.82	15	16.5	1.2	297.00	50.59	246.41	
171	CH 2550 : CH 2565	4.82	15	16.5	1.2	297.00	50.60	246.40	
172	CH 2565 : CH 2580	5.28	15	16.5	1.2	297.00	55.46	241.54	
173	CH 2580 : CH 2595	5.48	15	16.5	1.2	297.00	57.58	239.42	

Sl.No	Chainage		Cutting and dredging details						Remarks
		W (m)	L (m)	Proposed canal width (m)		Total Required Quantity (m3)	De-Silting Quantity (m3)	Net Cutting Quantity to be required (m3)	
174	CH 2595 : CH 2610	5.36	15	16.5	1.2	297.00	56.25	240.75	
175	CH 2610 : CH 2625	5.28	15	16.5	1.2	297.00	55.42	241.58	
176	CH 2625 : CH 2640	5.00	15	16.5	1.2	297.00	52.54	244.46	
177	CH 2640 : CH 2655	4.92	15	16.5	1.2	297.00	51.61	245.39	
178	CH 2655 : CH 2670	5.44	15	16.5	1.2	297.00	57.15	239.85	
179	CH 2670 : CH 2685	5.44	15	16.5	1.2	297.00	57.14	239.86	
180	CH 2685 : CH 2700	4.51	15	16.5	1.2	297.00	47.36	249.65	
181	CH 2700 : CH 2715	3.92	15	16.5	1.2	297.00	41.19	255.81	
182	CH 2715 : CH 2730	4.12	15	16.5	1.2	297.00	43.22	253.78	
183	CH 2730 : CH 2745	4.24	15	16.5	1.2	297.00	44.56	252.44	
184	CH 2745 : CH 2760	3.92	15	16.5	1.2	297.00	41.19	255.81	
185	CH 2760 : CH 2775	3.55	15	16.5	1.2	297.00	37.25	259.75	
186	CH 2775 : CH 2790	3.50	15	16.5	1.2	297.00	36.74	260.26	
187	CH 2790 : CH 2805	3.77	15	16.5	1.2	297.00	39.57	257.43	
188	CH 2805 : CH 2820	3.86	15	16.5	1.2	297.00	40.54	256.46	
189	CH 2820 : CH 2835	3.72	15	16.5	1.2	297.00	39.10	257.90	
190	CH 2835 : CH 2850	3.66	15	16.5	1.2	297.00	38.40	258.60	
191	CH 2850 : CH 2865	3.73	15	16.5	1.2	297.00	39.12	257.88	
192	CH 2865 : CH 2880	3.82	15	16.5	1.2	297.00	40.10	256.90	
193	CH 2880 : CH 2895	3.57	15	16.5	1.2	297.00	37.45	259.55	
194	CH 2895 : CH 2910	3.40	15	16.5	1.2	297.00	35.65	261.35	
195	CH 2910 : CH 2925	3.30	15	16.5	1.2	297.00	34.63	262.37	
196	CH 2925 : CH 2940	3.42	15	16.5	1.2	297.00	35.92	261.08	
197	CH 2940 : CH 2955	3.72	15	16.5	1.2	297.00	39.10	257.90	
198	CH 2955 : CH 2970	3.70	15	16.5	1.2	297.00	38.86	258.14	
199	CH 2970 : CH 2985	3.65	15	16.5	1.2	297.00	38.28	258.72	
200	CH 2985 : CH 3000	3.62	15	16.5	1.2	297.00	37.97	259.03	
201	CH 3000 : CH 3015	3.57	15	16.5	1.2	297.00	37.50	259.50	
202	CH 3015 : CH 3030	3.40	15	16.5	1.2	297.00	35.68	261.32	
203	CH 3030 : CH 3045	3.12	15	16.5	1.2	297.00	32.74	264.26	
204	CH 3045 : CH 3060	3.31	15	16.5	1.2	297.00	34.74	262.26	
205	CH 3060 : CH 3075	3.75	15	16.5	1.2	297.00	39.37	257.63	
206	CH 3075 : CH 3090	3.54	15	16.5	1.2	297.00	37.18	259.82	
207	CH 3090 : CH 3105	3.13	15	16.5	1.2	297.00	32.90	264.10	
208	CH 3105 : CH 3120	3.11	15	16.5	1.2	297.00	32.63	264.37	
209	CH 3120 : CH 3135	3.20	15	16.5	1.2	297.00	33.57	263.43	
210	CH 3135 : CH 3150	3.08	15	16.5	1.2	297.00	32.38	264.62	
211	CH 3150 : CH 3165	3.02	15	16.5	1.2	297.00	31.66	265.34	
212	CH 3165 : CH 3180	3.21	15	16.5	1.2	297.00	33.67	263.33	
213	CH 3180 : CH 3195	3.32	15	16.5	1.2	297.00	34.81	262.19	
214	CH 3195 : CH 3210	3.07	15	16.5	1.2	297.00	32.27	264.73	
215	CH 3210 : CH 3225	3.12	15	16.5	1.2	297.00	32.71	264.29	
216	CH 3225 : CH 3240	3.11	15	16.5	1.2	297.00	32.63	264.37	
217	CH 3240 : CH 3255	3.05	15	16.5	1.2	297.00	32.03	264.97	
218	CH 3255 : CH 3270	3.13	15	16.5	1.2	297.00	32.91	264.09	
219	CH 3270 : CH 3285	3.17	15	16.5	1.2	297.00	33.29	263.72	
220	CH 3285 : CH 3300	3.27	15	16.5	1.2	297.00	34.30	262.70	
221	CH 3300 : CH 3315	3.24	15	16.5	1.2	297.00	34.07	262.93	
222	CH 3315 : CH 3330	3.03	15	16.5	1.2	297.00	31.81	265.19	
223	CH 3330 : CH 3345	3.22	15	16.5	1.2	297.00	33.86	263.14	
224	CH 3345 : CH 3360	3.38	15	16.5	1.2	297.00	35.51	261.49	
225	CH 3360 : CH 3375	2.86	15	16.5	1.2	297.00	30.05	266.95	
226	CH 3375 : CH 3390	2.77	15	16.5	1.2	297.00	29.09	267.91	
227	CH 3390 : CH 3405	3.39	15	16.5	1.2	297.00	35.60	261.40	
228	CH 3405 : CH 3420	3.72	15	16.5	1.2	297.00	39.04	257.96	
229	CH 3420 : CH 3435	2.82	15	16.5	1.2	297.00	29.64	267.36	
230	CH 3435 : CH 3450	2.31	15	16.5	1.2	297.00	24.20	272.80	
231	CH 3450 : CH 3465	2.27	15	16.5	1.2	297.00	23.81	273.19	

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		W (m)	L (m)	Proposed canal width (m)		Total Required Quantity (m3)	De-Silting Quantity (m3)	Net Cutting Quantity to be required (m3)	
232	CH 3465 : CH 3480	2.29	15	16.5	1.2	297.00	24.01	272.99	
233	CH 3480 : CH 3495	2.51	15	16.5	1.2	297.00	26.32	270.68	
234	CH 3495 : CH 3510	2.57	15	16.5	1.2	297.00	26.99	270.01	
235	CH 3510 : CH 3525	2.49	15	16.5	1.2	297.00	26.13	270.87	
236	CH 3525 : CH 3540	2.43	15	16.5	1.2	297.00	25.52	271.49	
237	CH 3540 : CH 3555	2.56	15	16.5	1.2	297.00	26.87	270.13	
238	CH 3555 : CH 3570	2.48	15	16.5	1.2	297.00	25.99	271.01	
239	CH 3570 : CH 3585	2.52	15	16.5	1.2	297.00	26.50	270.50	
240	CH 3585 : CH 3600	2.59	15	16.5	1.2	297.00	27.20	269.80	
241	CH 3600 : CH 3615	2.43	15	16.5	1.2	297.00	25.48	271.52	
242	CH 3615 : CH 3630	2.20	15	16.5	1.2	297.00	23.06	273.94	
243	CH 3630 : CH 3645	2.14	15	16.5	1.2	297.00	22.50	274.50	
244	CH 3645 : CH 3660	2.11	15	16.5	1.2	297.00	22.11	274.89	
245	CH 3660 : CH 3675	2.01	15	16.5	1.2	297.00	21.08	275.92	
246	CH 3675 : CH 3690	2.40	15	16.5	1.2	297.00	25.20	271.80	
247	CH 3690 : CH 3705	2.99	15	16.5	1.2	297.00	31.44	265.56	
248	CH 3705 : CH 3720	3.16	15	16.5	1.2	297.00	33.13	263.87	
249	CH 3720 : CH 3735	2.61	15	16.5	1.2	297.00	27.37	269.63	
250	CH 3735 : CH 3750	2.10	15	16.5	1.2	297.00	22.00	275.00	
251	CH 3750 : CH 3765	2.12	15	16.5	1.2	297.00	22.22	274.78	
252	CH 3765 : CH 3780	2.82	15	16.5	1.2	297.00	29.60	267.40	
253	CH 3780 : CH 3795	3.47	15	16.5	1.2	297.00	36.41	260.59	
254	CH 3795 : CH 3810	3.54	15	16.5	1.2	297.00	37.20	259.80	
255	CH 3810 : CH 3825	3.46	15	16.5	1.2	297.00	36.30	260.70	
256	CH 3825 : CH 3840	3.10	15	16.5	1.2	297.00	32.52	264.48	
257	CH 3840 : CH 3855	2.78	15	16.5	1.2	297.00	29.22	267.78	
258	CH 3855 : CH 3870	2.76	15	16.5	1.2	297.00	29.02	267.98	
259	CH 3870 : CH 3885	3.39	15	16.5	1.2	297.00	35.59	261.41	
260	CH 3885 : CH 3900	3.27	15	16.5	1.2	297.00	34.28	262.72	
261	CH 3900 : CH 3915	2.63	15	16.5	1.2	297.00	27.65	269.35	
262	CH 3915 : CH 3930	2.63	15	16.5	1.2	297.00	27.66	269.34	
263	CH 3930 : CH 3945	2.60	15	16.5	1.2	297.00	27.31	269.69	
264	CH 3945 : CH 3960	2.65	15	16.5	1.2	297.00	27.80	269.20	
265	CH 3960 : CH 3975	2.70	15	16.5	1.2	297.00	28.33	268.67	
266	CH 3975 : CH 3990	2.64	15	16.5	1.2	297.00	27.71	269.29	
267	CH 3990 : CH 4005	2.63	15	16.5	1.2	297.00	27.61	269.39	
268	CH 4005 : CH 4020	2.62	15	16.5	1.2	297.00	27.54	269.46	
269	CH 4020 : CH 4035	2.60	15	16.5	1.2	297.00	27.27	269.73	
270	CH 4035 : CH 4050	2.67	15	16.5	1.2	297.00	28.04	268.96	
271	CH 4050 : CH 4065	2.73	15	16.5	1.2	297.00	28.66	268.34	
272	CH 4065 : CH 4080	2.68	15	16.5	1.2	297.00	28.11	268.89	
273	CH 4080 : CH 4095	2.68	15	16.5	1.2	297.00	28.19	268.81	
274	CH 4095 : CH 4110	2.74	15	16.5	1.2	297.00	28.75	268.25	
275	CH 4110 : CH 4125	2.64	15	16.5	1.2	297.00	27.69	269.31	
276	CH 4125 : CH 4140	1.27	15	16.5	1.2	297.00	13.33	283.67	"
277	CH 4140 : CH 4155	0.00	15	16.5	1.2	0.00	0.00	0.00	"
278	CH 4155 : CH 4170	0.00	15	16.5	1.2	0.00	0.00	0.00	"
279	CH 4170 : CH 4185	0.00	15	16.5	1.2	0.00	0.00	0.00	"
280	CH 4185 : CH 4200	0.00	15	16.5	1.2	0.00	0.00	0.00	"
281	CH 4200 : CH 4215	0.00	15	16.5	1.2	0.00	0.00	0.00	"
282	CH 4215 : CH 4230	0.00	15	16.5	1.2	0.00	0.00	0.00	"
283	CH 4230 : CH 4245	0.00	15	16.5	1.2	0.00	0.00	0.00	"
284	CH 4245 : CH 4260	0.00	15	16.5	1.2	0.00	0.00	0.00	"
285	CH 4260 : CH 4275	0.00	15	16.5	1.2	0.00	0.00	0.00	"
286	CH 4275 : CH 4290	2.01	15	16.5	1.2	297.00	21.13	275.87	
287	CH 4290 : CH 4305	3.96	15	16.5	1.2	297.00	41.60	255.40	
288	CH 4305 : CH 4320	4.02	15	16.5	1.2	297.00	42.18	254.82	
289	CH 4320 : CH 4335	4.17	15	16.5	1.2	297.00	43.81	253.19	

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		W (m)	L (m)	Proposed canal width (m)		Total Required Quantity (m3)	De-Silting Quantity (m3)	Net Cutting Quantity to be required (m3)	
290	CH 4335 : CH 4350	4.14	15	16.5	1.2	297.00	43.45	253.55	
291	CH 4350 : CH 4365	4.34	15	16.5	1.2	297.00	45.53	251.47	
292	CH 4365 : CH 4380	4.49	15	16.5	1.2	297.00	47.19	249.81	
293	CH 4380 : CH 4395	4.46	15	16.5	1.2	297.00	46.84	250.16	
294	CH 4395 : CH 4410	4.55	15	16.5	1.2	297.00	47.75	249.25	
295	CH 4410 : CH 4425	4.33	15	16.5	1.2	297.00	45.49	251.51	
296	CH 4425 : CH 4440	4.15	15	16.5	1.2	297.00	43.56	253.44	
297	CH 4440 : CH 4455	4.24	15	16.5	1.2	297.00	44.50	252.50	
298	CH 4455 : CH 4470	4.19	15	16.5	1.2	297.00	44.04	252.96	
299	CH 4470 : CH 4485	4.24	15	16.5	1.2	297.00	44.47	252.53	
300	CH 4485 : CH 4500	4.24	15	16.5	1.2	297.00	44.49	252.51	
301	CH 4500 : CH 4515	4.39	15	16.5	1.2	297.00	46.14	250.86	
302	CH 4515 : CH 4530	4.51	15	16.5	1.2	297.00	47.30	249.70	
303	CH 4530 : CH 4545	4.21	15	16.5	1.2	297.00	44.17	252.83	
304	CH 4545 : CH 4560	4.17	15	16.5	1.2	297.00	43.77	253.23	
305	CH 4560 : CH 4575	4.26	15	16.5	1.2	297.00	44.70	252.30	
306	CH 4575 : CH 4590	4.27	15	16.5	1.2	297.00	44.78	252.22	
307	CH 4590 : CH 4605	4.43	15	16.5	1.2	297.00	46.49	250.51	
308	CH 4605 : CH 4620	4.07	15	16.5	1.2	297.00	42.69	254.31	
309	CH 4620 : CH 4635	4.08	15	16.5	1.2	297.00	42.82	254.18	
310	CH 4635 : CH 4650	4.51	15	16.5	1.2	297.00	47.40	249.60	
311	CH 4650 : CH 4665	4.08	15	16.5	1.2	297.00	42.88	254.12	
312	CH 4665 : CH 4680	3.92	15	16.5	1.2	297.00	41.14	255.86	
313	CH 4680 : CH 4695	4.24	15	16.5	1.2	297.00	44.50	252.50	
314	CH 4695 : CH 4710	4.00	15	16.5	1.2	297.00	42.01	254.99	
315	CH 4710 : CH 4725	3.36	15	16.5	1.2	297.00	35.24	261.76	
316	CH 4725 : CH 4740	3.49	15	16.5	1.2	297.00	36.68	260.32	
317	CH 4740 : CH 4755	3.67	15	16.5	1.2	297.00	38.54	258.46	
318	CH 4755 : CH 4770	3.38	15	16.5	1.2	297.00	35.48	261.52	
319	CH 4770 : CH 4785	3.28	15	16.5	1.2	297.00	34.48	262.52	
320	CH 4785 : CH 4800	3.30	15	16.5	1.2	297.00	34.68	262.32	
321	CH 4800 : CH 4815	3.79	15	16.5	1.2	297.00	39.78	257.22	
322	CH 4815 : CH 4830	4.26	15	16.5	1.2	297.00	44.73	252.27	
323	CH 4830 : CH 4845	4.27	15	16.5	1.2	297.00	44.80	252.20	
324	CH 4845 : CH 4860	4.11	15	16.5	1.2	297.00	43.19	253.81	
325	CH 4860 : CH 4875	3.73	15	16.5	1.2	297.00	39.11	257.89	
326	CH 4875 : CH 4890	3.92	15	16.5	1.2	297.00	41.18	255.82	
327	CH 4890 : CH 4905	4.77	15	16.5	1.2	297.00	50.08	246.92	
328	CH 4905 : CH 4920	4.91	15	16.5	1.2	297.00	51.59	245.41	
329	CH 4920 : CH 4935	4.51	15	16.5	1.2	297.00	47.34	249.66	
330	CH 4935 : CH 4950	4.43	15	16.5	1.2	297.00	46.53	250.47	
331	CH 4950 : CH 4965	4.46	15	16.5	1.2	297.00	46.78	250.22	
332	CH 4965 : CH 4980	4.37	15	16.5	1.2	297.00	45.83	251.17	
333	CH 4980 : CH 4995	4.28	15	16.5	1.2	297.00	44.89	252.11	
334	CH 4995 : CH 5010	4.19	15	16.5	1.2	297.00	43.95	253.05	
335	CH 5010 : CH 5025	4.10	15	16.5	1.2	297.00	43.01	253.99	
336	CH 5025 : CH 5040	4.62	15	16.5	1.2	297.00	48.51	248.49	
337	CH 5040 : CH 5055	5.17	15	16.5	1.2	297.00	54.32	242.68	
338	CH 5055 : CH 5070	5.04	15	16.5	1.2	297.00	52.87	244.13	
339	CH 5070 : CH 5085	5.05	15	16.5	1.2	297.00	52.98	244.02	
340	CH 5085 : CH 5100	5.11	15	16.5	1.2	297.00	53.64	243.36	
341	CH 5100 : CH 5115	4.77	15	16.5	1.2	297.00	50.05	246.95	
342	CH 5115 : CH 5130	4.53	15	16.5	1.2	297.00	47.59	249.41	
343	CH 5130 : CH 5145	4.83	15	16.5	1.2	297.00	50.74	246.26	
344	CH 5145 : CH 5160	4.84	15	16.5	1.2	297.00	50.81	246.19	
345	CH 5160 : CH 5175	4.81	15	16.5	1.2	297.00	50.46	246.54	
346	CH 5175 : CH 5190	5.15	15	16.5	1.2	297.00	54.09	242.91	
347	CH 5190 : CH 5205	5.31	15	16.5	1.2	297.00	55.72	241.28	

Sl.No	Chainage		Cutting and dredging details						Remarks
		W (m)	L (m)	Proposed canal width (m)		Total Required Quantity (m3)	De-Silting Quantity (m3)	Net Cutting Quantity to be required (m3)	
348	CH 5205 : CH 5220	5.33	15	16.5	1.2	297.00	56.00	241.00	
349	CH 5220 : CH 5235	5.58	15	16.5	1.2	297.00	58.64	238.36	
350	CH 5235 : CH 5250	5.90	15	16.5	1.2	297.00	62.00	235.00	
351	CH 5250 : CH 5265	6.40	15	16.5	1.2	297.00	67.21	229.79	
352	CH 5265 : CH 5280	5.82	15	16.5	1.2	297.00	61.13	235.87	
353	CH 5280 : CH 5295	4.71	15	16.5	1.2	297.00	49.47	247.53	
354	CH 5295 : CH 5310	4.87	15	16.5	1.2	297.00	51.09	245.91	
355	CH 5310 : CH 5325	5.02	15	16.5	1.2	297.00	52.66	244.34	
356	CH 5325 : CH 5340	5.37	15	16.5	1.2	297.00	56.35	240.65	
357	CH 5340 : CH 5355	6.16	15	16.5	1.2	297.00	64.64	232.36	
358	CH 5355 : CH 5370	6.89	15	16.5	1.2	297.00	72.38	224.62	
359	CH 5370 : CH 5385	6.65	15	16.5	1.2	297.00	69.77	227.23	
360	CH 5385 : CH 5400	5.71	15	16.5	1.2	297.00	59.95	237.05	
361	CH 5400 : CH 5415	5.99	15	16.5	1.2	297.00	62.90	234.10	
362	CH 5415 : CH 5430	6.23	15	16.5	1.2	297.00	65.43	231.57	
363	CH 5430 : CH 5445	5.06	15	16.5	1.2	297.00	53.13	243.87	
364	CH 5445 : CH 5460	3.86	15	16.5	1.2	297.00	40.54	256.46	
365	CH 5460 : CH 5475	4.80	15	16.5	1.2	297.00	50.42	246.58	
366	CH 5475 : CH 5490	6.06	15	16.5	1.2	297.00	63.67	233.33	
367	CH 5490 : CH 5505	6.03	15	16.5	1.2	297.00	63.27	233.73	
368	CH 5505 : CH 5520	5.75	15	16.5	1.2	297.00	60.35	236.65	
369	CH 5520 : CH 5535	5.34	15	16.5	1.2	297.00	56.05	240.95	
370	CH 5535 : CH 5550	5.30	15	16.5	1.2	297.00	55.63	241.37	
371	CH 5550 : CH 5565	5.57	15	16.5	1.2	297.00	58.48	238.52	
372	CH 5565 : CH 5580	5.93	15	16.5	1.2	297.00	62.30	234.70	
373	CH 5580 : CH 5595	5.93	15	16.5	1.2	297.00	62.30	234.70	
374	CH 5595 : CH 5610	6.02	15	16.5	1.2	297.00	63.22	233.78	
375	CH 5610 : CH 5625	6.51	15	16.5	1.2	297.00	68.38	228.62	
376	CH 5625 : CH 5640	6.72	15	16.5	1.2	297.00	70.60	226.40	
377	CH 5640 : CH 5655	6.82	15	16.5	1.2	297.00	71.62	225.38	
378	CH 5655 : CH 5670	6.60	15	16.5	1.2	297.00	69.32	227.68	
379	CH 5670 : CH 5685	6.37	15	16.5	1.2	297.00	66.87	230.13	
380	CH 5685 : CH 5700	5.72	15	16.5	1.2	297.00	60.07	236.93	
381	CH 5700 : CH 5715	5.23	15	16.5	1.2	297.00	54.90	242.10	
382	CH 5715 : CH 5730	5.96	15	16.5	1.2	297.00	62.54	234.46	
383	CH 5730 : CH 5745	6.72	15	16.5	1.2	297.00	70.58	226.42	
384	CH 5745 : CH 5760	6.33	15	16.5	1.2	297.00	66.48	230.52	
385	CH 5760 : CH 5775	5.68	15	16.5	1.2	297.00	59.69	237.31	
386	CH 5775 : CH 5790	5.64	15	16.5	1.2	297.00	59.21	237.79	
387	CH 5790 : CH 5805	5.58	15	16.5	1.2	297.00	58.54	238.46	
388	CH 5805 : CH 5820	5.33	15	16.5	1.2	297.00	55.93	241.07	
389	CH 5820 : CH 5835	5.35	15	16.5	1.2	297.00	56.16	240.84	
390	CH 5835 : CH 5850	5.76	15	16.5	1.2	297.00	60.45	236.55	
391	CH 5850 : CH 5865	6.10	15	16.5	1.2	297.00	64.06	232.94	
392	CH 5865 : CH 5880	7.29	15	16.5	1.2	297.00	76.55	220.45	
393	CH 5880 : CH 5895	7.98	15	16.5	1.2	297.00	83.80	213.20	
394	CH 5895 : CH 5910	7.35	15	16.5	1.2	297.00	77.18	219.82	
395	CH 5910 : CH 5925	7.23	15	16.5	1.2	297.00	75.89	221.11	
396	CH 5925 : CH 5940	7.58	15	16.5	1.2	297.00	79.54	217.46	
397	CH 5940 : CH 5955	8.04	15	16.5	1.2	297.00	84.42	212.58	
398	CH 5955 : CH 5970	8.36	15	16.5	1.2	297.00	87.82	209.18	
399	CH 5970 : CH 5985	8.42	15	16.5	1.2	297.00	88.44	208.56	
400	CH 5985 : CH 6000	7.52	15	16.5	1.2	297.00	78.93	218.07	
401	CH 6000 : CH 6015	6.15	15	16.5	1.2	297.00	64.56	232.44	
402	CH 6015 : CH 6030	6.36	15	16.5	1.2	297.00	66.73	230.27	
403	CH 6030 : CH 6045	7.24	15	16.5	1.2	297.00	76.04	220.96	
404	CH 6045 : CH 6060	7.99	15	16.5	1.2	297.00	83.87	213.13	
405	CH 6060 : CH 6075	8.48	15	16.5	1.2	297.00	89.08	207.92	

Sl.No	Chainage		Cutting and dredging details						Remarks
		W (m)	L (m)	Proposed canal width (m)		Total Required Quantity (m3)	De-Silting Quantity (m3)	Net Cutting Quantity to be required (m3)	
406	CH 6075 : CH 6090	8.75	15	16.5	1.2	297.00	91.85	205.15	
407	CH 6090 : CH 6105	9.16	15	16.5	1.2	297.00	96.22	200.78	
408	CH 6105 : CH 6120	9.53	15	16.5	1.2	297.00	100.05	196.95	
409	CH 6120 : CH 6135	9.93	15	16.5	1.2	297.00	104.31	192.69	
410	CH 6135 : CH 6150	12.20	15	16.5	1.2	297.00	128.11	168.89	
411	CH 6150 : CH 6165	13.79	15	16.5	1.2	297.00	144.78	152.22	
412	CH 6165 : CH 6180	11.95	15	16.5	1.2	297.00	125.48	171.53	
413	CH 6180 : CH 6195	10.43	15	16.5	1.2	297.00	109.55	187.45	
414	CH 6195 : CH 6210	10.27	15	16.5	1.2	297.00	107.84	189.17	
415	CH 6210 : CH 6225	10.35	15	16.5	1.2	297.00	108.64	188.36	
416	CH 6225 : CH 6240	10.55	15	16.5	1.2	297.00	110.81	186.19	
417	CH 6240 : CH 6255	10.76	15	16.5	1.2	297.00	112.99	184.01	
418	CH 6255 : CH 6270	10.97	15	16.5	1.2	297.00	115.16	181.84	
419	CH 6270 : CH 6285	10.85	15	16.5	1.2	297.00	113.90	183.10	
420	CH 6285 : CH 6300	11.33	15	16.5	1.2	297.00	118.93	178.07	
421	CH 6300 : CH 6315	12.09	15	16.5	1.2	297.00	126.99	170.01	
422	CH 6315 : CH 6330	12.04	15	16.5	1.2	297.00	126.45	170.55	
423	CH 6330 : CH 6345	10.92	15	16.5	1.2	297.00	114.70	182.30	
424	CH 6345 : CH 6360	9.14	15	16.5	1.2	297.00	96.01	200.99	
425	CH 6360 : CH 6375	8.26	15	16.5	1.2	297.00	86.68	210.32	
426	CH 6375 : CH 6390	8.07	15	16.5	1.2	297.00	84.73	212.27	
427	CH 6390 : CH 6405	7.84	15	16.5	1.2	297.00	82.33	214.67	
428	CH 6405 : CH 6420	7.42	15	16.5	1.2	297.00	77.93	219.07	
429	CH 6420 : CH 6435	7.00	15	16.5	1.2	297.00	73.51	223.49	
430	CH 6435 : CH 6450	7.22	15	16.5	1.2	297.00	75.85	221.15	
431	CH 6450 : CH 6465	7.69	15	16.5	1.2	297.00	80.76	216.24	
432	CH 6465 : CH 6480	8.26	15	16.5	1.2	297.00	86.69	210.31	
433	CH 6480 : CH 6495	8.04	15	16.5	1.2	297.00	84.46	212.54	
434	CH 6495 : CH 6510	7.31	15	16.5	1.2	297.00	76.71	220.29	
435	CH 6510 : CH 6525	7.55	15	16.5	1.2	297.00	79.28	217.72	
436	CH 6525 : CH 6540	8.19	15	16.5	1.2	297.00	85.95	211.05	
437	CH 6540 : CH 6555	8.80	15	16.5	1.2	297.00	92.38	204.62	
438	CH 6555 : CH 6570	10.63	15	16.5	1.2	297.00	111.59	185.41	
439	CH 6570 : CH 6585	14.04	15	16.5	1.2	297.00	147.46	149.54	
440	CH 6585 : CH 6600	15.32	15	16.5	1.2	297.00	160.83	136.17	
441	CH 6600 : CH 6615	14.60	15	16.5	1.2	297.00	153.31	143.69	
442	CH 6615 : CH 6630	14.37	15	16.5	1.2	297.00	150.89	146.12	
443	CH 6630 : CH 6645	14.02	15	16.5	1.2	297.00	147.21	149.79	
444	CH 6645 : CH 6660	13.43	15	16.5	1.2	297.00	140.96	156.04	
445	CH 6660 : CH 6675	13.06	15	16.5	1.2	297.00	137.14	159.86	
446	CH 6675 : CH 6690	12.26	15	16.5	1.2	297.00	128.69	168.31	
447	CH 6690 : CH 6705	11.39	15	16.5	1.2	297.00	119.55	177.45	
448	CH 6705 : CH 6720	12.05	15	16.5	1.2	297.00	126.54	170.46	
449	CH 6720 : CH 6735	13.01	15	16.5	1.2	297.00	136.60	160.40	
450	CH 6735 : CH 6750	13.27	15	16.5	1.2	297.00	139.38	157.62	
451	CH 6750 : CH 6765	13.71	15	16.5	1.2	297.00	143.91	153.09	
452	CH 6765 : CH 6780	14.56	15	16.5	1.2	297.00	152.87	144.13	
453	CH 6780 : CH 6795	15.35	15	16.5	1.2	297.00	161.22	135.78	
454	CH 6795 : CH 6810	15.29	15	16.5	1.2	297.00	160.58	136.42	
455	CH 6810 : CH 6825	14.35	15	16.5	1.2	297.00	150.65	146.35	
456	CH 6825 : CH 6840	13.71	15	16.5	1.2	297.00	144.00	153.00	
457	CH 6840 : CH 6855	13.25	15	16.5	1.2	297.00	139.14	157.86	
458	CH 6855 : CH 6870	12.96	15	16.5	1.2	297.00	136.06	160.94	
459	CH 6870 : CH 6885	13.44	15	16.5	1.2	297.00	141.09	155.91	
460	CH 6885 : CH 6900	14.33	15	16.5	1.2	297.00	150.41	146.59	
461	CH 6900 : CH 6915	14.54	15	16.5	1.2	297.00	152.64	144.36	
462	CH 6915 : CH 6930	14.41	15	16.5	1.2	297.00	151.26	145.74	
463	CH 6930 : CH 6945	14.75	15	16.5	1.2	297.00	154.89	142.11	

Sl.No	Chainage		Cutting and dredging details						Remarks
		W (m)	L (m)	Proposed canal width (m)		Total Required Quantity (m3)	De-Silting Quantity (m3)	Net Cutting Quantity to be required (m3)	
464	CH 6945 : CH 6960	14.74	15	16.5	1.2	297.00	154.79	142.21	
465	CH 6960 : CH 6975	14.15	15	16.5	1.2	297.00	148.52	148.48	
466	CH 6975 : CH 6990	14.71	15	16.5	1.2	297.00	154.48	142.52	
467	CH 6990 : CH 7005	17.66	15	16.5	1.2	0.00	185.46	0.00	
468	CH 7005 : CH 7020	17.44	15	16.5	1.2	0.00	183.16	0.00	
469	CH 7020 : CH 7035	15.87	15	16.5	1.2	297.00	166.59	130.41	
470	CH 7035 : CH 7050	16.37	15	16.5	1.2	297.00	171.84	125.16	
471	CH 7050 : CH 7065	15.60	15	16.5	1.2	297.00	163.85	133.15	
472	CH 7065 : CH 7080	14.94	15	16.5	1.2	297.00	156.82	140.18	
473	CH 7080 : CH 7095	14.79	15	16.5	1.2	297.00	155.30	141.71	
474	CH 7095 : CH 7110	15.29	15	16.5	1.2	297.00	160.58	136.42	
475	CH 7110 : CH 7125	15.47	15	16.5	1.2	297.00	162.40	134.60	
476	CH 7125 : CH 7140	15.45	15	16.5	1.2	297.00	162.24	134.76	
477	CH 7140 : CH 7155	14.89	15	16.5	1.2	297.00	156.38	140.62	
478	CH 7155 : CH 7170	13.73	15	16.5	1.2	297.00	144.21	152.79	
479	CH 7170 : CH 7185	12.85	15	16.5	1.2	297.00	134.97	162.03	
480	CH 7185 : CH 7200	12.79	15	16.5	1.2	297.00	134.29	162.71	
481	CH 7200 : CH 7215	15.01	15	16.5	1.2	297.00	157.60	139.40	
482	CH 7215 : CH 7230	16.75	15	16.5	1.2	0.00	175.90	0.00	"
483	CH 7230 : CH 7245	22.85	15	16.5	1.2	0.00	239.94	0.00	"
484	CH 7245 : CH 7260	28.11	15	16.5	1.2	0.00	295.13	0.00	"
485	CH 7260 : CH 7275	17.48	15	16.5	1.2	0.00	183.49	0.00	
486	CH 7275 : CH 7290	12.84	15	16.5	1.2	297.00	134.78	162.22	
487	CH 7290 : CH 7305	9.40	15	16.5	1.2	297.00	98.68	198.32	
488	CH 7305 : CH 7320	9.09	15	16.5	1.2	297.00	95.40	201.60	
489	CH 7320 : CH 7335	10.59	15	16.5	1.2	297.00	111.20	185.80	
490	CH 7335 : CH 7350	11.93	15	16.5	1.2	297.00	125.31	171.69	
491	CH 7350 : CH 7365	14.62	15	16.5	1.2	297.00	153.48	143.52	
492	CH 7365 : CH 7380	18.72	15	16.5	1.2	0.00	196.59	0.00	
493	CH 7380 : CH 7395	18.20	15	16.5	1.2	0.00	191.14	0.00	
494	CH 7395 : CH 7410	14.11	15	16.5	1.2	297.00	148.11	148.89	
495	CH 7410 : CH 7425	13.98	15	16.5	1.2	297.00	146.80	150.20	
496	CH 7425 : CH 7440	15.54	15	16.5	1.2	297.00	163.20	133.80	
497	CH 7440 : CH 7455	15.19	15	16.5	1.2	297.00	159.49	137.51	
498	CH 7455 : CH 7470	15.40	15	16.5	1.2	297.00	161.71	135.29	
499	CH 7470 : CH 7485	14.59	15	16.5	1.2	297.00	153.22	143.78	
500	CH 7485 : CH 7500	13.05	15	16.5	1.2	297.00	136.99	160.01	
501	CH 7500 : CH 7515	14.34	15	16.5	1.2	297.00	150.53	146.47	
502	CH 7515 : CH 7530	15.30	15	16.5	1.2	297.00	160.69	136.31	
503	CH 7530 : CH 7545	15.58	15	16.5	1.2	297.00	163.55	133.45	
504	CH 7545 : CH 7560	16.14	15	16.5	1.2	297.00	169.50	127.50	
505	CH 7560 : CH 7575	16.07	15	16.5	1.2	297.00	168.71	128.29	
506	CH 7575 : CH 7590	16.02	15	16.5	1.2	297.00	168.24	128.76	
507	CH 7590 : CH 7605	16.49	15	16.5	1.2	297.00	173.11	123.89	
508	CH 7605 : CH 7620	16.33	15	16.5	1.2	297.00	171.44	125.56	
509	CH 7620 : CH 7635	16.41	15	16.5	1.2	297.00	172.35	124.65	
510	CH 7635 : CH 7650	16.60	15	16.5	1.2	0.00	174.30	0.00	
511	CH 7650 : CH 7665	14.60	15	16.5	1.2	297.00	153.32	143.68	
512	CH 7665 : CH 7680	11.01	15	16.5	1.2	297.00	115.63	181.37	
513	CH 7680 : CH 7695	10.26	15	16.5	1.2	297.00	107.71	189.29	
514	CH 7695 : CH 7710	12.10	15	16.5	1.2	297.00	127.08	169.92	
515	CH 7710 : CH 7725	13.07	15	16.5	1.2	297.00	137.24	159.76	
516	CH 7725 : CH 7740	13.22	15	16.5	1.2	297.00	138.76	158.24	
517	CH 7740 : CH 7755	12.99	15	16.5	1.2	297.00	136.38	160.62	
518	CH 7755 : CH 7770	12.64	15	16.5	1.2	297.00	132.67	164.33	
519	CH 7770 : CH 7785	12.28	15	16.5	1.2	297.00	128.92	168.08	
520	CH 7785 : CH 7800	12.32	15	16.5	1.2	297.00	129.33	167.67	
521	CH 7800 : CH 7815	12.44	15	16.5	1.2	297.00	130.66	166.34	

Sl.No	Chainage		Cutting and dredging details						Remarks
		W (m)	L (m)	Proposed canal width (m)		Total Required Quantity (m3)	De-Silting Quantity (m3)	Net Cutting Quantity to be required (m3)	
522	CH 7815 : CH 7830	12.30	15	16.5	1.2	297.00	129.16	167.84	
523	CH 7830 : CH 7845	12.39	15	16.5	1.2	297.00	130.13	166.87	
524	CH 7845 : CH 7860	12.66	15	16.5	1.2	297.00	132.95	164.05	
525	CH 7860 : CH 7875	12.79	15	16.5	1.2	297.00	134.30	162.70	
526	CH 7875 : CH 7890	12.76	15	16.5	1.2	297.00	133.93	163.07	
527	CH 7890 : CH 7905	12.60	15	16.5	1.2	297.00	132.28	164.72	
528	CH 7905 : CH 7920	12.52	15	16.5	1.2	297.00	131.50	165.50	
529	CH 7920 : CH 7935	12.51	15	16.5	1.2	297.00	131.31	165.69	
530	CH 7935 : CH 7950	12.47	15	16.5	1.2	297.00	130.98	166.02	
531	CH 7950 : CH 7965	12.49	15	16.5	1.2	297.00	131.10	165.90	
532	CH 7965 : CH 7980	12.51	15	16.5	1.2	297.00	131.37	165.63	
533	CH 7980 : CH 7995	12.54	15	16.5	1.2	297.00	131.70	165.30	
534	CH 7995 : CH 8010	12.37	15	16.5	1.2	297.00	129.83	167.17	
535	CH 8010 : CH 8025	11.18	15	16.5	1.2	297.00	117.34	179.66	
536	CH 8025 : CH 8040	10.33	15	16.5	1.2	297.00	108.42	188.58	
537	CH 8040 : CH 8055	10.27	15	16.5	1.2	297.00	107.86	189.14	
538	CH 8055 : CH 8070	9.91	15	16.5	1.2	297.00	104.08	192.92	
539	CH 8070 : CH 8085	9.64	15	16.5	1.2	297.00	101.18	195.82	
540	CH 8085 : CH 8100	9.48	15	16.5	1.2	297.00	99.54	197.46	
541	CH 8100 : CH 8115	10.19	15	16.5	1.2	297.00	106.98	190.02	
542	CH 8115 : CH 8130	18.38	15	16.5	1.2	0.00	192.94	0.00	
543	CH 8130 : CH 8145	18.52	15	16.5	1.2	0.00	194.49	0.00	
544	CH 8145 : CH 8160	9.59	15	16.5	1.2	297.00	100.70	196.31	
545	CH 8160 : CH 8175	7.94	15	16.5	1.2	297.00	83.32	213.68	
546	CH 8175 : CH 8190	7.95	15	16.5	1.2	297.00	83.49	213.51	
547	CH 8190 : CH 8205	8.08	15	16.5	1.2	297.00	84.85	212.15	
548	CH 8205 : CH 8220	8.37	15	16.5	1.2	297.00	87.84	209.16	
549	CH 8220 : CH 8235	8.51	15	16.5	1.2	297.00	89.40	207.60	
550	CH 8235 : CH 8250	8.25	15	16.5	1.2	297.00	86.61	210.39	
551	CH 8250 : CH 8265	8.27	15	16.5	1.2	297.00	86.82	210.18	
552	CH 8265 : CH 8280	8.13	15	16.5	1.2	297.00	85.37	211.63	
553	CH 8280 : CH 8295	7.87	15	16.5	1.2	297.00	82.61	214.39	
554	CH 8295 : CH 8310	9.35	15	16.5	1.2	297.00	98.20	198.80	
555	CH 8310 : CH 8325	11.07	15	16.5	1.2	297.00	116.20	180.80	
556	CH 8325 : CH 8340	11.46	15	16.5	1.2	297.00	120.34	176.66	
557	CH 8340 : CH 8355	11.41	15	16.5	1.2	297.00	119.77	177.23	
558	CH 8355 : CH 8370	11.30	15	16.5	1.2	297.00	118.63	178.37	
559	CH 8370 : CH 8385	11.16	15	16.5	1.2	297.00	117.16	179.84	
560	CH 8385 : CH 8400	10.36	15	16.5	1.2	297.00	108.74	188.26	
561	CH 8400 : CH 8415	9.47	15	16.5	1.2	297.00	99.47	197.53	
562	CH 8415 : CH 8430	9.06	15	16.5	1.2	297.00	95.15	201.85	
563	CH 8430 : CH 8445	8.42	15	16.5	1.2	297.00	88.36	208.64	
564	CH 8445 : CH 8460	8.58	15	16.5	1.2	297.00	90.09	206.91	
565	CH 8460 : CH 8475	9.37	15	16.5	1.2	297.00	98.43	198.57	
566	CH 8475 : CH 8490	9.36	15	16.5	1.2	297.00	98.24	198.76	
567	CH 8490 : CH 8505	9.33	15	16.5	1.2	297.00	97.94	199.06	
568	CH 8505 : CH 8520	9.79	15	16.5	1.2	297.00	102.81	194.19	
569	CH 8520 : CH 8535	10.30	15	16.5	1.2	297.00	108.14	188.86	
570	CH 8535 : CH 8550	8.86	15	16.5	1.2	297.00	93.04	203.96	
571	CH 8550 : CH 8565	7.83	15	16.5	1.2	297.00	82.17	214.83	
572	CH 8565 : CH 8580	8.72	15	16.5	1.2	297.00	91.58	205.42	
573	CH 8580 : CH 8595	9.07	15	16.5	1.2	297.00	95.19	201.81	
574	CH 8595 : CH 8610	9.34	15	16.5	1.2	297.00	98.03	198.97	
575	CH 8610 : CH 8625	9.84	15	16.5	1.2	297.00	103.36	193.64	
576	CH 8625 : CH 8640	10.15	15	16.5	1.2	297.00	106.61	190.39	
577	CH 8640 : CH 8655	10.03	15	16.5	1.2	297.00	105.26	191.74	
578	CH 8655 : CH 8670	9.98	15	16.5	1.2	297.00	104.75	192.25	
579	CH 8670 : CH 8685	10.15	15	16.5	1.2	297.00	106.54	190.46	

Sl.No	Chainage		Cutting and dredging details						Remarks
		W (m)	L (m)	Proposed canal width (m)		Total Required Quantity (m3)	De-Silting Quantity (m3)	Net Cutting Quantity to be required (m3)	
580	CH 8685 : CH 8700	10.50	15	16.5	1.2	297.00	110.27	186.73	
581	CH 8700 : CH 8715	11.05	15	16.5	1.2	297.00	116.01	180.99	
582	CH 8715 : CH 8730	11.77	15	16.5	1.2	297.00	123.53	173.47	
583	CH 8730 : CH 8745	12.44	15	16.5	1.2	297.00	130.67	166.33	
584	CH 8745 : CH 8760	12.73	15	16.5	1.2	297.00	133.70	163.30	
585	CH 8760 : CH 8775	12.74	15	16.5	1.2	297.00	133.75	163.25	
586	CH 8775 : CH 8790	8.61	15	16.5	1.2	297.00	90.40	206.60	
587	CH 8790 : CH 8805	6.53	15	16.5	1.2	297.00	68.53	228.47	
588	CH 8805 : CH 8820	8.62	15	16.5	1.2	297.00	90.54	206.46	
589	CH 8820 : CH 8835	8.93	15	16.5	1.2	297.00	93.75	203.25	
590	CH 8835 : CH 8850	9.67	15	16.5	1.2	297.00	101.52	195.48	
591	CH 8850 : CH 8865	7.65	15	16.5	1.2	297.00	80.33	216.68	
592	CH 8865 : CH 8880	8.75	15	16.5	1.2	297.00	91.86	205.14	
593	CH 8880 : CH 8895	28.73	15	16.5	1.2	0.00	301.70	0.00	
594	CH 8895 : CH 8910	45.14	15	16.5	1.2	0.00	473.95	0.00	"
595	CH 8910 : CH 8925	45.35	15	16.5	1.2	0.00	476.21	0.00	"
596	CH 8925 : CH 8940	53.12	15	16.5	1.2	0.00	557.76	0.00	"
597	CH 8940 : CH 8955	69.01	15	16.5	1.2	0.00	724.59	0.00	"
598	CH 8955 : CH 8970	74.80	15	16.5	1.2	0.00	785.43	0.00	"
599	CH 8970 : CH 8985	71.82	15	16.5	1.2	0.00	754.11	0.00	"
600	CH 8985 : CH 9000	71.44	15	16.5	1.2	0.00	750.10	0.00	"
601	CH 9000 : CH 9015	71.63	15	16.5	1.2	0.00	752.09	0.00	"
602	CH 9015 : CH 9030	71.91	15	16.5	1.2	0.00	755.04	0.00	"
603	CH 9030 : CH 9045	73.15	15	16.5	1.2	0.00	768.08	0.00	"
604	CH 9045 : CH 9060	72.67	15	16.5	1.2	0.00	763.08	0.00	"
605	CH 9060 : CH 9075	69.39	15	16.5	1.2	0.00	728.61	0.00	"
606	CH 9075 : CH 9090	66.64	15	16.5	1.2	0.00	699.71	0.00	"
607	CH 9090 : CH 9105	65.20	15	16.5	1.2	0.00	684.62	0.00	"
608	CH 9105 : CH 9120	65.51	15	16.5	1.2	0.00	687.88	0.00	"
609	CH 9120 : CH 9135	66.33	15	16.5	1.2	0.00	696.44	0.00	"
610	CH 9135 : CH 9150	67.38	15	16.5	1.2	0.00	707.45	0.00	"
611	CH 9150 : CH 9165	68.89	15	16.5	1.2	0.00	723.37	0.00	"
612	CH 9165 : CH 9180	72.09	15	16.5	1.2	0.00	756.99	0.00	"
613	CH 9180 : CH 9195	76.78	15	16.5	1.2	0.00	806.18	0.00	"
614	CH 9195 : CH 9210	80.56	15	16.5	1.2	0.00	845.87	0.00	"
615	CH 9210 : CH 9225	84.22	15	16.5	1.2	0.00	884.30	0.00	"
616	CH 9225 : CH 9240	87.33	15	16.5	1.2	0.00	916.95	0.00	"
617	CH 9240 : CH 9255	88.77	15	16.5	1.2	0.00	932.06	0.00	"
618	CH 9255 : CH 9270	90.25	15	16.5	1.2	0.00	947.60	0.00	"
619	CH 9270 : CH 9285	93.18	15	16.5	1.2	0.00	978.42	0.00	"
620	CH 9285 : CH 9300	95.57	15	16.5	1.2	0.00	1003.43	0.00	"
621	CH 9300 : CH 9315	95.92	15	16.5	1.2	0.00	1007.12	0.00	"
622	CH 9315 : CH 9330	95.65	15	16.5	1.2	0.00	1004.28	0.00	"
623	CH 9330 : CH 9345	95.95	15	16.5	1.2	0.00	1007.50	0.00	"
624	CH 9345 : CH 9360	93.67	15	16.5	1.2	0.00	983.49	0.00	"
625	CH 9360 : CH 9375	86.92	15	16.5	1.2	0.00	912.69	0.00	"
626	CH 9375 : CH 9390	91.45	15	16.5	1.2	0.00	960.26	0.00	"
627	CH 9390 : CH 9405	99.38	15	16.5	1.2	0.00	1043.52	0.00	"
628	CH 9405 : CH 9420	96.29	15	16.5	1.2	0.00	1011.02	0.00	"
629	CH 9420 : CH 9435	90.94	15	16.5	1.2	0.00	954.89	0.00	"
630	CH 9435 : CH 9450	88.15	15	16.5	1.2	0.00	925.60	0.00	"
631	CH 9450 : CH 9465	88.64	15	16.5	1.2	0.00	930.75	0.00	"
632	CH 9465 : CH 9480	87.56	15	16.5	1.2	0.00	919.37	0.00	"
633	CH 9480 : CH 9495	83.71	15	16.5	1.2	0.00	878.98	0.00	"
634	CH 9495 : CH 9510	77.89	15	16.5	1.2	0.00	817.87	0.00	"
635	CH 9510 : CH 9525	72.00	15	16.5	1.2	0.00	755.97	0.00	"
636	CH 9525 : CH 9540	66.20	15	16.5	1.2	0.00	695.05	0.00	"
637	CH 9540 : CH 9555	60.62	15	16.5	1.2	0.00	636.56	0.00	"

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		W (m)	L (m)	Proposed canal width (m)		Total Required Quantity (m3)	De-Silting Quantity (m3)	Net Cutting Quantity to be required (m3)	
638	CH 9555 : CH 9570	54.40	15	16.5	1.2	0.00	571.24	0.00	"
639	CH 9570 : CH 9585	47.16	15	16.5	1.2	0.00	495.17	0.00	"
640	CH 9585 : CH 9600	41.04	15	16.5	1.2	0.00	430.91	0.00	"
641	CH 9600 : CH 9615	44.41	15	16.5	1.2	0.00	466.25	0.00	"
642	CH 9615 : CH 9630	60.63	15	16.5	1.2	0.00	636.60	0.00	"
643	CH 9630 : CH 9645	79.97	15	16.5	1.2	0.00	839.70	0.00	"
644	CH 9645 : CH 9660	90.19	15	16.5	1.2	0.00	946.97	0.00	"
645	CH 9660 : CH 9675	93.14	15	16.5	1.2	0.00	977.93	0.00	"
646	CH 9675 : CH 9690	97.81	15	16.5	1.2	0.00	1026.96	0.00	"
647	CH 9690 : CH 9705	103.96	15	16.5	1.2	0.00	1091.61	0.00	"
648	CH 9705 : CH 9720	111.06	15	16.5	1.2	0.00	1166.16	0.00	"
649	CH 9720 : CH 9735	118.45	15	16.5	1.2	0.00	1243.71	0.00	"
650	CH 9735 : CH 9750	123.13	15	16.5	1.2	0.00	1292.82	0.00	"
651	CH 9750 : CH 9765	123.42	15	16.5	1.2	0.00	1295.86	0.00	"
652	CH 9765 : CH 9780	122.01	15	16.5	1.2	0.00	1281.05	0.00	"
653	CH 9780 : CH 9795	121.36	15	16.5	1.2	0.00	1274.29	0.00	"
654	CH 9795 : CH 9810	121.07	15	16.5	1.2	0.00	1271.27	0.00	"
655	CH 9810 : CH 9825	123.94	15	16.5	1.2	0.00	1301.37	0.00	"
656	CH 9825 : CH 9840	129.23	15	16.5	1.2	0.00	1356.95	0.00	"
657	CH 9840 : CH 9855	133.05	15	16.5	1.2	0.00	1396.98	0.00	"
658	CH 9855 : CH 9870	135.95	15	16.5	1.2	0.00	1427.51	0.00	"
659	CH 9870 : CH 9885	138.70	15	16.5	1.2	0.00	1456.30	0.00	"
660	CH 9885 : CH 9900	142.48	15	16.5	1.2	0.00	1496.02	0.00	"
661	CH 9900 : CH 9915	147.10	15	16.5	1.2	0.00	1544.59	0.00	"
662	CH 9915 : CH 9930	154.03	15	16.5	1.2	0.00	1617.33	0.00	"
663	CH 9930 : CH 9945	163.78	15	16.5	1.2	0.00	1719.67	0.00	"
664	CH 9945 : CH 9960	198.86	15	16.5	1.2	0.00	2088.06	0.00	"
665	CH 9960 : CH 9975	230.46	15	16.5	1.2	0.00	2419.84	0.00	"
666	CH 9975 : CH 9990	234.72	15	16.5	1.2	0.00	2464.57	0.00	"
667	CH 9990 : CH 10005	238.51	15	16.5	1.2	0.00	2504.30	0.00	"
668	CH 10005 : CH 10020	241.81	15	16.5	1.2	0.00	2539.04	0.00	"
669	CH 10020 : CH 10035	246.76	15	16.5	1.2	0.00	2590.93	0.00	"
670	CH 10035 : CH 10050	243.21	15	16.5	1.2	0.00	2553.67	0.00	"
671	CH 10050 : CH 10065	238.80	15	16.5	1.2	0.00	2507.37	0.00	"
672	CH 10065 : CH 10080	244.57	15	16.5	1.2	0.00	2568.00	0.00	"
673	CH 10080 : CH 10095	252.73	15	16.5	1.2	0.00	2653.64	0.00	"
674	CH 10095 : CH 10110	259.00	15	16.5	1.2	0.00	2719.48	0.00	"
675	CH 10110 : CH 10125	252.45	15	16.5	1.2	0.00	2650.68	0.00	"
676	CH 10125 : CH 10140	228.10	15	16.5	1.2	0.00	2395.03	0.00	"
677	CH 10140 : CH 10155	195.06	15	16.5	1.2	0.00	2048.16	0.00	"
678	CH 10155 : CH 10170	172.57	15	16.5	1.2	0.00	1811.94	0.00	"
679	CH 10170 : CH 10185	169.73	15	16.5	1.2	0.00	1782.15	0.00	"
680	CH 10185 : CH 10200	177.30	15	16.5	1.2	0.00	1861.63	0.00	"
681	CH 10200 : CH 10215	183.86	15	16.5	1.2	0.00	1930.58	0.00	"
682	CH 10215 : CH 10230	187.13	15	16.5	1.2	0.00	1964.85	0.00	"
683	CH 10230 : CH 10245	190.89	15	16.5	1.2	0.00	2004.39	0.00	"
684	CH 10245 : CH 10260	193.99	15	16.5	1.2	0.00	2036.92	0.00	"
685	CH 10260 : CH 10275	197.61	15	16.5	1.2	0.00	2074.89	0.00	"
686	CH 10275 : CH 10290	203.15	15	16.5	1.2	0.00	2133.09	0.00	"
687	CH 10290 : CH 10305	208.94	15	16.5	1.2	0.00	2193.83	0.00	"
688	CH 10305 : CH 10320	214.11	15	16.5	1.2	0.00	2248.18	0.00	"
689	CH 10320 : CH 10335	219.04	15	16.5	1.2	0.00	2299.87	0.00	"
690	CH 10335 : CH 10350	223.37	15	16.5	1.2	0.00	2345.42	0.00	"
691	CH 10350 : CH 10365	226.63	15	16.5	1.2	0.00	2379.66	0.00	"
692	CH 10365 : CH 10380	229.60	15	16.5	1.2	0.00	2410.84	0.00	"
693	CH 10380 : CH 10395	232.94	15	16.5	1.2	0.00	2445.82	0.00	"
694	CH 10395 : CH 10410	236.24	15	16.5	1.2	0.00	2480.56	0.00	"
695	CH 10410 : CH 10425	236.76	15	16.5	1.2	0.00	2486.00	0.00	"

Sl.No	Chainage		Cutting and dredging details						Remarks
		W (m)	L (m)	Proposed canal width (m)		Total Required Quantity (m3)	De-Silting Quantity (m3)	Net Cutting Quantity to be required (m3)	
696	CH 10425 : CH 10440	235.76	15	16.5	1.2	0.00	2475.47	0.00	"
697	CH 10440 : CH 10455	236.06	15	16.5	1.2	0.00	2478.58	0.00	"
698	CH 10455 : CH 10470	237.04	15	16.5	1.2	0.00	2488.93	0.00	"
699	CH 10470 : CH 10485	237.68	15	16.5	1.2	0.00	2495.65	0.00	"
700	CH 10485 : CH 10500	236.91	15	16.5	1.2	0.00	2487.52	0.00	"
701	CH 10500 : CH 10515	235.75	15	16.5	1.2	0.00	2475.40	0.00	"
702	CH 10515 : CH 10530	232.99	15	16.5	1.2	0.00	2446.40	0.00	"
703	CH 10530 : CH 10545	229.15	15	16.5	1.2	0.00	2406.05	0.00	"
704	CH 10545 : CH 10560	225.20	15	16.5	1.2	0.00	2364.59	0.00	"
705	CH 10560 : CH 10575	219.98	15	16.5	1.2	0.00	2309.74	0.00	"
706	CH 10575 : CH 10590	219.61	15	16.5	1.2	0.00	2305.86	0.00	"
707	CH 10590 : CH 10605	222.04	15	16.5	1.2	0.00	2331.46	0.00	"
708	CH 10605 : CH 10620	223.67	15	16.5	1.2	0.00	2348.51	0.00	"
709	CH 10620 : CH 10635	227.85	15	16.5	1.2	0.00	2392.44	0.00	"
710	CH 10635 : CH 10650	232.74	15	16.5	1.2	0.00	2443.80	0.00	"
711	CH 10650 : CH 10665	238.00	15	16.5	1.2	0.00	2498.98	0.00	"
712	CH 10665 : CH 10680	241.35	15	16.5	1.2	0.00	2534.14	0.00	"
713	CH 10680 : CH 10695	240.98	15	16.5	1.2	0.00	2530.26	0.00	"
714	CH 10695 : CH 10710	239.69	15	16.5	1.2	0.00	2516.73	0.00	"
715	CH 10710 : CH 10725	239.54	15	16.5	1.2	0.00	2515.14	0.00	"
716	CH 10725 : CH 10740	240.78	15	16.5	1.2	0.00	2528.20	0.00	"
717	CH 10740 : CH 10755	242.50	15	16.5	1.2	0.00	2546.24	0.00	"
718	CH 10755 : CH 10770	244.55	15	16.5	1.2	0.00	2567.75	0.00	"
719	CH 10770 : CH 10785	246.84	15	16.5	1.2	0.00	2591.82	0.00	"
720	CH 10785 : CH 10800	246.99	15	16.5	1.2	0.00	2593.43	0.00	"
721	CH 10800 : CH 10815	248.20	15	16.5	1.2	0.00	2606.13	0.00	"
722	CH 10815 : CH 10830	254.53	15	16.5	1.2	0.00	2672.58	0.00	"
723	CH 10830 : CH 10845	260.70	15	16.5	1.2	0.00	2737.37	0.00	"
724	CH 10845 : CH 10860	265.08	15	16.5	1.2	0.00	2783.36	0.00	"
725	CH 10860 : CH 10875	269.72	15	16.5	1.2	0.00	2832.09	0.00	"
726	CH 10875 : CH 10890	274.46	15	16.5	1.2	0.00	2881.78	0.00	"
727	CH 10890 : CH 10905	279.27	15	16.5	1.2	0.00	2932.31	0.00	"
728	CH 10905 : CH 10920	284.08	15	16.5	1.2	0.00	2982.88	0.00	"
729	CH 10920 : CH 10935	288.46	15	16.5	1.2	0.00	3028.78	0.00	"
730	CH 10935 : CH 10950	292.25	15	16.5	1.2	0.00	3068.58	0.00	"
731	CH 10950 : CH 10965	295.09	15	16.5	1.2	0.00	3098.46	0.00	"
732	CH 10965 : CH 10980	295.35	15	16.5	1.2	0.00	3101.12	0.00	"
733	CH 10980 : CH 10995	297.21	15	16.5	1.2	0.00	3120.74	0.00	"
734	CH 10995 : CH 11010	302.48	15	16.5	1.2	0.00	3176.08	0.00	"
735	CH 11010 : CH 11025	306.20	15	16.5	1.2	0.00	3215.15	0.00	"
736	CH 11025 : CH 11040	306.73	15	16.5	1.2	0.00	3220.62	0.00	"
737	CH 11040 : CH 11055	305.64	15	16.5	1.2	0.00	3209.20	0.00	"
738	CH 11055 : CH 11070	302.00	15	16.5	1.2	0.00	3171.01	0.00	"
739	CH 11070 : CH 11085	294.68	15	16.5	1.2	0.00	3094.11	0.00	"
740	CH 11085 : CH 11100	288.17	15	16.5	1.2	0.00	3025.76	0.00	"
741	CH 11100 : CH 11115	285.42	15	16.5	1.2	0.00	2996.95	0.00	"
742	CH 11115 : CH 11130	284.35	15	16.5	1.2	0.00	2985.64	0.00	"
743	CH 11130 : CH 11145	159.74	15	16.5	1.2	0.00	1677.27	0.00	"
744	CH 11145 : CH 11150	33.88	5	16.5	1.2	0.00	118.56	0.00	"
	Total Quantity							**1,09,554.11**	

Thevara _ Perandoor Canal									
Sl.No	Chainage	W (m)	L (m)	Deepening and Widening details					Remarks
				Proposed canal width (m)		Total Required Quantity (m3)	De-Silting Quantity (m3)	Net Cutting Quantity to be required (m3)	
1	CH 000 : CH 15	25.30	15	16.5	1.2	0.00	257.25	0.00	w>16.50
2	CH 15 : CH 30	49.30	15	16.5	1.2	0.00	257.25	0.00	"
3	CH 30 : CH 45	67.07	15	16.5	1.2	0.00	257.25	0.00	"
4	CH 45 : CH 60	64.31	15	16.5	1.2	0.00	257.25	0.00	"
5	CH 60 : CH 75	58.34	15	16.5	1.2	0.00	257.25	0.00	"
6	CH 75 : CH 90	53.13	15	16.5	1.2	0.00	257.25	0.00	"
7	CH 90 : CH 105	50.09	15	16.5	1.2	0.00	257.25	0.00	"
8	CH 105 : CH 120	48.44	15	16.5	1.2	0.00	257.25	0.00	"
9	CH 120 : CH 135	47.32	15	16.5	1.2	0.00	257.25	0.00	"
10	CH 135 : CH 150	43.11	15	16.5	1.2	0.00	257.25	0.00	"
11	CH 150 : CH 165	38.61	15	16.5	1.2	0.00	257.25	0.00	"
12	CH 165 : CH 180	37.13	15	16.5	1.2	0.00	257.25	0.00	"
13	CH 180 : CH 195	35.38	15	16.5	1.2	0.00	257.25	0.00	"
14	CH 195 : CH 210	33.55	15	16.5	1.2	0.00	257.25	0.00	"
15	CH 210 : CH 225	35.58	15	16.5	1.2	0.00	257.25	0.00	"
16	CH 225 : CH 240	45.02	15	16.5	1.2	0.00	257.25	0.00	"
17	CH 240 : CH 255	54.70	15	16.5	1.2	0.00	257.25	0.00	"
18	CH 255 : CH 270	61.94	15	16.5	1.2	0.00	257.25	0.00	"
19	CH 270 : CH 285	72.24	15	16.5	1.2	0.00	257.25	0.00	"
20	CH 285 : CH 300	84.74	15	16.5	1.2	0.00	257.25	0.00	"
21	CH 300 : CH 315	97.48	15	16.5	1.2	0.00	257.25	0.00	"
22	CH 315 : CH 330	109.16	15	16.5	1.2	0.00	257.25	0.00	"
23	CH 330 : CH 345	113.84	15	16.5	1.2	0.00	257.25	0.00	"
24	CH 345 : CH 360	110.19	15	16.5	1.2	0.00	257.25	0.00	"
25	CH 360 : CH 375	106.99	15	16.5	1.2	0.00	257.25	0.00	"
26	CH 375 : CH 390	107.36	15	16.5	1.2	0.00	257.25	0.00	"
27	CH 390 : CH 405	105.45	15	16.5	1.2	0.00	257.25	0.00	"
28	CH 405 : CH 420	99.31	15	16.5	1.2	0.00	257.25	0.00	"
29	CH 420 : CH 435	91.69	15	16.5	1.2	0.00	257.25	0.00	"
30	CH 435 : CH 450	82.75	15	16.5	1.2	0.00	257.25	0.00	"
31	CH 450 : CH 465	73.05	15	16.5	1.2	0.00	257.25	0.00	"
32	CH 465 : CH 480	66.41	15	16.5	1.2	0.00	257.25	0.00	"
33	CH 480 : CH 495	64.29	15	16.5	1.2	0.00	257.25	0.00	"
34	CH 495 : CH 510	63.95	15	16.5	1.2	0.00	257.25	0.00	"
35	CH 510 : CH 525	66.68	15	16.5	1.2	0.00	257.25	0.00	"
36	CH 525 : CH 540	72.52	15	16.5	1.2	0.00	257.25	0.00	"
37	CH 540 : CH 555	77.48	15	16.5	1.2	0.00	257.25	0.00	"
38	CH 555 : CH 570	79.59	15	16.5	1.2	0.00	257.25	0.00	"
39	CH 570 : CH 585	79.07	15	16.5	1.2	0.00	257.25	0.00	"
40	CH 585 : CH 600	78.42	15	16.5	1.2	0.00	257.25	0.00	"
41	CH 600 : CH 615	78.58	15	16.5	1.2	0.00	257.25	0.00	"
42	CH 615 : CH 630	77.31	15	16.5	1.2	0.00	257.25	0.00	"
43	CH 630 : CH 645	74.03	15	16.5	1.2	0.00	257.25	0.00	"
44	CH 645 : CH 660	70.41	15	16.5	1.2	0.00	257.25	0.00	"
45	CH 660 : CH 675	66.81	15	16.5	1.2	0.00	257.25	0.00	"
46	CH 675 : CH 690	63.26	15	16.5	1.2	0.00	257.25	0.00	"
47	CH 690 : CH 705	60.14	15	16.5	1.2	0.00	257.25	0.00	"
48	CH 705 : CH 720	57.73	15	16.5	1.2	0.00	257.25	0.00	"
49	CH 720 : CH 735	55.71	15	16.5	1.2	0.00	257.25	0.00	"
50	CH 735 : CH 750	54.23	15	16.5	1.2	0.00	257.25	0.00	"
51	CH 750 : CH 765	53.20	15	16.5	1.2	0.00	257.25	0.00	"
52	CH 765 : CH 780	52.46	15	16.5	1.2	0.00	257.25	0.00	"
53	CH 780 : CH 795	51.64	15	16.5	1.2	0.00	257.25	0.00	"
54	CH 795 : CH 810	50.61	15	16.5	1.2	0.00	257.25	0.00	"
55	CH 810 : CH 825	50.87	15	16.5	1.2	0.00	257.25	0.00	"
56	CH 825 : CH 840	51.96	15	16.5	1.2	0.00	257.25	0.00	"
57	CH 840 : CH 855	52.91	15	16.5	1.2	0.00	257.25	0.00	"
58	CH 855 : CH 870	54.95	15	16.5	1.2	0.00	257.25	0.00	"

Sl.No	Chainage	W (m)	L (m)	Deepening and Widening details					Remarks
				Proposed canal width (m)		Total Required Quantity (m3)	De-Silting Quantity (m3)	Net Cutting Quantity to be required (m3)	
59	CH 870 : CH 885	56.77	15	16.5	1.2	0.00	257.25	0.00	"
60	CH 885 : CH 900	54.49	15	16.5	1.2	0.00	257.25	0.00	"
61	CH 900 : CH 915	49.51	15	16.5	1.2	0.00	257.25	0.00	"
62	CH 915 : CH 930	46.68	15	16.5	1.2	0.00	257.25	0.00	"
63	CH 930 : CH 945	46.08	15	16.5	1.2	0.00	257.25	0.00	"
64	CH 945 : CH 960	46.45	15	16.5	1.2	0.00	257.25	0.00	"
65	CH 960 : CH 975	48.36	15	16.5	1.2	0.00	257.25	0.00	"
66	CH 975 : CH 990	50.81	15	16.5	1.2	0.00	257.25	0.00	"
67	CH 990 : CH 1005	52.51	15	16.5	1.2	0.00	257.25	0.00	"
68	CH 1005 : CH 1020	50.70	15	16.5	1.2	0.00	257.25	0.00	"
69	CH 1020 : CH 1035	45.11	15	16.5	1.2	0.00	257.25	0.00	"
70	CH 1035 : CH 1050	39.05	15	16.5	1.2	0.00	257.25	0.00	"
71	CH 1050 : CH 1065	33.40	15	16.5	1.2	0.00	257.25	0.00	"
72	CH 1065 : CH 1080	30.51	15	16.5	1.2	0.00	257.25	0.00	"
73	CH 1080 : CH 1095	30.80	15	16.5	1.2	0.00	257.25	0.00	"
74	CH 1095 : CH 1110	32.56	15	16.5	1.2	0.00	257.25	0.00	"
75	CH 1110 : CH 1125	32.79	15	16.5	1.2	0.00	257.25	0.00	"
76	CH 1125 : CH 1140	31.07	15	16.5	1.2	0.00	257.25	0.00	"
77	CH 1140 : CH 1155	31.90	15	16.5	1.2	0.00	257.25	0.00	"
78	CH 1155 : CH 1170	39.23	15	16.5	1.2	0.00	257.25	0.00	"
79	CH 1170 : CH 1185	52.13	15	16.5	1.2	0.00	257.25	0.00	"
80	CH 1185 : CH 1200	52.32	15	16.5	1.2	0.00	257.25	0.00	"
81	CH 1200 : CH 1215	49.13	15	16.5	1.2	0.00	257.25	0.00	"
82	CH 1215 : CH 1230	47.09	15	16.5	1.2	0.00	257.25	0.00	"
83	CH 1230 : CH 1245	48.96	15	16.5	1.2	0.00	257.25	0.00	"
84	CH 1245 : CH 1260	54.42	15	16.5	1.2	0.00	257.25	0.00	"
85	CH 1260 : CH 1275	54.95	15	16.5	1.2	0.00	257.25	0.00	"
86	CH 1275 : CH 1290	50.32	15	16.5	1.2	0.00	257.25	0.00	"
87	CH 1290 : CH 1305	48.22	15	16.5	1.2	0.00	257.25	0.00	"
88	CH 1305 : CH 1320	47.20	15	16.5	1.2	0.00	257.25	0.00	"
89	CH 1320 : CH 1335	43.99	15	16.5	1.2	0.00	257.25	0.00	"
90	CH 1335 : CH 1350	39.31	15	16.5	1.2	0.00	257.25	0.00	"
91	CH 1350 : CH 1365	35.56	15	16.5	1.2	0.00	257.25	0.00	"
92	CH 1365 : CH 1380	34.40	15	16.5	1.2	0.00	257.25	0.00	"
93	CH 1380 : CH 1395	35.29	15	16.5	1.2	0.00	257.25	0.00	"
94	CH 1395 : CH 1410	37.35	15	16.5	1.2	0.00	257.25	0.00	"
95	CH 1410 : CH 1425	40.04	15	16.5	1.2	0.00	257.25	0.00	"
96	CH 1425 : CH 1440	43.77	15	16.5	1.2	0.00	257.25	0.00	"
97	CH 1440 : CH 1455	47.00	15	16.5	1.2	0.00	257.25	0.00	"
98	CH 1455 : CH 1470	47.51	15	16.5	1.2	0.00	257.25	0.00	"
99	CH 1470 : CH 1485	46.26	15	16.5	1.2	0.00	257.25	0.00	"
100	CH 1485 : CH 1500	46.62	15	16.5	1.2	0.00	257.25	0.00	"
101	CH 1500 : CH 1515	45.56	15	16.5	1.2	0.00	257.25	0.00	"
102	CH 1515 : CH 1530	42.11	15	16.5	1.2	0.00	257.25	0.00	"
103	CH 1530 : CH 1545	38.74	15	16.5	1.2	0.00	257.25	0.00	"
104	CH 1545 : CH 1560	36.90	15	16.5	1.2	0.00	257.25	0.00	"
105	CH 1560 : CH 1575	36.53	15	16.5	1.2	0.00	257.25	0.00	"
106	CH 1575 : CH 1590	37.47	15	16.5	1.2	0.00	257.25	0.00	"
107	CH 1590 : CH 1605	42.37	15	16.5	1.2	0.00	257.25	0.00	"
108	CH 1605 : CH 1620	48.95	15	16.5	1.2	0.00	257.25	0.00	"
109	CH 1620 : CH 1635	54.54	15	16.5	1.2	0.00	257.25	0.00	"
110	CH 1635 : CH 1650	58.02	15	16.5	1.2	0.00	257.25	0.00	"
111	CH 1650 : CH 1665	60.78	15	16.5	1.2	0.00	257.25	0.00	"
112	CH 1665 : CH 1680	63.63	15	16.5	1.2	0.00	257.25	0.00	"
113	CH 1680 : CH 1695	67.95	15	16.5	1.2	0.00	257.25	0.00	"
114	CH 1695 : CH 1710	60.83	15	16.5	1.2	0.00	257.25	0.00	"
115	CH 1710 : CH 1725	45.46	15	16.5	1.2	0.00	257.25	0.00	"
116	CH 1725 : CH 1740	36.95	15	16.5	1.2	0.00	257.25	0.00	"
117	CH 1740 : CH 1755	36.28	15	16.5	1.2	0.00	257.25	0.00	"

Sl.No	Chainage	W (m)	L (m)	Deepening and Widening details					Remarks
				Proposed canal width (m)		Total Required Quantity (m3)	De-Silting Quantity (m3)	Net Cutting Quantity to be required (m3)	
118	CH 1755 : CH 1770	40.92	15	16.5	1.2	0.00	257.25	0.00	"
119	CH 1770 : CH 1785	40.78	15	16.5	1.2	0.00	257.25	0.00	"
120	CH 1785 : CH 1800	37.79	15	16.5	1.2	0.00	257.25	0.00	"
121	CH 1800 : CH 1815	36.01	15	16.5	1.2	0.00	257.25	0.00	"
122	CH 1815 : CH 1830	34.74	15	16.5	1.2	0.00	257.25	0.00	"
123	CH 1830 : CH 1845	33.26	15	16.5	1.2	0.00	257.25	0.00	"
124	CH 1845 : CH 1860	31.66	15	16.5	1.2	0.00	257.25	0.00	"
125	CH 1860 : CH 1875	31.74	15	16.5	1.2	0.00	257.25	0.00	"
126	CH 1875 : CH 1890	33.71	15	16.5	1.2	0.00	257.25	0.00	"
127	CH 1890 : CH 1905	35.89	15	16.5	1.2	0.00	257.25	0.00	"
128	CH 1905 : CH 1920	33.32	15	16.5	1.2	0.00	257.25	0.00	"
129	CH 1920 : CH 1935	30.38	15	16.5	1.2	0.00	257.25	0.00	"
130	CH 1935 : CH 1950	31.36	15	16.5	1.2	0.00	257.25	0.00	"
131	CH 1950 : CH 1965	30.72	15	16.5	1.2	0.00	257.25	0.00	"
132	CH 1965 : CH 1980	28.36	15	16.5	1.2	0.00	257.25	0.00	"
133	CH 1980 : CH 1995	26.91	15	16.5	1.2	0.00	257.25	0.00	"
134	CH 1995 : CH 2010	27.12	15	16.5	1.2	0.00	257.25	0.00	"
135	CH 2010 : CH 2025	28.12	15	16.5	1.2	0.00	257.25	0.00	"
136	CH 2025 : CH 2040	30.64	15	16.5	1.2	0.00	257.25	0.00	"
137	CH 2040 : CH 2055	32.85	15	16.5	1.2	0.00	257.25	0.00	"
138	CH 2055 : CH 2070	34.69	15	16.5	1.2	0.00	257.25	0.00	"
139	CH 2070 : CH 2085	27.28	15	16.5	1.2	0.00	257.25	0.00	"
140	CH 2085 : CH 2100	17.71	15	16.5	1.2	0.00	185.95	0.00	
141	CH 2100 : CH 2115	16.21	15	16.5	1.2	297.00	170.16	126.84	
142	CH 2115 : CH 2130	14.08	15	16.5	1.2	297.00	147.86	149.14	
143	CH 2130 : CH 2145	14.33	15	16.5	1.2	297.00	150.49	146.51	
144	CH 2145 : CH 2160	16.72	15	16.5	1.2	0.00	175.51	0.00	w>16.50
145	CH 2160 : CH 2175	18.04	15	16.5	1.2	0.00	189.43	0.00	"
146	CH 2175 : CH 2190	17.73	15	16.5	1.2	0.00	186.21	0.00	"
147	CH 2190 : CH 2205	18.18	15	16.5	1.2	0.00	190.88	0.00	"
148	CH 2205 : CH 2220	20.37	15	16.5	1.2	0.00	213.88	0.00	"
149	CH 2220 : CH 2235	22.16	15	16.5	1.2	0.00	232.72	0.00	"
150	CH 2235 : CH 2250	21.40	15	16.5	1.2	0.00	224.73	0.00	"
151	CH 2250 : CH 2265	19.76	15	16.5	1.2	0.00	207.44	0.00	"
152	CH 2265 : CH 2280	19.52	15	16.5	1.2	0.00	204.91	0.00	"
153	CH 2280 : CH 2295	19.57	15	16.5	1.2	0.00	205.53	0.00	"
154	CH 2295 : CH 2310	20.06	15	16.5	1.2	0.00	210.65	0.00	"
155	CH 2310 : CH 2325	20.84	15	16.5	1.2	0.00	218.80	0.00	"
156	CH 2325 : CH 2340	20.73	15	16.5	1.2	0.00	217.67	0.00	"
157	CH 2340 : CH 2355	19.88	15	16.5	1.2	0.00	208.76	0.00	"
158	CH 2355 : CH 2370	19.58	15	16.5	1.2	0.00	205.62	0.00	"
159	CH 2370 : CH 2385	19.32	15	16.5	1.2	0.00	202.86	0.00	"
160	CH 2385 : CH 2400	19.27	15	16.5	1.2	0.00	202.36	0.00	"
161	CH 2400 : CH 2415	20.64	15	16.5	1.2	0.00	216.70	0.00	"
162	CH 2415 : CH 2430	21.16	15	16.5	1.2	0.00	222.23	0.00	"
163	CH 2430 : CH 2445	21.62	15	16.5	1.2	0.00	226.97	0.00	"
164	CH 2445 : CH 2460	24.05	15	16.5	1.2	0.00	252.51	0.00	"
165	CH 2460 : CH 2475	24.44	15	16.5	1.2	0.00	256.66	0.00	"
166	CH 2475 : CH 2490	24.67	15	16.5	1.2	0.00	257.25	0.00	"
167	CH 2490 : CH 2505	25.07	15	16.5	1.2	0.00	257.25	0.00	"
168	CH 2505 : CH 2520	27.40	15	16.5	1.2	0.00	257.25	0.00	"
169	CH 2520 : CH 2535	23.59	15	16.5	1.2	0.00	247.71	0.00	"
170	CH 2535 : CH 2550	20.26	15	16.5	1.2	0.00	212.76	0.00	"
171	CH 2550 : CH 2565	33.32	15	16.5	1.2	0.00	257.25	0.00	"
172	CH 2565 : CH 2580	37.03	15	16.5	1.2	0.00	257.25	0.00	"
173	CH 2580 : CH 2595	25.38	15	16.5	1.2	0.00	257.25	0.00	"
174	CH 2595 : CH 2610	20.51	15	16.5	1.2	0.00	215.31	0.00	
175	CH 2610 : CH 2625	17.70	15	16.5	1.2	0.00	185.83	0.00	
176	CH 2625 : CH 2640	14.28	15	16.5	1.2	297.00	149.89	147.11	

Sl.No	Chainage	W (m)	L (m)	Deepening and Widening details					Remarks
				Proposed canal width (m)		Total Required Quantity (m3)	De-Silting Quantity (m3)	Net Cutting Quantity to be required (m3)	
177	CH 2640 : CH 2655	14.45	15	16.5	1.2	297.00	151.73	145.27	
178	CH 2655 : CH 2670	14.11	15	16.5	1.2	297.00	148.12	148.88	
179	CH 2670 : CH 2685	12.57	15	16.5	1.2	297.00	131.97	165.03	
180	CH 2685 : CH 2700	13.48	15	16.5	1.2	297.00	141.56	155.44	
181	CH 2700 : CH 2715	16.65	15	16.5	1.2	0.00	174.80	0.00	w>16.50
182	CH 2715 : CH 2730	18.48	15	16.5	1.2	0.00	194.02	0.00	
183	CH 2730 : CH 2745	18.93	15	16.5	1.2	0.00	198.78	-198.78	
184	CH 2745 : CH 2760	13.93	15	16.5	1.2	297.00	146.29	150.71	
185	CH 2760 : CH 2775	11.35	15	16.5	1.2	297.00	119.18	177.83	
186	CH 2775 : CH 2790	10.78	15	16.5	1.2	297.00	113.14	183.86	
187	CH 2790 : CH 2805	10.53	15	16.5	1.2	297.00	110.54	186.46	
188	CH 2805 : CH 2820	10.65	15	16.5	1.2	297.00	111.85	185.15	
189	CH 2820 : CH 2835	14.76	15	16.5	1.2	297.00	155.02	141.98	
190	CH 2835 : CH 2850	14.04	15	16.5	1.2	297.00	147.39	149.61	
191	CH 2850 : CH 2865	17.50	15	16.5	1.2	0.00	183.78	0.00	
192	CH 2865 : CH 2880	18.65	15	16.5	1.2	0.00	195.85	-195.85	
193	CH 2880 : CH 2895	14.25	15	16.5	1.2	297.00	149.64	147.36	
194	CH 2895 : CH 2910	12.74	15	16.5	1.2	297.00	133.76	163.24	
195	CH 2910 : CH 2925	12.40	15	16.5	1.2	297.00	130.18	166.82	
196	CH 2925 : CH 2940	11.22	15	16.5	1.2	297.00	117.78	179.22	
197	CH 2940 : CH 2955	10.75	15	16.5	1.2	297.00	112.92	184.08	
198	CH 2955 : CH 2970	9.02	15	16.5	1.2	297.00	94.70	202.30	
199	CH 2970 : CH 2985	8.01	15	16.5	1.2	297.00	84.14	212.86	
200	CH 2985 : CH 3000	10.35	15	16.5	1.2	297.00	108.65	188.35	
201	CH 3000 : CH 3015	11.84	15	16.5	1.2	297.00	124.34	172.66	
202	CH 3015 : CH 3030	11.67	15	16.5	1.2	297.00	122.52	174.48	
203	CH 3030 : CH 3045	12.09	15	16.5	1.2	297.00	126.97	170.03	
204	CH 3045 : CH 3060	12.91	15	16.5	1.2	297.00	135.56	161.44	
205	CH 3060 : CH 3075	14.78	15	16.5	1.2	297.00	155.22	141.78	
206	CH 3075 : CH 3090	15.54	15	16.5	1.2	297.00	163.20	133.80	
207	CH 3090 : CH 3105	16.50	15	16.5	1.2	297.00	173.30	123.70	
208	CH 3105 : CH 3120	16.63	15	16.5	1.2	0.00	174.58	0.00	
209	CH 3120 : CH 3135	12.09	15	16.5	1.2	297.00	126.99	170.01	
210	CH 3135 : CH 3150	9.09	15	16.5	1.2	297.00	95.43	201.57	
211	CH 3150 : CH 3165	8.41	15	16.5	1.2	297.00	88.33	208.67	
212	CH 3165 : CH 3180	9.40	15	16.5	1.2	297.00	98.66	198.34	
213	CH 3180 : CH 3195	10.06	15	16.5	1.2	297.00	105.63	191.37	
214	CH 3195 : CH 3210	8.90	15	16.5	1.2	297.00	93.44	203.56	
215	CH 3210 : CH 3225	8.98	15	16.5	1.2	297.00	94.33	202.67	
216	CH 3225 : CH 3240	8.64	15	16.5	1.2	297.00	90.70	206.30	
217	CH 3240 : CH 3255	7.87	15	16.5	1.2	297.00	82.67	214.33	
218	CH 3255 : CH 3270	7.81	15	16.5	1.2	297.00	81.95	215.05	
219	CH 3270 : CH 3285	8.01	15	16.5	1.2	297.00	84.12	212.88	
220	CH 3285 : CH 3300	7.84	15	16.5	1.2	297.00	82.30	214.70	
221	CH 3300 : CH 3315	7.03	15	16.5	1.2	297.00	73.76	223.24	
222	CH 3315 : CH 3330	8.10	15	16.5	1.2	297.00	85.00	212.00	
223	CH 3330 : CH 3345	8.34	15	16.5	1.2	297.00	87.56	209.44	
224	CH 3345 : CH 3360	6.83	15	16.5	1.2	297.00	71.76	225.24	
225	CH 3360 : CH 3375	6.75	15	16.5	1.2	297.00	70.87	226.13	
226	CH 3375 : CH 3390	6.64	15	16.5	1.2	297.00	69.67	227.33	
227	CH 3390 : CH 3405	6.33	15	16.5	1.2	297.00	66.50	230.50	
228	CH 3405 : CH 3420	5.61	15	16.5	1.2	297.00	58.87	238.13	
229	CH 3420 : CH 3435	5.12	15	16.5	1.2	297.00	53.73	243.27	
230	CH 3435 : CH 3450	5.37	15	16.5	1.2	297.00	56.35	240.65	
231	CH 3450 : CH 3465	6.42	15	16.5	1.2	297.00	67.43	229.57	
232	CH 3465 : CH 3480	8.10	15	16.5	1.2	297.00	85.01	211.99	
233	CH 3480 : CH 3495	7.58	15	16.5	1.2	297.00	79.61	217.39	
234	CH 3495 : CH 3510	6.35	15	16.5	1.2	297.00	66.63	230.37	
235	CH 3510 : CH 3525	6.81	15	16.5	1.2	297.00	71.49	225.51	

Sl.No	Chainage	W (m)	L (m)	Deepening and Widening details					Remarks
				Proposed canal width (m)		Total Required Quantity (m3)	De-Silting Quantity (m3)	Net Cutting Quantity to be required (m3)	
236	CH 3525 : CH 3540	7.53	15	16.5	1.2	297.00	79.04	217.96	
237	CH 3540 : CH 3555	8.74	15	16.5	1.2	297.00	91.81	205.19	
238	CH 3555 : CH 3570	9.85	15	16.5	1.2	297.00	103.38	193.62	
239	CH 3570 : CH 3585	9.93	15	16.5	1.2	297.00	104.31	192.69	
240	CH 3585 : CH 3600	9.54	15	16.5	1.2	297.00	100.13	196.87	
241	CH 3600 : CH 3615	9.25	15	16.5	1.2	297.00	97.16	199.84	
242	CH 3615 : CH 3630	8.82	15	16.5	1.2	297.00	92.57	204.43	
243	CH 3630 : CH 3645	8.05	15	16.5	1.2	297.00	84.54	212.46	
244	CH 3645 : CH 3660	7.15	15	16.5	1.2	297.00	75.11	221.89	
245	CH 3660 : CH 3675	6.84	15	16.5	1.2	297.00	71.82	225.18	
246	CH 3675 : CH 3690	7.42	15	16.5	1.2	297.00	77.94	219.06	
247	CH 3690 : CH 3705	8.08	15	16.5	1.2	297.00	84.89	212.11	
248	CH 3705 : CH 3720	7.25	15	16.5	1.2	297.00	76.17	220.83	
249	CH 3720 : CH 3735	6.23	15	16.5	1.2	297.00	65.45	231.55	
250	CH 3735 : CH 3750	6.56	15	16.5	1.2	297.00	68.86	228.14	
251	CH 3750 : CH 3765	7.00	15	16.5	1.2	297.00	73.49	223.51	
252	CH 3765 : CH 3780	7.69	15	16.5	1.2	297.00	80.72	216.28	
253	CH 3780 : CH 3795	8.25	15	16.5	1.2	297.00	86.58	210.42	
254	CH 3795 : CH 3810	8.27	15	16.5	1.2	297.00	86.78	210.22	
255	CH 3810 : CH 3825	7.31	15	16.5	1.2	297.00	76.80	220.20	
256	CH 3825 : CH 3840	6.18	15	16.5	1.2	297.00	64.91	232.09	
257	CH 3840 : CH 3855	6.11	15	16.5	1.2	297.00	64.19	232.81	
258	CH 3855 : CH 3870	6.26	15	16.5	1.2	297.00	65.72	231.28	
259	CH 3870 : CH 3885	6.45	15	16.5	1.2	297.00	67.68	229.32	
260	CH 3885 : CH 3900	6.82	15	16.5	1.2	297.00	71.60	225.40	
261	CH 3900 : CH 3915	6.56	15	16.5	1.2	297.00	68.91	228.09	
262	CH 3915 : CH 3930	5.92	15	16.5	1.2	297.00	62.13	234.87	
263	CH 3930 : CH 3945	5.32	15	16.5	1.2	297.00	55.86	241.14	
264	CH 3945 : CH 3960	4.98	15	16.5	1.2	297.00	52.28	244.72	
265	CH 3960 : CH 3975	4.83	15	16.5	1.2	297.00	50.68	246.32	
266	CH 3975 : CH 3990	4.71	15	16.5	1.2	297.00	49.45	247.55	
267	CH 3990 : CH 4005	4.93	15	16.5	1.2	297.00	51.77	245.24	
268	CH 4005 : CH 4020	5.45	15	16.5	1.2	297.00	57.18	239.82	
269	CH 4020 : CH 4035	6.32	15	16.5	1.2	297.00	66.41	230.59	
270	CH 4035 : CH 4050	6.45	15	16.5	1.2	297.00	67.71	229.29	
271	CH 4050 : CH 4065	5.89	15	16.5	1.2	297.00	61.82	235.18	
272	CH 4065 : CH 4080	5.64	15	16.5	1.2	297.00	59.24	237.76	
273	CH 4080 : CH 4095	5.47	15	16.5	1.2	297.00	57.39	239.61	
274	CH 4095 : CH 4110	5.93	15	16.5	1.2	297.00	62.24	234.76	
275	CH 4110 : CH 4125	6.63	15	16.5	1.2	297.00	69.61	227.39	
276	CH 4125 : CH 4140	6.74	15	16.5	1.2	297.00	70.82	226.18	
277	CH 4140 : CH 4155	6.23	15	16.5	1.2	297.00	65.37	231.63	
278	CH 4155 : CH 4170	5.77	15	16.5	1.2	297.00	60.57	236.43	
279	CH 4170 : CH 4185	6.39	15	16.5	1.2	297.00	67.14	229.86	
280	CH 4185 : CH 4200	7.00	15	16.5	1.2	297.00	73.55	223.45	
281	CH 4200 : CH 4215	6.87	15	16.5	1.2	297.00	72.15	224.85	
282	CH 4215 : CH 4230	6.83	15	16.5	1.2	297.00	71.68	225.32	
283	CH 4230 : CH 4245	6.68	15	16.5	1.2	297.00	70.13	226.87	
284	CH 4245 : CH 4260	6.43	15	16.5	1.2	297.00	67.51	229.49	
285	CH 4260 : CH 4275	6.76	15	16.5	1.2	297.00	71.01	225.99	
286	CH 4275 : CH 4290	6.42	15	16.5	1.2	297.00	67.43	229.57	
287	CH 4290 : CH 4305	5.95	15	16.5	1.2	297.00	62.44	234.56	
288	CH 4305 : CH 4320	6.98	15	16.5	1.2	297.00	73.31	223.69	
289	CH 4320 : CH 4335	7.69	15	16.5	1.2	297.00	80.73	216.27	
290	CH 4335 : CH 4350	6.98	15	16.5	1.2	297.00	73.33	223.67	
291	CH 4350 : CH 4365	6.14	15	16.5	1.2	297.00	64.49	232.51	
292	CH 4365 : CH 4380	6.07	15	16.5	1.2	297.00	63.74	233.27	
293	CH 4380 : CH 4395	6.95	15	16.5	1.2	297.00	72.92	224.08	
294	CH 4395 : CH 4410	8.02	15	16.5	1.2	297.00	84.24	212.76	

Sl.No	Chainage	W (m)	L (m)	Deepening and Widening details					Remarks
				Proposed canal width (m)		Total Required Quantity (m3)	De-Silting Quantity (m3)	Net Cutting Quantity to be required (m3)	
295	CH 4410 : CH 4425	8.78	15	16.5	1.2	297.00	92.15	204.85	
296	CH 4425 : CH 4440	9.32	15	16.5	1.2	297.00	97.81	199.19	
297	CH 4440 : CH 4455	9.26	15	16.5	1.2	297.00	97.28	199.72	
298	CH 4455 : CH 4470	8.84	15	16.5	1.2	297.00	92.80	204.20	
299	CH 4470 : CH 4485	8.61	15	16.5	1.2	297.00	90.45	206.55	
300	CH 4485 : CH 4500	8.78	15	16.5	1.2	297.00	92.24	204.76	
301	CH 4500 : CH 4515	8.92	15	16.5	1.2	297.00	93.69	203.31	
302	CH 4515 : CH 4530	8.75	15	16.5	1.2	297.00	91.89	205.11	
303	CH 4530 : CH 4545	8.83	15	16.5	1.2	297.00	92.76	204.24	
304	CH 4545 : CH 4560	8.90	15	16.5	1.2	297.00	93.43	203.57	
305	CH 4560 : CH 4575	8.68	15	16.5	1.2	297.00	91.13	205.87	
306	CH 4575 : CH 4590	8.36	15	16.5	1.2	297.00	87.76	209.24	
307	CH 4590 : CH 4605	8.04	15	16.5	1.2	297.00	84.41	212.59	
308	CH 4605 : CH 4620	7.92	15	16.5	1.2	297.00	83.12	213.88	
309	CH 4620 : CH 4635	8.07	15	16.5	1.2	297.00	84.77	212.23	
310	CH 4635 : CH 4650	7.72	15	16.5	1.2	297.00	81.02	215.98	
311	CH 4650 : CH 4665	6.81	15	16.5	1.2	297.00	71.46	225.54	
312	CH 4665 : CH 4680	7.05	15	16.5	1.2	297.00	73.97	223.03	
313	CH 4680 : CH 4695	7.61	15	16.5	1.2	297.00	79.89	217.11	
314	CH 4695 : CH 4710	7.41	15	16.5	1.2	297.00	77.77	219.23	
315	CH 4710 : CH 4725	7.13	15	16.5	1.2	297.00	74.88	222.12	
316	CH 4725 : CH 4740	7.14	15	16.5	1.2	297.00	74.95	222.05	
317	CH 4740 : CH 4755	7.57	15	16.5	1.2	297.00	79.53	217.47	
318	CH 4755 : CH 4770	7.65	15	16.5	1.2	297.00	80.34	216.66	
319	CH 4770 : CH 4785	7.29	15	16.5	1.2	297.00	76.58	220.42	
320	CH 4785 : CH 4800	7.02	15	16.5	1.2	297.00	73.70	223.30	
321	CH 4800 : CH 4815	6.54	15	16.5	1.2	297.00	68.66	228.34	
322	CH 4815 : CH 4830	6.31	15	16.5	1.2	297.00	66.21	230.79	
323	CH 4830 : CH 4845	6.78	15	16.5	1.2	297.00	71.16	225.84	
324	CH 4845 : CH 4860	6.68	15	16.5	1.2	297.00	70.19	226.81	
325	CH 4860 : CH 4875	6.36	15	16.5	1.2	297.00	66.81	230.19	
326	CH 4875 : CH 4890	6.76	15	16.5	1.2	297.00	70.97	226.03	
327	CH 4890 : CH 4905	7.13	15	16.5	1.2	297.00	74.88	222.12	
328	CH 4905 : CH 4920	7.32	15	16.5	1.2	297.00	76.87	220.13	
329	CH 4920 : CH 4935	7.18	15	16.5	1.2	297.00	75.36	221.64	
330	CH 4935 : CH 4950	6.69	15	16.5	1.2	297.00	70.25	226.76	
331	CH 4950 : CH 4965	6.54	15	16.5	1.2	297.00	68.66	228.34	
332	CH 4965 : CH 4980	7.39	15	16.5	1.2	297.00	77.57	219.43	
333	CH 4980 : CH 4995	8.02	15	16.5	1.2	297.00	84.26	212.74	
334	CH 4995 : CH 5010	8.08	15	16.5	1.2	297.00	84.85	212.15	
335	CH 5010 : CH 5025	8.36	15	16.5	1.2	297.00	87.74	209.26	
336	CH 5025 : CH 5040	8.62	15	16.5	1.2	297.00	90.53	206.47	
337	CH 5040 : CH 5055	8.79	15	16.5	1.2	297.00	92.26	204.74	
338	CH 5055 : CH 5070	8.92	15	16.5	1.2	297.00	93.62	203.38	
339	CH 5070 : CH 5085	9.09	15	16.5	1.2	297.00	95.42	201.58	
340	CH 5085 : CH 5100	9.22	15	16.5	1.2	297.00	96.83	200.17	
341	CH 5100 : CH 5115	9.37	15	16.5	1.2	297.00	98.37	198.63	
342	CH 5115 : CH 5130	9.41	15	16.5	1.2	297.00	98.79	198.21	
343	CH 5130 : CH 5145	9.32	15	16.5	1.2	297.00	97.90	199.10	
344	CH 5145 : CH 5160	9.22	15	16.5	1.2	297.00	96.76	200.24	
345	CH 5160 : CH 5175	9.19	15	16.5	1.2	297.00	96.45	200.55	
346	CH 5175 : CH 5190	9.32	15	16.5	1.2	297.00	97.81	199.19	
347	CH 5190 : CH 5205	9.49	15	16.5	1.2	297.00	99.69	197.31	
348	CH 5205 : CH 5220	9.60	15	16.5	1.2	297.00	100.83	196.17	
349	CH 5220 : CH 5235	8.10	15	16.5	1.2	297.00	85.03	211.97	
350	CH 5235 : CH 5250	6.71	15	16.5	1.2	297.00	70.45	226.55	
351	CH 5250 : CH 5265	7.14	15	16.5	1.2	297.00	74.99	222.01	
352	CH 5265 : CH 5280	7.18	15	16.5	1.2	297.00	75.40	221.60	
353	CH 5280 : CH 5295	6.97	15	16.5	1.2	297.00	73.15	223.85	

Sl.No	Chainage	W (m)	L (m)	Deepening and Widening details					Remarks
				Proposed canal width (m)		Total Required Quantity (m3)	De-Silting Quantity (m3)	Net Cutting Quantity to be required (m3)	
354	CH 5295 : CH 5310	7.30	15	16.5	1.2	297.00	76.64	220.36	
355	CH 5310 : CH 5325	7.88	15	16.5	1.2	297.00	82.71	214.29	
356	CH 5325 : CH 5340	2.32	15	16.5	1.2	297.00	24.36	272.64	
357	CH 5340 : CH 5355	0.00	15	16.5	1.2	297.00	0.00	297.00	
358	CH 5355 : CH 5370	0.00	15	16.5	1.2	297.00	0.00	297.00	
359	CH 5370 : CH 5385	0.95	15	16.5	1.2	297.00	9.95	287.05	
360	CH 5385 : CH 5400	4.54	15	16.5	1.2	297.00	47.63	249.37	
361	CH 5400 : CH 5415	7.70	15	16.5	1.2	297.00	80.88	216.12	
362	CH 5415 : CH 5430	8.25	15	16.5	1.2	297.00	86.57	210.43	
363	CH 5430 : CH 5445	8.35	15	16.5	1.2	297.00	87.63	209.37	
364	CH 5445 : CH 5460	8.18	15	16.5	1.2	297.00	85.90	211.10	
365	CH 5460 : CH 5475	7.34	15	16.5	1.2	297.00	77.02	219.98	
366	CH 5475 : CH 5490	5.82	15	16.5	1.2	297.00	61.06	235.94	
367	CH 5490 : CH 5505	5.48	15	16.5	1.2	297.00	57.50	239.50	
368	CH 5505 : CH 5520	6.62	15	16.5	1.2	297.00	69.51	227.49	
369	CH 5520 : CH 5535	7.28	15	16.5	1.2	297.00	76.42	220.58	
370	CH 5535 : CH 5550	7.38	15	16.5	1.2	297.00	77.53	219.47	
371	CH 5550 : CH 5565	7.31	15	16.5	1.2	297.00	76.74	220.26	
372	CH 5565 : CH 5580	8.20	15	16.5	1.2	297.00	86.15	210.85	
373	CH 5580 : CH 5595	10.06	15	16.5	1.2	297.00	105.61	191.39	
374	CH 5595 : CH 5610	7.62	15	16.5	1.2	297.00	80.00	217.00	
375	CH 5610 : CH 5625	5.97	15	16.5	1.2	297.00	62.65	234.35	
376	CH 5625 : CH 5640	6.14	15	16.5	1.2	297.00	64.48	232.52	
377	CH 5640 : CH 5655	6.30	15	16.5	1.2	297.00	66.18	230.82	
378	CH 5655 : CH 5670	6.28	15	16.5	1.2	297.00	65.97	231.03	
379	CH 5670 : CH 5685	6.11	15	16.5	1.2	297.00	64.19	232.81	
380	CH 5685 : CH 5700	6.12	15	16.5	1.2	297.00	64.23	232.77	
381	CH 5700 : CH 5715	6.34	15	16.5	1.2	297.00	66.53	230.47	
382	CH 5715 : CH 5730	6.63	15	16.5	1.2	297.00	69.59	227.41	
383	CH 5730 : CH 5745	6.44	15	16.5	1.2	297.00	67.58	229.42	
384	CH 5745 : CH 5760	5.24	15	16.5	1.2	297.00	54.99	242.01	
385	CH 5760 : CH 5775	7.81	15	16.5	1.2	297.00	82.01	214.99	
386	CH 5775 : CH 5790	11.50	15	16.5	1.2	297.00	120.73	176.27	
387	CH 5790 : CH 5805	13.57	15	16.5	1.2	297.00	142.43	154.57	
388	CH 5805 : CH 5820	12.29	15	16.5	1.2	297.00	129.03	167.97	
389	CH 5820 : CH 5835	8.53	15	16.5	1.2	297.00	89.59	207.41	
390	CH 5835 : CH 5850	8.22	15	16.5	1.2	297.00	86.30	210.70	
391	CH 5850 : CH 5865	8.20	15	16.5	1.2	297.00	86.06	210.94	
392	CH 5865 : CH 5880	9.04	15	16.5	1.2	297.00	94.91	202.09	
393	CH 5880 : CH 5895	9.71	15	16.5	1.2	297.00	101.91	195.09	
394	CH 5895 : CH 5910	9.57	15	16.5	1.2	297.00	100.53	196.47	
395	CH 5910 : CH 5925	9.72	15	16.5	1.2	297.00	102.11	194.89	
396	CH 5925 : CH 5940	10.35	15	16.5	1.2	297.00	108.69	188.31	
397	CH 5940 : CH 5955	11.47	15	16.5	1.2	297.00	120.40	176.60	
398	CH 5955 : CH 5970	13.47	15	16.5	1.2	297.00	141.46	155.54	
399	CH 5970 : CH 5985	15.60	15	16.5	1.2	297.00	163.79	133.21	
400	CH 5985 : CH 6000	15.20	15	16.5	1.2	297.00	159.64	137.36	
401	CH 6000 : CH 6015	14.13	15	16.5	1.2	297.00	148.41	148.59	
402	CH 6015 : CH 6030	14.17	15	16.5	1.2	297.00	148.81	148.19	
403	CH 6030 : CH 6045	14.01	15	16.5	1.2	297.00	147.15	149.85	
404	CH 6045 : CH 6060	13.66	15	16.5	1.2	297.00	143.44	153.56	
405	CH 6060 : CH 6075	13.25	15	16.5	1.2	297.00	139.12	157.88	
406	CH 6075 : CH 6090	13.57	15	16.5	1.2	297.00	142.50	154.50	
407	CH 6090 : CH 6105	13.88	15	16.5	1.2	297.00	145.71	151.29	
408	CH 6105 : CH 6120	12.96	15	16.5	1.2	297.00	136.11	160.89	
409	CH 6120 : CH 6135	12.17	15	16.5	1.2	297.00	127.79	169.22	
410	CH 6135 : CH 6150	13.63	15	16.5	1.2	297.00	143.13	153.87	
411	CH 6150 : CH 6165	14.95	15	16.5	1.2	297.00	157.01	139.99	
412	CH 6165 : CH 6180	14.19	15	16.5	1.2	297.00	148.97	148.03	

Sl.No	Chainage	W (m)	L (m)	Deepening and Widening details					Remarks
				Proposed canal width (m)		Total Required Quantity (m3)	De-Silting Quantity (m3)	Net Cutting Quantity to be required (m3)	
413	CH 6180 : CH 6195	12.51	15	16.5	1.2	297.00	131.32	165.68	
414	CH 6195 : CH 6210	11.53	15	16.5	1.2	297.00	121.02	175.98	
415	CH 6210 : CH 6225	12.16	15	16.5	1.2	297.00	127.70	169.30	
416	CH 6225 : CH 6240	13.12	15	16.5	1.2	297.00	137.79	159.21	
417	CH 6240 : CH 6255	12.42	15	16.5	1.2	297.00	130.40	166.60	
418	CH 6255 : CH 6270	11.27	15	16.5	1.2	297.00	118.34	178.66	
419	CH 6270 : CH 6285	11.67	15	16.5	1.2	297.00	122.55	174.45	
420	CH 6285 : CH 6300	12.68	15	16.5	1.2	297.00	133.19	163.81	
421	CH 6300 : CH 6315	14.28	15	16.5	1.2	297.00	149.90	147.10	
422	CH 6315 : CH 6330	15.78	15	16.5	1.2	297.00	165.66	131.34	w>16.50
423	CH 6330 : CH 6345	16.77	15	16.5	1.2	0.00	176.04	0.00	"
424	CH 6345 : CH 6360	17.47	15	16.5	1.2	0.00	183.41	0.00	"
425	CH 6360 : CH 6375	17.47	15	16.5	1.2	0.00	183.45	0.00	"
426	CH 6375 : CH 6390	17.02	15	16.5	1.2	0.00	178.66	0.00	
427	CH 6390 : CH 6405	16.52	15	16.5	1.2	0.00	173.42	0.00	
428	CH 6405 : CH 6420	16.02	15	16.5	1.2	297.00	168.18	128.82	
429	CH 6420 : CH 6435	15.52	15	16.5	1.2	297.00	162.95	134.05	
430	CH 6435 : CH 6450	15.02	15	16.5	1.2	297.00	157.71	139.29	
431	CH 6450 : CH 6465	14.52	15	16.5	1.2	297.00	152.47	144.53	
432	CH 6465 : CH 6480	14.02	15	16.5	1.2	297.00	147.24	149.76	
433	CH 6480 : CH 6495	13.42	15	16.5	1.2	297.00	140.90	156.10	
434	CH 6495 : CH 6510	12.66	15	16.5	1.2	297.00	132.88	164.12	
435	CH 6510 : CH 6525	10.60	15	16.5	1.2	297.00	111.28	185.72	
436	CH 6525 : CH 6540	8.11	15	16.5	1.2	297.00	85.20	211.80	
437	CH 6540 : CH 6555	9.15	15	16.5	1.2	297.00	96.08	200.93	
438	CH 6555 : CH 6570	12.23	15	16.5	1.2	297.00	128.46	168.54	
439	CH 6570 : CH 6585	13.65	15	16.5	1.2	297.00	143.28	153.72	
440	CH 6585 : CH 6600	12.07	15	16.5	1.2	297.00	126.72	170.28	
441	CH 6600 : CH 6615	9.66	15	16.5	1.2	297.00	101.44	195.56	
442	CH 6615 : CH 6630	10.45	15	16.5	1.2	297.00	109.77	187.23	
443	CH 6630 : CH 6645	12.03	15	16.5	1.2	297.00	126.27	170.73	
444	CH 6645 : CH 6660	12.55	15	16.5	1.2	297.00	131.82	165.18	
445	CH 6660 : CH 6675	11.94	15	16.5	1.2	297.00	125.32	171.68	
446	CH 6675 : CH 6690	11.22	15	16.5	1.2	297.00	117.76	179.24	
447	CH 6690 : CH 6705	11.59	15	16.5	1.2	297.00	121.68	175.32	
448	CH 6705 : CH 6720	12.79	15	16.5	1.2	297.00	134.26	162.74	
449	CH 6720 : CH 6735	14.62	15	16.5	1.2	297.00	153.52	143.48	
450	CH 6735 : CH 6750	16.25	15	16.5	1.2	297.00	170.59	126.41	
451	CH 6750 : CH 6765	16.50	15	16.5	1.2	297.00	173.23	123.77	
452	CH 6765 : CH 6780	16.17	15	16.5	1.2	297.00	169.81	127.19	
453	CH 6780 : CH 6795	16.44	15	16.5	1.2	297.00	172.65	124.35	
454	CH 6795 : CH 6810	16.26	15	16.5	1.2	297.00	170.69	126.31	
455	CH 6810 : CH 6825	15.94	15	16.5	1.2	297.00	167.40	129.60	
456	CH 6825 : CH 6840	15.12	15	16.5	1.2	297.00	158.74	138.26	
457	CH 6840 : CH 6855	13.27	15	16.5	1.2	297.00	139.34	157.67	
458	CH 6855 : CH 6870	12.05	15	16.5	1.2	297.00	126.51	170.49	
459	CH 6870 : CH 6885	12.69	15	16.5	1.2	297.00	133.21	163.79	
460	CH 6885 : CH 6900	14.78	15	16.5	1.2	297.00	155.14	141.86	
461	CH 6900 : CH 6915	16.45	15	16.5	1.2	297.00	172.77	124.23	w>16.50
462	CH 6915 : CH 6930	17.34	15	16.5	1.2	0.00	182.04	0.00	"
463	CH 6930 : CH 6945	17.34	15	16.5	1.2	0.00	182.09	0.00	
464	CH 6945 : CH 6960	16.51	15	16.5	1.2	0.00	173.36	0.00	
465	CH 6960 : CH 6975	16.19	15	16.5	1.2	297.00	170.03	126.97	
466	CH 6975 : CH 6990	15.71	15	16.5	1.2	297.00	164.94	132.06	
467	CH 6990 : CH 7005	15.27	15	16.5	1.2	297.00	160.29	136.71	
468	CH 7005 : CH 7020	15.55	15	16.5	1.2	297.00	163.25	133.75	
469	CH 7020 : CH 7035	15.88	15	16.5	1.2	297.00	166.75	130.25	
470	CH 7035 : CH 7050	15.46	15	16.5	1.2	297.00	162.30	134.70	
471	CH 7050 : CH 7065	14.85	15	16.5	1.2	297.00	155.94	141.06	

Sl.No	Chainage	W (m)	L (m)	Deepening and Widening details					Remarks
				Proposed canal width (m)		Total Required Quantity (m3)	De-Silting Quantity (m3)	Net Cutting Quantity to be required (m3)	
472	CH 7065 : CH 7080	14.42	15	16.5	1.2	297.00	151.42	145.58	
473	CH 7080 : CH 7095	13.98	15	16.5	1.2	297.00	146.74	150.26	
474	CH 7095 : CH 7110	13.53	15	16.5	1.2	297.00	142.09	154.91	
475	CH 7110 : CH 7125	13.19	15	16.5	1.2	297.00	138.51	158.49	
476	CH 7125 : CH 7140	13.57	15	16.5	1.2	297.00	142.52	154.48	
477	CH 7140 : CH 7155	14.41	15	16.5	1.2	297.00	151.26	145.74	
478	CH 7155 : CH 7170	13.49	15	16.5	1.2	297.00	141.68	155.32	
479	CH 7170 : CH 7185	12.33	15	16.5	1.2	297.00	129.46	167.54	
480	CH 7185 : CH 7200	13.29	15	16.5	1.2	297.00	139.52	157.48	
481	CH 7200 : CH 7215	13.72	15	16.5	1.2	297.00	144.01	152.99	
482	CH 7215 : CH 7230	12.95	15	16.5	1.2	297.00	135.99	161.01	
483	CH 7230 : CH 7245	12.27	15	16.5	1.2	297.00	128.82	168.18	
484	CH 7245 : CH 7260	13.08	15	16.5	1.2	297.00	137.32	159.68	
485	CH 7260 : CH 7275	14.51	15	16.5	1.2	297.00	152.37	144.63	
486	CH 7275 : CH 7290	14.67	15	16.5	1.2	297.00	154.02	142.98	
487	CH 7290 : CH 7305	14.26	15	16.5	1.2	297.00	149.74	147.26	
488	CH 7305 : CH 7320	14.12	15	16.5	1.2	297.00	148.21	148.79	
489	CH 7320 : CH 7335	14.71	15	16.5	1.2	297.00	154.49	142.51	
490	CH 7335 : CH 7350	14.97	15	16.5	1.2	297.00	157.20	139.80	
491	CH 7350 : CH 7365	14.37	15	16.5	1.2	297.00	150.93	146.07	
492	CH 7365 : CH 7380	13.36	15	16.5	1.2	297.00	140.25	156.75	
493	CH 7380 : CH 7395	12.52	15	16.5	1.2	297.00	131.49	165.51	
494	CH 7395 : CH 7410	12.69	15	16.5	1.2	297.00	133.21	163.79	
495	CH 7410 : CH 7425	13.70	15	16.5	1.2	297.00	143.81	153.19	
496	CH 7425 : CH 7440	14.91	15	16.5	1.2	297.00	156.52	140.48	
497	CH 7440 : CH 7455	16.15	15	16.5	1.2	297.00	169.56	127.44	w>16.50
498	CH 7455 : CH 7470	16.80	15	16.5	1.2	0.00	176.40	0.00	"
499	CH 7470 : CH 7485	16.65	15	16.5	1.2	0.00	174.84	0.00	
500	CH 7485 : CH 7500	16.31	15	16.5	1.2	297.00	171.24	125.76	
501	CH 7500 : CH 7515	15.96	15	16.5	1.2	297.00	167.57	129.43	
502	CH 7515 : CH 7530	15.61	15	16.5	1.2	297.00	163.86	133.14	
503	CH 7530 : CH 7545	14.73	15	16.5	1.2	297.00	154.66	142.34	
504	CH 7545 : CH 7560	13.38	15	16.5	1.2	297.00	140.47	156.53	
505	CH 7560 : CH 7575	12.11	15	16.5	1.2	297.00	127.12	169.88	
506	CH 7575 : CH 7590	11.49	15	16.5	1.2	297.00	120.68	176.32	
507	CH 7590 : CH 7605	12.20	15	16.5	1.2	297.00	128.11	168.89	
508	CH 7605 : CH 7620	12.94	15	16.5	1.2	297.00	135.82	161.18	
509	CH 7620 : CH 7635	12.98	15	16.5	1.2	297.00	136.31	160.69	
510	CH 7635 : CH 7650	13.01	15	16.5	1.2	297.00	136.56	160.44	
511	CH 7650 : CH 7665	12.91	15	16.5	1.2	297.00	135.52	161.48	
512	CH 7665 : CH 7680	12.81	15	16.5	1.2	297.00	134.54	162.46	
513	CH 7680 : CH 7695	13.15	15	16.5	1.2	297.00	138.06	158.94	
514	CH 7695 : CH 7710	14.53	15	16.5	1.2	297.00	152.60	144.40	
515	CH 7710 : CH 7725	15.87	15	16.5	1.2	297.00	166.64	130.36	
516	CH 7725 : CH 7740	15.26	15	16.5	1.2	297.00	160.21	136.79	
517	CH 7740 : CH 7755	15.53	15	16.5	1.2	297.00	163.11	133.89	w>16.50
518	CH 7755 : CH 7770	16.74	15	16.5	1.2	0.00	175.81	0.00	"
519	CH 7770 : CH 7785	16.81	15	16.5	1.2	0.00	176.48	0.00	"
520	CH 7785 : CH 7800	16.86	15	16.5	1.2	0.00	177.07	0.00	"
521	CH 7800 : CH 7815	16.99	15	16.5	1.2	0.00	178.39	0.00	"
522	CH 7815 : CH 7830	17.05	15	16.5	1.2	0.00	179.05	0.00	
523	CH 7830 : CH 7845	16.07	15	16.5	1.2	297.00	168.70	128.30	
524	CH 7845 : CH 7860	15.76	15	16.5	1.2	297.00	165.45	131.55	w>16.50
525	CH 7860 : CH 7875	16.49	15	16.5	1.2	297.00	173.11	123.89	
526	CH 7875 : CH 7890	16.45	15	16.5	1.2	297.00	172.71	124.29	
527	CH 7890 : CH 7905	16.03	15	16.5	1.2	297.00	168.29	128.71	
528	CH 7905 : CH 7920	15.50	15	16.5	1.2	297.00	162.71	134.29	
529	CH 7920 : CH 7935	15.07	15	16.5	1.2	297.00	158.21	138.79	
530	CH 7935 : CH 7950	14.83	15	16.5	1.2	297.00	155.75	141.25	

Sl.No	Chainage	W (m)	L (m)	Deepening and Widening details					Remarks
				Proposed canal width (m)		Total Required Quantity (m3)	De-Silting Quantity (m3)	Net Cutting Quantity to be required (m3)	
531	CH 7950 : CH 7965	14.66	15	16.5	1.2	297.00	153.96	143.04	
532	CH 7965 : CH 7980	14.53	15	16.5	1.2	297.00	152.58	144.42	
533	CH 7980 : CH 7995	14.44	15	16.5	1.2	297.00	151.59	145.41	
534	CH 7995 : CH 8010	14.34	15	16.5	1.2	297.00	150.56	146.44	
535	CH 8010 : CH 8025	14.34	15	16.5	1.2	297.00	150.55	146.45	
536	CH 8025 : CH 8040	13.63	15	16.5	1.2	297.00	143.14	153.86	
537	CH 8040 : CH 8055	13.29	15	16.5	1.2	297.00	139.50	157.50	
538	CH 8055 : CH 8070	13.62	15	16.5	1.2	297.00	143.02	153.98	
539	CH 8070 : CH 8085	14.04	15	16.5	1.2	297.00	147.41	149.59	
540	CH 8085 : CH 8100	14.36	15	16.5	1.2	297.00	150.80	146.20	
541	CH 8100 : CH 8115	13.96	15	16.5	1.2	297.00	146.58	150.42	
542	CH 8115 : CH 8130	15.05	15	16.5	1.2	297.00	157.99	139.01	
543	CH 8130 : CH 8145	15.96	15	16.5	1.2	297.00	167.55	129.45	
544	CH 8145 : CH 8160	15.62	15	16.5	1.2	297.00	163.96	133.04	
545	CH 8160 : CH 8175	16.04	15	16.5	1.2	297.00	168.39	128.61	w>16.50
546	CH 8175 : CH 8190	16.83	15	16.5	1.2	0.00	176.66	0.00	"
547	CH 8190 : CH 8205	17.19	15	16.5	1.2	0.00	180.48	0.00	"
548	CH 8205 : CH 8220	17.10	15	16.5	1.2	0.00	179.53	0.00	"
549	CH 8220 : CH 8235	17.24	15	16.5	1.2	0.00	181.01	0.00	"
550	CH 8235 : CH 8250	17.38	15	16.5	1.2	0.00	182.44	0.00	"
551	CH 8250 : CH 8265	17.67	15	16.5	1.2	0.00	185.57	0.00	"
552	CH 8265 : CH 8280	17.57	15	16.5	1.2	0.00	184.49	0.00	
553	CH 8280 : CH 8295	16.63	15	16.5	1.2	0.00	174.63	0.00	
554	CH 8295 : CH 8310	15.83	15	16.5	1.2	297.00	166.23	130.77	
555	CH 8310 : CH 8325	15.59	15	16.5	1.2	297.00	163.67	133.33	
556	CH 8325 : CH 8340	15.39	15	16.5	1.2	297.00	161.55	135.45	
557	CH 8340 : CH 8355	15.15	15	16.5	1.2	297.00	159.09	137.91	
558	CH 8355 : CH 8370	13.64	15	16.5	1.2	297.00	143.21	153.79	
559	CH 8370 : CH 8385	12.85	15	16.5	1.2	297.00	134.95	162.05	
560	CH 8385 : CH 8400	14.11	15	16.5	1.2	297.00	148.14	148.86	
561	CH 8400 : CH 8415	14.41	15	16.5	1.2	297.00	151.29	145.71	
562	CH 8415 : CH 8430	14.29	15	16.5	1.2	297.00	150.00	147.00	
563	CH 8430 : CH 8445	14.77	15	16.5	1.2	297.00	155.09	141.91	
564	CH 8445 : CH 8460	14.85	15	16.5	1.2	297.00	155.97	141.03	
565	CH 8460 : CH 8475	14.40	15	16.5	1.2	297.00	151.16	145.84	
566	CH 8475 : CH 8490	13.94	15	16.5	1.2	297.00	146.41	150.59	
567	CH 8490 : CH 8505	13.67	15	16.5	1.2	297.00	143.52	153.48	
568	CH 8505 : CH 8520	13.59	15	16.5	1.2	297.00	142.71	154.29	
569	CH 8520 : CH 8535	13.41	15	16.5	1.2	297.00	140.76	156.24	
570	CH 8535 : CH 8550	13.28	15	16.5	1.2	297.00	139.43	157.57	
571	CH 8550 : CH 8565	13.30	15	16.5	1.2	297.00	139.69	157.31	
572	CH 8565 : CH 8580	13.46	15	16.5	1.2	297.00	141.28	155.72	
573	CH 8580 : CH 8595	13.69	15	16.5	1.2	297.00	143.72	153.28	
574	CH 8595 : CH 8610	13.78	15	16.5	1.2	297.00	144.68	152.32	
575	CH 8610 : CH 8625	13.42	15	16.5	1.2	297.00	140.90	156.10	
576	CH 8625 : CH 8640	13.10	15	16.5	1.2	297.00	137.56	159.44	
577	CH 8640 : CH 8655	13.19	15	16.5	1.2	297.00	138.49	158.51	
578	CH 8655 : CH 8670	13.27	15	16.5	1.2	297.00	139.35	157.65	
579	CH 8670 : CH 8685	13.30	15	16.5	1.2	297.00	139.68	157.32	
580	CH 8685 : CH 8700	13.52	15	16.5	1.2	297.00	141.94	155.06	
581	CH 8700 : CH 8715	14.98	15	16.5	1.2	297.00	157.31	139.69	
582	CH 8715 : CH 8730	16.37	15	16.5	1.2	297.00	171.90	125.10	
583	CH 8730 : CH 8745	16.05	15	16.5	1.2	297.00	168.49	128.51	
584	CH 8745 : CH 8760	15.55	15	16.5	1.2	297.00	163.31	133.69	
585	CH 8760 : CH 8775	15.74	15	16.5	1.2	297.00	165.24	131.76	
586	CH 8775 : CH 8790	16.16	15	16.5	1.2	297.00	169.63	127.37	
587	CH 8790 : CH 8805	15.93	15	16.5	1.2	297.00	167.28	129.72	
588	CH 8805 : CH 8820	15.51	15	16.5	1.2	297.00	162.82	134.18	
589	CH 8820 : CH 8835	15.60	15	16.5	1.2	297.00	163.82	133.18	

Sl.No	Chainage	W (m)	L (m)	Deepening and Widening details					Remarks
				Proposed canal width (m)		Total Required Quantity (m3)	De-Silting Quantity (m3)	Net Cutting Quantity to be required (m3)	
590	CH 8835 : CH 8850	15.55	15	16.5	1.2	297.00	163.27	133.73	
591	CH 8850 : CH 8865	16.46	15	16.5	1.2	297.00	172.88	124.12	
592	CH 8865 : CH 8880	16.95	15	16.5	1.2	297.00	178.02	118.98	
593	CH 8880 : CH 8895	15.71	15	16.5	1.2	297.00	165.00	132.00	
594	CH 8895 : CH 8910	14.94	15	16.5	1.2	297.00	156.91	140.09	
595	CH 8910 : CH 8925	15.24	15	16.5	1.2	297.00	160.05	136.95	
596	CH 8925 : CH 8940	16.05	15	16.5	1.2	297.00	168.55	128.45	w>16.50
597	CH 8940 : CH 8955	16.91	15	16.5	1.2	0.00	177.56	0.00	"
598	CH 8955 : CH 8970	17.66	15	16.5	1.2	0.00	185.42	0.00	"
599	CH 8970 : CH 8985	18.09	15	16.5	1.2	0.00	189.96	0.00	"
600	CH 8985 : CH 9000	18.18	15	16.5	1.2	0.00	190.84	0.00	"
601	CH 9000 : CH 9015	17.97	15	16.5	1.2	0.00	188.73	0.00	"
602	CH 9015 : CH 9030	17.53	15	16.5	1.2	0.00	184.07	0.00	"
603	CH 9030 : CH 9045	19.86	15	16.5	1.2	0.00	208.54	0.00	"
604	CH 9045 : CH 9060	22.06	15	16.5	1.2	0.00	231.63	0.00	"
605	CH 9060 : CH 9075	22.27	15	16.5	1.2	0.00	233.80	0.00	"
606	CH 9075 : CH 9090	22.19	15	16.5	1.2	0.00	233.04	0.00	"
607	CH 9090 : CH 9105	19.34	15	16.5	1.2	0.00	203.06	0.00	"
608	CH 9105 : CH 9120	17.23	15	16.5	1.2	0.00	180.96	0.00	"
609	CH 9120 : CH 9135	17.32	15	16.5	1.2	0.00	181.81	0.00	"
610	CH 9135 : CH 9150	17.43	15	16.5	1.2	0.00	183.04	0.00	"
611	CH 9150 : CH 9165	17.81	15	16.5	1.2	0.00	187.03	0.00	"
612	CH 9165 : CH 9180	18.43	15	16.5	1.2	0.00	193.53	0.00	"
613	CH 9180 : CH 9195	18.86	15	16.5	1.2	0.00	198.07	0.00	"
614	CH 9195 : CH 9210	19.06	15	16.5	1.2	0.00	200.18	0.00	"
615	CH 9210 : CH 9225	19.11	15	16.5	1.2	0.00	200.62	0.00	"
616	CH 9225 : CH 9240	19.03	15	16.5	1.2	0.00	199.82	0.00	"
617	CH 9240 : CH 9255	18.40	15	16.5	1.2	0.00	193.16	0.00	
618	CH 9255 : CH 9270	16.98	15	16.5	1.2	0.00	178.27	0.00	
619	CH 9270 : CH 9285	15.50	15	16.5	1.2	297.00	162.79	134.21	
620	CH 9285 : CH 9300	14.67	15	16.5	1.2	297.00	154.00	143.00	
621	CH 9300 : CH 9315	14.53	15	16.5	1.2	297.00	152.52	144.48	
622	CH 9315 : CH 9330	14.68	15	16.5	1.2	297.00	154.09	142.91	
623	CH 9330 : CH 9345	14.95	15	16.5	1.2	297.00	156.94	140.06	
624	CH 9345 : CH 9360	14.91	15	16.5	1.2	297.00	156.60	140.40	
625	CH 9360 : CH 9375	14.58	15	16.5	1.2	297.00	153.14	143.86	
626	CH 9375 : CH 9390	14.32	15	16.5	1.2	297.00	150.40	146.60	
627	CH 9390 : CH 9405	14.12	15	16.5	1.2	297.00	148.28	148.72	
628	CH 9405 : CH 9420	14.17	15	16.5	1.2	297.00	148.73	148.27	
629	CH 9420 : CH 9435	14.41	15	16.5	1.2	297.00	151.33	145.67	
630	CH 9435 : CH 9450	14.63	15	16.5	1.2	297.00	153.64	143.36	
631	CH 9450 : CH 9465	14.93	15	16.5	1.2	297.00	156.72	140.28	
632	CH 9465 : CH 9480	15.43	15	16.5	1.2	297.00	161.99	135.01	
633	CH 9480 : CH 9495	15.78	15	16.5	1.2	297.00	165.72	131.28	
634	CH 9495 : CH 9510	15.60	15	16.5	1.2	297.00	163.77	133.23	
635	CH 9510 : CH 9525	15.07	15	16.5	1.2	297.00	158.24	138.77	
636	CH 9525 : CH 9540	14.78	15	16.5	1.2	297.00	155.23	141.77	
637	CH 9540 : CH 9555	14.79	15	16.5	1.2	297.00	155.26	141.74	
638	CH 9555 : CH 9570	15.64	15	16.5	1.2	297.00	164.21	132.79	w>16.50
639	CH 9570 : CH 9585	17.45	15	16.5	1.2	0.00	183.25	0.00	"
640	CH 9585 : CH 9600	18.87	15	16.5	1.2	0.00	198.10	0.00	"
641	CH 9600 : CH 9615	18.69	15	16.5	1.2	0.00	196.23	0.00	"
642	CH 9615 : CH 9630	18.03	15	16.5	1.2	0.00	189.32	0.00	"
643	CH 9630 : CH 9645	18.03	15	16.5	1.2	0.00	189.30	0.00	"
644	CH 9645 : CH 9660	18.18	15	16.5	1.2	0.00	190.92	0.00	"
645	CH 9660 : CH 9675	18.18	15	16.5	1.2	0.00	190.89	0.00	"
646	CH 9675 : CH 9690	17.97	15	16.5	1.2	0.00	188.69	0.00	"
647	CH 9690 : CH 9705	17.74	15	16.5	1.2	0.00	186.28	0.00	"
648	CH 9705 : CH 9720	17.36	15	16.5	1.2	0.00	182.30	0.00	"

Sl.No	Chainage	W (m)	L (m)	Deepening and Widening details					Remarks
				Proposed canal width (m)		Total Required Quantity (m3)	De-Silting Quantity (m3)	Net Cutting Quantity to be required (m3)	
649	CH 9720 : CH 9735	17.01	15	16.5	1.2	0.00	178.62	0.00	"
650	CH 9735 : CH 9750	16.94	15	16.5	1.2	0.00	177.83	0.00	"
651	CH 9750 : CH 9765	17.13	15	16.5	1.2	0.00	179.88	0.00	"
652	CH 9765 : CH 9780	17.40	15	16.5	1.2	0.00	182.66	0.00	"
653	CH 9780 : CH 9795	17.84	15	16.5	1.2	0.00	187.35	0.00	"
654	CH 9795 : CH 9810	18.35	15	16.5	1.2	0.00	192.63	0.00	"
655	CH 9810 : CH 9825	18.52	15	16.5	1.2	0.00	194.50	0.00	"
656	CH 9825 : CH 9840	17.69	15	16.5	1.2	0.00	185.77	0.00	"
657	CH 9840 : CH 9855	17.08	15	16.5	1.2	0.00	179.29	0.00	"
658	CH 9855 : CH 9870	16.90	15	16.5	1.2	0.00	177.50	0.00	"
	CH 9870 : CH 9884.64	30.88	14.6	16.5	1.2	0.00	251.01	0.00	
	Total Quantity							**74,872.30**	

Thevara Canal									
Sl. No	Chainage		Cutting and dredging details						Remarks
		W (m)	L (m)	Proposed canal width (m)		Total Required Quantity (m3)	De-Silting Quantity (m3)	Balance Cutting Quantity to be required (m3)	
1	CH 000 : CH 15	21.88	15	16.5	1.2	0.00	229.69	0.00	w>16.50
2	CH 15 : CH 30	20.45	15	16.5	1.2	0.00	214.67	0.00	"
3	CH 30 : CH 45	19.53	15	16.5	1.2	0.00	205.07	0.00	"
4	CH 45 : CH 60	18.94	15	16.5	1.2	0.00	198.87	0.00	"
5	CH 60 : CH 75	18.82	15	16.5	1.2	0.00	197.56	0.00	"
6	CH 75 : CH 90	17.64	15	16.5	1.2	0.00	185.17	0.00	
7	CH 90 : CH 105	16.26	15	16.5	1.2	297.00	170.68	126.32	
8	CH 105 : CH 120	15.42	15	16.5	1.2	297.00	161.86	135.14	
9	CH 120 : CH 135	14.60	15	16.5	1.2	297.00	153.30	143.70	
10	CH 135 : CH 150	15.92	15	16.5	1.2	297.00	167.11	129.89	
11	CH 150 : CH 165	18.39	15	16.5	1.2	0.00	193.10	0.00	"
12	CH 165 : CH 180	19.32	15	16.5	1.2	0.00	202.86	0.00	"
13	CH 180 : CH 195	19.24	15	16.5	1.2	0.00	201.97	0.00	"
14	CH 195 : CH 210	19.28	15	16.5	1.2	0.00	202.44	0.00	"
15	CH 210 : CH 225	19.18	15	16.5	1.2	0.00	201.39	0.00	"
16	CH 225 : CH 240	19.16	15	16.5	1.2	0.00	201.18	0.00	"
17	CH 240 : CH 255	19.39	15	16.5	1.2	0.00	203.60	0.00	"
18	CH 255 : CH 270	19.52	15	16.5	1.2	0.00	204.91	0.00	"
19	CH 270 : CH 285	19.50	15	16.5	1.2	0.00	204.75	0.00	"
20	CH 285 : CH 300	19.31	15	16.5	1.2	0.00	202.70	0.00	"
21	CH 300 : CH 315	18.93	15	16.5	1.2	0.00	198.77	0.00	"
22	CH 315 : CH 330	18.93	15	16.5	1.2	0.00	198.71	0.00	"
23	CH 330 : CH 345	19.59	15	16.5	1.2	0.00	205.70	0.00	"
24	CH 345 : CH 360	20.02	15	16.5	1.2	0.00	210.16	0.00	"
25	CH 360 : CH 375	19.61	15	16.5	1.2	0.00	205.85	0.00	"
26	CH 375 : CH 390	18.86	15	16.5	1.2	0.00	198.03	0.00	"
27	CH 390 : CH 405	18.40	15	16.5	1.2	0.00	193.15	0.00	"
28	CH 405 : CH 420	18.63	15	16.5	1.2	0.00	195.56	0.00	"
29	CH 420 : CH 435	18.98	15	16.5	1.2	0.00	199.29	0.00	"
30	CH 435 : CH 450	19.22	15	16.5	1.2	0.00	201.81	0.00	"
31	CH 450 : CH 465	19.31	15	16.5	1.2	0.00	202.76	0.00	"
32	CH 465 : CH 480	19.28	15	16.5	1.2	0.00	202.44	0.00	"
33	CH 480 : CH 495	18.86	15	16.5	1.2	0.00	197.98	0.00	"
34	CH 495 : CH 510	17.13	15	16.5	1.2	0.00	179.81	0.00	
35	CH 510 : CH 525	15.93	15	16.5	1.2	297.00	167.21	129.79	
36	CH 525 : CH 540	15.82	15	16.5	1.2	297.00	166.11	130.89	
37	CH 540 : CH 555	15.68	15	16.5	1.2	297.00	164.64	132.36	
38	CH 555 : CH 570	15.71	15	16.5	1.2	297.00	164.90	132.10	
39	CH 570 : CH 585	16.43	15	16.5	1.2	297.00	172.52	124.49	
40	CH 585 : CH 600	17.08	15	16.5	1.2	0.00	179.34	0.00	"
41	CH 600 : CH 615	16.95	15	16.5	1.2	0.00	177.98	0.00	"
42	CH 615 : CH 630	16.24	15	16.5	1.2	297.00	170.47	126.53	
43	CH 630 : CH 645	16.04	15	16.5	1.2	297.00	168.42	128.58	
44	CH 645 : CH 660	16.49	15	16.5	1.2	297.00	173.15	123.86	
45	CH 660 : CH 675	16.76	15	16.5	1.2	0.00	175.93	0.00	"

Sl. No	Chainage		Cutting and dredging details						Remarks
		W (m)	L (m)	Proposed canal width (m)		Total Required Quantity (m3)	De-Silting Quantity (m3)	Balance Cutting Quantity to be required (m3)	
46	CH 675 : CH 690	17.06	15	16.5	1.2	0.00	179.08	0.00	"
47	CH 690 : CH 705	17.11	15	16.5	1.2	0.00	179.60	0.00	"
48	CH 705 : CH 720	15.96	15	16.5	1.2	297.00	167.58	129.42	
49	CH 720 : CH 735	14.35	15	16.5	1.2	297.00	150.68	146.33	
50	CH 735 : CH 750	13.67	15	16.5	1.2	297.00	143.54	153.47	
51	CH 750 : CH 765	13.25	15	16.5	1.2	297.00	139.13	157.88	
52	CH 765 : CH 780	14.73	15	16.5	1.2	297.00	154.67	142.34	
53	CH 780 : CH 795	17.77	15	16.5	1.2	0.00	186.59	0.00	
54	CH 795 : CH 810	18.48	15	16.5	1.2	0.00	194.04	0.00	"
55	CH 810 : CH 825	18.31	15	16.5	1.2	0.00	192.20	0.00	"
56	CH 825 : CH 840	20.35	15	16.5	1.2	0.00	213.62	0.00	"
57	CH 840 : CH 855	19.64	15	16.5	1.2	0.00	206.17	0.00	"
58	CH 855 : CH 870	17.96	15	16.5	1.2	0.00	188.58	0.00	"
59	CH 870 : CH 885	19.01	15	16.5	1.2	0.00	199.55	0.00	"
60	CH 885 : CH 900	19.93	15	16.5	1.2	0.00	209.21	0.00	"
61	CH 900 : CH 915	19.61	15	16.5	1.2	0.00	205.91	0.00	"
62	CH 915 : CH 930	18.57	15	16.5	1.2	0.00	194.99	0.00	"
63	CH 930 : CH 945	18.06	15	16.5	1.2	0.00	189.63	0.00	"
64	CH 945 : CH 960	17.62	15	16.5	1.2	0.00	185.01	0.00	"
65	CH 960 : CH 975	17.32	15	16.5	1.2	0.00	181.86	0.00	"
66	CH 975 : CH 990	16.69	15	16.5	1.2	0.00	175.19	0.00	"
67	CH 990 : CH 1005	16.67	15	16.5	1.2	0.00	175.04	0.00	"
68	CH 1005 : CH 1020	16.81	15	16.5	1.2	0.00	176.45	0.00	"
69	CH 1020 : CH 1035	16.16	15	16.5	1.2	297.00	169.63	127.37	
70	CH 1035 : CH 1050	15.45	15	16.5	1.2	297.00	162.23	134.78	
71	CH 1050 : CH 1065	15.63	15	16.5	1.2	297.00	164.12	132.89	
72	CH 1065 : CH 1080	16.68	15	16.5	1.2	0.00	175.09	0.00	
73	CH 1080 : CH 1095	16.88	15	16.5	1.2	0.00	177.19	0.00	"
74	CH 1095 : CH 1110	16.97	15	16.5	1.2	0.00	178.19	0.00	"
75	CH 1110 : CH 1125	17.12	15	16.5	1.2	0.00	179.71	0.00	"
76	CH 1125 : CH 1140	17.31	15	16.5	1.2	0.00	181.76	0.00	"
77	CH 1140 : CH 1155	18.14	15	16.5	1.2	0.00	190.47	0.00	"
78	CH 1155 : CH 1170	19.76	15	16.5	1.2	0.00	207.48	0.00	"
79	CH 1170 : CH 1185	22.05	15	16.5	1.2	0.00	231.53	0.00	"
80	CH 1185 : CH 1200	24.05	15	16.5	1.2	0.00	252.47	0.00	"
81	CH 1200 : CH 1215	24.94	15	16.5	1.2	0.00	261.82	0.00	"
82	CH 1215 : CH 1230	24.70	15	16.5	1.2	0.00	259.30	0.00	"
83	CH 1230 : CH 1245	23.92	15	16.5	1.2	0.00	251.11	0.00	"
84	CH 1245 : CH 1260	22.67	15	16.5	1.2	0.00	237.98	0.00	"
85	CH 1260 : CH 1275	21.68	15	16.5	1.2	0.00	227.59	0.00	"
86	CH 1275 : CH 1290	21.09	15	16.5	1.2	0.00	221.39	0.00	"
87	CH 1290 : CH 1305	20.37	15	16.5	1.2	0.00	213.89	0.00	"
88	CH 1305 : CH 1320	19.54	15	16.5	1.2	0.00	205.12	0.00	"
89	CH 1320 : CH 1335	18.80	15	16.5	1.2	0.00	197.40	0.00	"
90	CH 1335 : CH 1350	18.14	15	16.5	1.2	0.00	190.47	0.00	"
91	CH 1350 : CH 1365	17.60	15	16.5	1.2	0.00	184.75	0.00	"
92	CH 1365 : CH 1380	17.53	15	16.5	1.2	0.00	184.07	0.00	"
93	CH 1380 : CH 1395	17.66	15	16.5	1.2	0.00	185.38	0.00	"
94	CH 1395 : CH 1405	17.74	10	16.5	1.2	0.00	124.18	0.00	"
	Total Quantity							**2,688.10**	

Market Canal									
Sl. No	Chainage	Cutting and dredging details							Remarks
		W	L (m)	Proposed canal width (m)		Total Required Quantity (m3)	De-Silting Quantity (m3)	Balance Cutting Quantity to be required (m3)	
1	CH 0 : CH 15	15.46	15.00	16.50	1.20	297.00	162.33	134.67	
2	CH 15 : CH 30	14.00	15.00	16.50	1.20	297.00	147.00	150.00	
3	CH 30 : CH 45	13.97	15.00	16.50	1.20	297.00	146.63	150.37	
4	CH 45 : CH 60	14.07	15.00	16.50	1.20	297.00	147.74	149.27	
5	CH 60 : CH 75	14.01	15.00	16.50	1.20	297.00	147.11	149.90	
6	CH 75 : CH 90	15.03	15.00	16.50	1.20	297.00	157.82	139.19	
7	CH 90 : CH 105	15.84	15.00	16.50	1.20	297.00	166.32	130.68	
8	CH 105 : CH 120	13.75	15.00	16.50	1.20	297.00	144.38	152.63	
9	CH 120 : CH 135	12.18	15.00	16.50	1.20	297.00	127.84	169.16	
10	CH 135 : CH 150	12.32	15.00	16.50	1.20	297.00	129.36	167.64	
11	CH 150 : CH 165	12.32	15.00	16.50	1.20	297.00	129.36	167.64	
12	CH 165 : CH 180	12.37	15.00	16.50	1.20	297.00	129.89	167.12	
13	CH 180 : CH 195	12.31	15.00	16.50	1.20	297.00	129.20	167.80	
14	CH 195 : CH 210	12.37	15.00	16.50	1.20	297.00	129.89	167.12	
15	CH 210 : CH 225	12.78	15.00	16.50	1.20	297.00	134.19	162.81	
16	CH 225 : CH 240	13.08	15.00	16.50	1.20	297.00	137.34	159.66	
17	CH 240 : CH 255	13.14	15.00	16.50	1.20	297.00	137.97	159.03	
18	CH 255 : CH 270	13.07	15.00	16.50	1.20	297.00	137.24	159.77	
19	CH 270 : CH 285	13.11	15.00	16.50	1.20	297.00	137.66	159.35	
20	CH 285 : CH 300	13.30	15.00	16.50	1.20	297.00	139.60	157.40	
21	CH 300 : CH 315	19.94	15.00	16.50	1.20	0.00	209.34	0.00	
22	CH 315 : CH 330	31.56	15.00	16.50	1.20	0.00	331.33	0.00	w>16.50
23	CH 330 : CH 345	31.88	15.00	16.50	1.20	0.00	334.74	0.00	"
24	CH 345 : CH 360	27.46	15.00	16.50	1.20	0.00	288.28	0.00	"
25	CH 360 : CH 375	15.27	15.00	16.50	1.20	297.00	160.28	136.72	
26	CH 375 : CH 390	7.65	15.00	16.50	1.20	297.00	80.27	216.73	
27	CH 390 : CH 405	7.52	15.00	16.50	1.20	297.00	78.91	218.09	
28	CH 405 : CH 420	7.39	15.00	16.50	1.20	297.00	77.54	219.46	
29	CH 420 : CH 435	7.26	15.00	16.50	1.20	297.00	76.23	220.77	
30	CH 435 : CH 450	7.19	15.00	16.50	1.20	297.00	75.50	221.51	
31	CH 450 : CH 465	7.15	15.00	16.50	1.20	297.00	75.08	221.93	
32	CH 465 : CH 480	7.12	15.00	16.50	1.20	297.00	74.71	222.29	
33	CH 480 : CH 495	7.11	15.00	16.50	1.20	297.00	74.66	222.35	
34	CH 495 : CH 510	7.11	15.00	16.50	1.20	297.00	74.66	222.35	
35	CH 510 : CH 525	7.04	15.00	16.50	1.20	297.00	73.92	223.08	
36	CH 525 : CH 540	6.92	15.00	16.50	1.20	297.00	72.66	224.34	
37	CH 540 : CH 555	6.83	15.00	16.50	1.20	297.00	71.72	225.29	
38	CH 555 : CH 570	6.94	15.00	16.50	1.20	297.00	72.87	224.13	
39	CH 570 : CH 585	7.01	15.00	16.50	1.20	297.00	73.61	223.40	
40	CH 585 : CH 600	7.14	15.00	16.50	1.20	297.00	74.97	222.03	
41	CH 600 : CH 615	7.30	15.00	16.50	1.20	297.00	76.65	220.35	
42	CH 615 : CH 630	7.52	15.00	16.50	1.20	297.00	78.96	218.04	
43	CH 630 : CH 645	7.72	15.00	16.50	1.20	297.00	81.06	215.94	
44	CH 645 : CH 660	7.74	15.00	16.50	1.20	297.00	81.27	215.73	
45	CH 660 : CH 664	5.90	4.00	16.50	1.20	79.20	16.52	62.68	
	Total Quantity							**7,518.35**	

DEEPENING AND WIDENING- RATE ANALYSIS OF EDAPALLY CANAL							
2.6	**Earth work in excavation by mechanical means (Hydraulic excavator)/manual means over areas (exceeding 30 cm in depth, 1.5 m in width as well as 10 sqm on plan) including getting out and disposal of excavated earth lead upto 50 m and lift upto 1.5 m, as directed by Engineer-in-charge.**						
2.6.1	All kinds of soil						
	Code	**Description**	**Unit**	**Quantity**	**Rate (Rs)**	**Amount (Rs)**	**Remarks**
		Subdata 1					
		Details of cost for 10 cum.					
		Average output of Hydraulic Excavator per hour = 30cum.					
		MACHINERY					
	C-0020	Hydraulic Excavator (3D) with driver and fuel.	day	0.041	7000.00	287.00	
	C-0018	Hire and running charges of loader	day	0.041	5000.00	205.00	
		LABOUR					
	C-0128	Mate	day	0.32	617.00	197.44	
	C-0115	Coolie	day	1.2	558.00	669.60	
		TOTAL				1,359.04	
		Add 1 % Water charges on "W"				13.59	
		TOTAL				1,372.63	
		Add GST on "X" (multiplying factor 0.1405)				192.85	
		TOTAL				1,565.48	
		Add 15% CPOH on "Y"				234.82	
		TOTAL				1,800.31	
		Add Cess @ 1% on "Z"				18.00	
		Cost of 10 cum.				1,818.31	
		Add Cost Index @ 39.89%				725.32	
		Cost of 10 cum.				2,543.63	
		Cost of 1 cum.				254.36	
		Say				*254.00*	
		Subdata 2		213376			
	OD	Hire charges of floating pontoon (C)	day	875	2500	21,87,500.00	MR
	OD	Time lost for shifting of Potoon	day	12	2500	30,000.00	MR
	C-0020,C-0018	Time lost for shifting of excavator and other machineries	day	12	12000	1,44,000.00	
		LABOUR FOR SHIFTING					
	C-0128	Mate	day	24	617	14,808.00	
	C-0115	Coolie	day	24	558	13,392.00	
		TOTAL				23,89,700.00	
		Add 1 % Water charges on "W"				23,897.00	
		TOTAL				24,13,597.00	
		Add GST on "X" (multiplying factor 0.1405)				3,39,110.38	
		TOTAL				27,52,707.38	
		Add 15% CPOH on "Y"				4,12,906.11	
		TOTAL				31,65,613.49	
		Add Cess @ 1% on "Z"				31,656.13	
		TOTAL				31,97,269.62	
		Add Cost Index @ 39.89%				68,690.58	
		Cost of 388695 cum.				32,65,960.20	
		Cost of 1 cum.				15.31	
		Say				*15.00*	
		SUB DATA 2.1 20%				**3.00**	
		SUB DATA 2.2 80%				**12.00**	

		SUBDATA 3					
	Code	**Description**	**Unit**	**Quantity**		**Amount**	
	2.24.2	Extra due to slow progress and dewatering: 25% of the rate of the item	metre depth	(25% of the rate of the item. The extra percentage in rate is applicable in respect of each item but limited to quantities of work executed in difficult condition.)			
		Total for Excavation from sub data 1				254.00	
		Additional 25%				**63.50**	
		Say				*64.00*	
		SUBDATA 4					
2.25	**Filling available excavated earth (excluding rock) in trenches, plinth, sides of foundations etc. in layers not exceeding 20cm in depth, consolidating each deposited layer by ramming and watering, lead up to 50 m and lift upto 1.5 m.**						
	Code	**Description**	**Unit**	**Quantity**	**Rate**	**Amount**	
		Details of cost for 10 cum					
		LABOUR					
	C-0128	Mate	day	0.20	617.00	123.40	
	C-0115	Coolie	day	2.50	558.00	1,395.00	
	C-0101	Bhisti	day	0.20	617.00	123.40	
		TOTAL				1,641.80	
		Add 1 % Water charges on "W-A"				16.42	
		TOTAL				1,658.22	
		Add GST on "X-A" (multiplying factor 0.1405)				232.98	
		TOTAL				1,891.20	
		Add 15% CPOH on "Y-A"				283.68	
		TOTAL				2,174.88	
		Add Cess @ 1% on "Z-A"				21.75	
		total				2,196.63	
		Add Cost Index @ 39.89%				876.23	
		Cost of 10 cum				3,072.86	
		cost for 1 cum Say				*307.00*	
		SUB DATA 5					
1.1.2		Carriage of earth	Upto 25km				
		5km	201.83				
		5km - 10km	277.83				
		10km - 20km	404.13				
		20km - 25km	456.33				
		quantity per trip	6.4				
		Rate per cum	71.301563	0			
		Say				*71.30*	
		Add 1 % Water charges on "W-A"				0.71	
						72.01	
		Add GST on "X-A" (multiplying factor 0.1405)				10.12	
						82.13	
		Add Cess @ 1% on "Z-A"				0.82	
						82.95	
		Add Cost Index @ 39.89%				33.09	
		TOTAL				116.04	
		Say				*116.00*	
	20%	**Earthwork + pontoon + pontoon shifting + working in foul position + filling**				**628.00**	
		Say				***630.00***	
	80%	**Earthwork + pontoon + pontoon shifting + working in foul position + carriage of earth**				**446.00**	
		Say				***450.00***	

DEEPENING AND WIDENING- RATE ANALYSIS OF THEVARA_PERANDOOR CANAL							
2.6	**Earth work in excavation by mechanical means (Hydraulic excavator)/manual means over areas (exceeding 30 cm in depth, 1.5 m in width as well as 10 sqm on plan) including getting out and disposal of excavated earth lead upto 50 m and lift upto 1.5 m, as directed by Engineer-in-charge.**						
2.6.1	All kinds of soil						
	Code	**Description**	**Unit**	**Quantity**	**Rate (Rs)**	**Amount (Rs)**	**Remarks**
		Subdata 1					
		Details of cost for 10 cum.					
		Average output of Hydraulic Excavator per hour = 30cum.					
		MACHINERY					
	C-0020	Hydraulic Excavator (3D) with driver and fuel.	day	0.041	7000.00	287.00	
	C-0018	Hire and running charges of loader	day	0.041	5000.00	205.00	
		LABOUR					
	C-0128	Mate	day	0.32	617.00	197.44	
	C-0115	Coolie	day	1.2	558.00	669.60	
		TOTAL				1,359.04	
		Add 1 % Water charges on "W"				13.59	
		TOTAL				1,372.63	
		Add GST on "X" (multiplying factor 0.1405)				192.85	
		TOTAL				1,565.48	
		Add 15% CPOH on "Y"				234.82	
		TOTAL				1,800.31	
		Add Cess @ 1% on "Z"				18.00	
		Cost of 10 cum.				1,818.31	
		Add Cost Index @ 39.89%				725.32	
		Cost of 10 cum.				2,543.63	
		Cost of 1 cum.				254.36	
		Say				*254.00*	
		Subdata 2		179168			
	OD	Hire charges of floating pontoon (C)	day	735	2500	18,37,500.00	MR
	OD	Time lost for shifting of Potoon	day	41	2500	1,02,500.00	MR
	C-0020,C-0018	Time lost for shifting of excavator and other machineries	day	41	12000	4,92,000.00	
		LABOUR FOR SHIFTING					
	C-0128	Mate	day	82	617	50,594.00	
	C-0115	Coolie	day	82	558	45,756.00	
		TOTAL				25,28,350.00	
		Add 1 % Water charges on "W"				25,283.50	
		TOTAL				25,53,633.50	
		Add GST on "X" (multiplying factor 0.1405)				3,58,785.51	
		TOTAL				29,12,419.01	
		Add 15% CPOH on "Y"				4,36,862.85	
		TOTAL				33,49,281.86	
		Add Cess @ 1% on "Z"				33,492.82	
		TOTAL				33,82,774.68	
		Add Cost Index @ 39.89%				2,34,692.82	
		Cost of 598155.9 cum.				36,17,467.49	
		Cost of 1 cum.				20.19	
		Say				*20.00*	
		SUB DATA 2.1 20%				**4.00**	
		SUB DATA 2.2 80%				**16.00**	
		SUBDATA 3					
	Code	**Description**	**Unit**	**Quantity**		**Amount**	
	2.24.2	Extra due to slow progress and dewatering: 25% of the rate of the item	metre depth	(25% of the rate of the item. The extra percentage in rate is applicable in respect of each item but limited to quantities of work executed in difficult condition.)			
		Total for Excavation from sub data 1				254.00	
		Additional 25%				**63.50**	
		Say				*64.00*	
		SUBDATA 4					
2.25	**Filling available excavated earth (excluding rock) in trenches, plinth, sides of foundations etc. in layers not exceeding 20cm in depth, consolidating each deposited layer by ramming and watering, lead up to 50 m and lift upto 1.5 m.**						

	Code	Description	Unit	Quantity	Rate	Amount	
		Details of cost for 10 cum					
		LABOUR					
	C-0128	Mate	day	0.20	617.00	123.40	
	C-0115	Coolie	day	2.50	558.00	1,395.00	
	C-0101	Bhisti	day	0.20	617.00	123.40	
		TOTAL				1,641.80	
		Add 1 % Water charges on "W-A"				16.42	
		TOTAL				1,658.22	
		Add GST on "X-A" (multiplying factor 0.1405)				232.98	
		TOTAL				1,891.20	
		Add 15% CPOH on "Y-A"				283.68	
		TOTAL				2,174.88	
		Add Cess @ 1% on "Z-A"				21.75	
		total				2,196.63	
		Add Cost Index @ 39.89%				876.23	
		Cost of 10 cum				3,072.86	
		cost for 1 cum Say				*307.00*	
		SUB DATA 5					
1.1.2		Carriage of earth	Upto 25km				
		5km	201.83				
		5km - 10km	277.83				
		10km - 20km	404.13				
		20km - 25km	456.33				
		quantity per trip	6.4				
		Rate per cum	71.301563	0			
		Say				*71.30*	
		Add 1 % Water charges on "W-A"				0.71	
						72.01	
		Add GST on "X-A" (multiplying factor 0.1405)				10.12	
						82.13	
		Add Cess @ 1% on "Z-A"				0.82	
						82.95	
		Add Cost Index @ 39.89%				33.09	
		TOTAL				116.04	
		Say				*116.00*	
	20%	**Earthwork + pontoon + pontoon shifting + working in foul position + filling**				**629.00**	
		Say				***630.00***	
	80%	**Earthwork + pontoon + pontoon shifting + working in foul position + carriage of earth**				**450.00**	
		Say				***450.00***	

DEEPENING AND WIDENING- RATE ANALYSIS OF CHILAVANOOR CANAL							
2.6	**Earth work in excavation by mechanical means (Hydraulic excavator)/manual means over areas (exceeding 30 cm in depth, 1.5 m in width as well as 10 sqm on plan) including getting out and disposal of excavated earth lead upto 50 m and lift upto 1.5 m, as directed by Engineer-in-charge.**						
2.6.1	All kinds of soil						
	Code	**Description**	**Unit**	**Quantity**	**Rate (Rs)**	**Amount (Rs)**	**Remarks**
		Subdata 1					
		Details of cost for 10 cum.					
		Average output of Hydraulic Excavator per hour = 30cum.					
		MACHINERY					
	C-0020	Hydraulic Excavator (3D) with driver and fuel.	day	0.041	7000.00	287.00	
	C-0018	Hire and running charges of loader	day	0.041	5000.00	205.00	
		LABOUR					
	C-0128	Mate	day	0.32	617.00	197.44	
	C-0115	Coolie	day	1.2	558.00	669.60	
		TOTAL				1,359.04	
		Add 1 % Water charges on "W"				13.59	
		TOTAL				1,372.63	
		Add GST on "X" (multiplying factor 0.1405)				192.85	
		TOTAL				1,565.48	
		Add 15% CPOH on "Y"				234.82	
		TOTAL				1,800.31	
		Add Cess @ 1% on "Z"				18.00	
		Cost of 10 cum.				1,818.31	
		Add Cost Index @ 39.89%				725.32	
		Cost of 10 cum.				2,543.63	
		Cost of 1 cum.				254.36	
		Say				*254.00*	
		Subdata 2		240099			
	OD	Hire charges of floating pontoon (C)	day	985	2500	24,62,500.00	MR
	OD	Time lost for shifting of Potoon	day	52	2500	1,30,000.00	MR
	C-0020,C-0018	Time lost for shifting of excavator and other machineries	day	52	12000	6,24,000.00	
		LABOUR FOR SHIFTING					
	C-0128	Mate	day	104	617	64,168.00	
	C-0115	Coolie	day	104	558	58,032.00	
		TOTAL				33,38,700.00	
		Add 1 % Water charges on "W"				33,387.00	
		TOTAL				33,72,087.00	
		Add GST on "X" (multiplying factor 0.1405)				4,73,778.22	
		TOTAL				38,45,865.22	
		Add 15% CPOH on "Y"				5,76,879.78	
		TOTAL				44,22,745.01	
		Add Cess @ 1% on "Z"				44,227.45	
		TOTAL				44,66,972.46	
		Add Cost Index @ 39.89%				2,97,659.18	
		Cost of 598155.9 cum.				47,64,631.64	
		Cost of 1 cum.				19.84	
		Say				*20.00*	
		SUB DATA 2.1 20%				**4.00**	
		SUB DATA 2.2 80%				**16.00**	

		SUBDATA 3					
	Code	**Description**	**Unit**	**Quantity**		**Amount**	
	2.24.2	Extra due to slow progress and dewatering: 25% of the rate of the item	metre depth	(25% of the rate of the item. The extra percentage in rate is applicable in respect of each item but limited to quantities of work executed in difficult condition.)			
		Total for Excavation from sub data 1				254.00	
		Additional 25%				**63.50**	
		Say				*64.00*	
		SUBDATA 4					
2.25	**Filling available excavated earth (excluding rock) in trenches, plinth, sides of foundations etc. in layers not exceeding 20cm in depth, consolidating each deposited layer by ramming and watering, lead up to 50 m and lift upto 1.5 m.**						
	Code	**Description**	**Unit**	**Quantity**	**Rate**	**Amount**	
		Details of cost for 10 cum					
		LABOUR					
	C-0128	Mate	day	0.20	617.00	123.40	
	C-0115	Coolie	day	2.50	558.00	1,395.00	
	C-0101	Bhisti	day	0.20	617.00	123.40	
		TOTAL				1,641.80	
		Add 1 % Water charges on "W-A"				16.42	
		TOTAL				1,658.22	
		Add GST on "X-A" (multiplying factor 0.1405)				232.98	
		TOTAL				1,891.20	
		Add 15% CPOH on "Y-A"				283.68	
		TOTAL				2,174.88	
		Add Cess @ 1% on "Z-A"				21.75	
		total				2,196.63	
		Add Cost Index @ 39.89%				876.23	
		Cost of 10 cum				3,072.86	
		cost for 1 cum Say				*307.00*	
		SUB DATA 5					
1.1.2		Carriage of earth	Upto 25km				
		5km	201.83				
		5km - 10km	277.83				
		10km - 20km	404.13				
		20km - 25km	456.33				
		quantity per trip	6.4				
		Rate per cum	71.3015625	0			
		Say				*71.30*	
		Add 1 % Water charges on "W-A"				0.71	
						72.01	
		Add GST on "X-A" (multiplying factor 0.1405)				10.12	
						82.13	
		Add Cess @ 1% on "Z-A"				0.82	
						82.95	
		Add Cost Index @ 39.89%				33.09	
		TOTAL				116.04	
		Say				*116.00*	
	20%	**Earthwork + pontoon + pontoon shifting + working in foul position + filling**				**629.00**	
		Say				***630.00***	
	80%	**Earthwork + pontoon + pontoon shifting + working in foul position + carriage of earth**				**450.00**	
		Say				***450.00***	

DEEPENING AND WIDENING- RATE ANALYSIS OF THEVARA CANAL							
2.6	**Earth work in excavation by mechanical means (Hydraulic excavator)/manual means over areas (exceeding 30 cm in depth, 1.5 m in width as well as 10 sqm on plan) including getting out and disposal of excavated earth lead upto 50 m and lift upto 1.5 m, as directed by Engineer-in-charge.**						
2.6.1	All kinds of soil						
	Code	**Description**	**Unit**	**Quantity**	**Rate (Rs)**	**Amount (Rs)**	**Remarks**
		Subdata 1					
		Details of cost for 10 cum.					
		Average output of Hydraulic Excavator per hour = 30cum.					
		MACHINERY					
	C-0020	Hydraulic Excavator (3D) with driver and fuel.	day	0.041	7000.00	287.00	
	C-0018	Hire and running charges of loader	day	0.041	5000.00	205.00	
		LABOUR					
	C-0128	Mate	day	0.32	617.00	197.44	
	C-0115	Coolie	day	1.2	558.00	669.60	
		TOTAL				1,359.04	
		Add 1 % Water charges on "W"				13.59	
		TOTAL				1,372.63	
		Add GST on "X" (multiplying factor 0.1405)				192.85	
		TOTAL				1,565.48	
		Add 15% CPOH on "Y"				234.82	
		TOTAL				1,800.31	
		Add Cess @ 1% on "Z"				18.00	
		Cost of 10 cum.				1,818.31	
		Add Cost Index @ 39.89%				725.32	
		Cost of 10 cum.				2,543.63	
		Cost of 1 cum.				254.36	
		Say				*254.00*	
		Subdata 2		27330			
	OD	Hire charges of floating pontoon (C)	day	113	2500	2,82,500.00	MR
	OD	Time lost for shifting of Potoon	day	2	2500	5,000.00	MR
	C-0020,C-0018	Time lost for shifting of excavator and other machineries	day	2	12000	24,000.00	
		LABOUR FOR SHIFTING					
	C-0128	Mate	day	4	617	2,468.00	
	C-0115	Coolie	day	4	558	2,232.00	
		TOTAL				3,16,200.00	
		Add 1 % Water charges on "W"				3,162.00	
		TOTAL				3,19,362.00	
		Add GST on "X" (multiplying factor 0.1405)				44,870.36	
		TOTAL				3,64,232.36	
		Add 15% CPOH on "Y"				54,634.85	
		TOTAL				4,18,867.22	
		Add Cess @ 1% on "Z"				4,188.67	
		TOTAL				4,23,055.89	
		Add Cost Index @ 39.89%				11,448.43	
		Cost of 598155.9 cum.				4,34,504.32	
		Cost of 1 cum.				15.90	
		Say				*16.00*	
		SUB DATA 2.1 20%				**3.20**	
		SUB DATA 2.2 80%				**12.80**	
		SUBDATA 3					
	Code	**Description**	**Unit**	**Quantity**		**Amount**	
	2.24.2	Extra due to slow progress and dewatering: 25% of the rate of the item	metre depth	(25% of the rate of the item. The extra percentage in rate is applicable in respect of each item but limited to quantities of work executed in difficult condition.)			
		Total for Excavation from sub data 1				254.00	
		Additional 25%				**63.50**	

		Say				*64.00*	
		SUBDATA 4					
2.25	**Filling available excavated earth (excluding rock) in trenches, plinth, sides of foundations etc. in layers not exceeding 20cm in depth, consolidating each deposited layer by ramming and watering, lead up to 50 m and lift upto 1.5 m.**						
	Code	**Description**	**Unit**	**Quantity**	**Rate**	**Amount**	
		Details of cost for 10 cum					
		LABOUR					
	C-0128	Mate	day	0.20	617.00	123.40	
	C-0115	Coolie	day	2.50	558.00	1,395.00	
	C-0101	Bhisti	day	0.20	617.00	123.40	
		TOTAL				1,641.80	
		Add 1 % Water charges on "W-A"				16.42	
		TOTAL				1,658.22	
		Add GST on "X-A" (multiplying factor 0.1405)				232.98	
		TOTAL				1,891.20	
		Add 15% CPOH on "Y-A"				283.68	
		TOTAL				2,174.88	
		Add Cess @ 1% on "Z-A"				21.75	
		total				2,196.63	
		Add Cost Index @ 39.89%				876.23	
		Cost of 10 cum				3,072.86	
		cost for 1 cum Say				*307.00*	
		SUB DATA 5					
1.1.2		Carriage of earth	Upto 25km				
		5km	201.83				
		5km - 10km	277.83				
		10km - 20km	404.13				
		20km - 25km	456.33				
		quantity per trip	6.4				
		Rate per cum	71.301563	0			
		Say				*71.30*	
		Add 1 % Water charges on "W-A"				0.71	
						72.01	
		Add GST on "X-A" (multiplying factor 0.1405)				10.12	
						82.13	
		Add Cess @ 1% on "Z-A"				0.82	
						82.95	
		Add Cost Index @ 39.89%				33.09	
		TOTAL				116.04	
		Say				*116.00*	
	20%	**Earthwork + pontoon + pontoon shifting + working in foul position + filling**				**628.20**	
		Say				***630.00***	
	80%	**Earthwork + pontoon + pontoon shifting + working in foul position + carriage of earth**				**446.80**	
		Say				***450.00***	

DEEPENING AND WIDENING -RATE ANALYSIS OF MARKET CANAL							
2.6	**Earth work in excavation by mechanical means (Hydraulic excavator)/manual means over areas (exceeding 30 cm in depth, 1.5 m in width as well as 10 sqm on plan) including getting out and disposal of excavated earth lead upto 50 m and lift upto 1.5 m, as directed by Engineer-in-charge.**						
2.6.1	All kinds of soil						
	Code	**Description**	**Unit**	**Quantity**	**Rate (Rs)**	**Amount (Rs)**	**Remarks**
		Subdata 1					
		Details of cost for 10 cum.					
		Average output of Hydraulic Excavator per hour = 30cum.					
		MACHINERY					
	C-0020	Hydraulic Excavator (3D) with driver and fuel.	day	0.041	7000.00	287.00	
	C-0018	Hire and running charges of loader	day	0.041	5000.00	205.00	
		LABOUR					
	C-0128	Mate	day	0.32	617.00	197.44	
	C-0115	Coolie	day	1.2	558.00	669.60	
		TOTAL				1,359.04	
		Add 1 % Water charges on "W"				13.59	
		TOTAL				1,372.63	
		Add GST on "X" (multiplying factor 0.1405)				192.85	
		TOTAL				1,565.48	
		Add 15% CPOH on "Y"				234.82	
		TOTAL				1,800.31	
		Add Cess @ 1% on "Z"				18.00	
		Cost of 10 cum.				1,818.31	
		Add Cost Index @ 39.89%				725.32	
		Cost of 10 cum.				2,543.63	
		Cost of 1 cum.				254.36	
		Say				*254.00*	
		Subdata 2		14152			
	OD	Hire charges of floating pontoon (C)	day	59	2500	1,47,500.00	MR
	OD	Time lost for shifting of Potoon	day	4	2500	10,000.00	MR
	C-0020,C-0018	Time lost for shifting of excavator and other machineries	day	4	12000	48,000.00	
		LABOUR FOR SHIFTING					
	C-0128	Mate	day	8	617	4,936.00	
	C-0115	Coolie	day	8	558	4,464.00	
		TOTAL				2,14,900.00	
		Add 1 % Water charges on "W"				2,149.00	
		TOTAL				2,17,049.00	
		Add GST on "X" (multiplying factor 0.1405)				30,495.38	
		TOTAL				2,47,544.38	
		Add 15% CPOH on "Y"				37,131.66	
		TOTAL				2,84,676.04	
		Add Cess @ 1% on "Z"				2,846.76	
		TOTAL				2,87,522.80	
		Add Cost Index @ 39.89%				22,896.86	
		Cost of 598155.9 cum.				3,10,419.66	
		Cost of 1 cum.				21.93	
		Say				*22.00*	
		SUB DATA 2.1 20%				**4.40**	
		SUB DATA 2.2 80%				**17.60**	
		SUBDATA 3					
	Code	**Description**	**Unit**	**Quantity**		**Amount**	

	2.24.2	Extra due to slow progress and dewatering: 25% of the rate of the item	metre depth	(25% of the rate of the item. The extra percentage in rate is applicable in respect of each item but limited to quantities of work executed in difficult condition.)			
		Total for Excavation from sub data 1				254.00	
		Additional 25%				**63.50**	
		Say				*64.00*	
		SUBDATA 4					
2.25	**Filling available excavated earth (excluding rock) in trenches, plinth, sides of foundations etc. in layers not exceeding 20cm in depth, consolidating each deposited layer by ramming and watering, lead up to 50 m and lift upto 1.5 m.**						
	Code	**Description**	**Unit**	**Quantity**	**Rate**	**Amount**	
		Details of cost for 10 cum					
		LABOUR					
	C-0128	Mate	day	0.20	617.00	123.40	
	C-0115	Coolie	day	2.50	558.00	1,395.00	
	C-0101	Bhisti	day	0.20	617.00	123.40	
		TOTAL				1,641.80	
		Add 1 % Water charges on "W-A"				16.42	
		TOTAL				1,658.22	
		Add GST on "X-A" (multiplying factor 0.1405)				232.98	
		TOTAL				1,891.20	
		Add 15% CPOH on "Y-A"				283.68	
		TOTAL				2,174.88	
		Add Cess @ 1% on "Z-A"				21.75	
		total				2,196.63	
		Add Cost Index @ 39.89%				876.23	
		Cost of 10 cum				3,072.86	
		cost for 1 cum Say				*307.00*	
		SUB DATA 5					
1.1.2		Carriage of earth	Upto 25km				
		5km	201.83				
		5km - 10km	277.83				
		10km - 20km	404.13				
		20km - 25km	456.33				
		quantity per trip	6.4				
		Rate per cum	71.301563	0			
		Say				*71.30*	
		Add 1 % Water charges on "W-A"				0.71	
						72.01	
		Add GST on "X-A" (multiplying factor 0.1405)				10.12	
						82.13	
		Add Cess @ 1% on "Z-A"				0.82	
						82.95	
		Add Cost Index @ 39.89%				33.09	
		TOTAL				116.04	
		Say				*116.00*	
	20%	**Earthwork + pontoon + pontoon shifting + working in foul position + filling**				**629.40**	
		Say				***630.00***	
	80%	**Earthwork + pontoon + pontoon shifting + working in foul position + carriage of earth**				**451.60**	
		Say				***450.00***	

PROJECT:IURWTS Kochi.WT-2024 Integrate Urban Rejuvenation and Water Transport System Kochi

Abstract

Sl No	Description	Quantity	Units	Rate (Rs)	Amount (Rs)	Remarks
A.2	**Shore Protection**					
	Edappally Canal	5217.86	m	57059.75	297729989.08	
	Chilavanoor Canal	9386.68	m	57059.75	535601577.09	
	Thevara Perandoor Canal	9665.72	m	57059.75	551523770.50	
	Total Amount				**1384855336.67**	

Note: Rate is taken as average of sheet pile, random rubble and pile and slab works. The strech where each type of shore protection which is to be given will be finalised during the detail design stage.

PROJECT: IURWTS Kochi.WT-2024 Integrate Urban Rejuvenation and Water Transport System Kochi

DETAILED ESTIMATE

Detailed estimate for 10m length

Sl No	Code	Description	Unit	No.	L	B	H	Qty	Rate (Rs)	Amount	Remarks
1	2.6.1	Earth work in excavation by mechanical means (Hydraulic excavator)/manual means over areas (exceeding 30 cm in depth, 1.5 m in width as well as 10 sqm on plan) including getting out and disposal of excavated earth lead upto 50 m and lift upto 1.5 m, as directed by Engineer-in-charge.									DSR
		All kinds of soil	cum		10.00	1.20	0.60	7.20	254.389965	1831.607748	
2	od	**Dry rubble** packing for foundation of retaining wall including all cost, conveyance and packing to proper lines and levels etc,complete as per the direction of deptl. Officers Ret wall foundation									
			cum		10.00	1.30	0.80	10.40	3611	37554.4	
			cum		10.00	0.80	0.65	5.20	3611	18777.2	
3	7.2.1	**Random rubble** masonry with hard stone in superstructure above plinth level and upto floor five level, including leveling up with cement concrete 1:6:12 (1 cement : 6 coarse sand : 12 graded stone aggregate 20 mm nominal size) Ret .wall									DSR
			cum		10.00	0.55	0.50	2.75	₹ 10,477.69	28813.6504	
4	5.34.1	Providing and laying in position machine batched and machine mixed design mix M-30 grade cement concrete for reinforced cement concrete work, using cement content as per approved design mix, including pumping of concrete to site of laying but excluding the cost of centering, shuttering, finishing and reinforcement, including admixtures in recommended proportions as per IS: 9103 to accelerate, retard setting of concrete, improve workability without impairing strength and durability as per direction of Engineer-in-charge. @ 340 kg/cum.			10.00			10.00			DSR
			cum		10.00	1.20	0.20	2.40	13248.00	31,795.20	
			cum		10.00	0.60	0.10	0.60	13248.00	7,948.80	
5	5.22.A.3	Steel reinforcement for R.C.C. work including straightening, cutting, bending, placing in position and binding all complete above plinth level.									DSR
			kg						117.00	-	
6	5.9.6	Centering and shuttering including strutting, propping etc. and removal of form work									DSR
		side	sqm	2.00	10.00		0.20	4.00	1026.00	4,104.00	

7		**Putting up ring bund** of size not less than 1.00m wide at top, 3.00m wide at bottom using coconut wood 200 mm to 300 mm dia driving down for an average depth of 3.00 m and for an average height of 4.00 m (total height of 7.00m) with full grown coconut piles in two row at 50 cm c/c, half split coconut wood horizontal at 60 cm c/c, 1/3rd split coconut wood cross ties for connecting two row at 120cm c/c tied with coir yarn and wire rope, providing screening using new bamboo matt thatties with 1/6th bamboo reepers on both sides for filling with cotractor's own earth conveyed from sources of availability with all leads and lifts and maintaining the bund throughout the period of construction and dismantling and removing the bund after completion of work etc, complete as per the direction of deptl. officers at site. (3 months)	m	1.00	15.00			15.00	₹ 22,227.00	3,33,405.00	OD
		TOTAL								**4,64,229.86**	

PROJECT: IURWTS Kochi.WT-2024 Integrate Urban Rejuvenation and Water Transport System Kochi

DETAILED ESTIMATE

Sl No	Code	Description	No.	L	B	H	Qty	Unit	Rate (Rs)	Amount	Remarks
1	2.1	Supply, installation and painting of Sheetpile including all forseen and unforseen involved etc complete as per the Engineer in Charge									DSR
		Edappally Canal	1.00	4217.86	0.00	6.50	27416.12				
		Chilavanoor Canal	1.00	8386.68	0.00	6.50	54513.42				
		Thevara Perandoor Canal	1.00	8665.72	0.00	6.50	56327.21				
							138256.74				
							138256.74	sqm	11395.00	1,57,54,34,936.64	
2	5.34.1	Providing and laying in position machine batched and machine mixed design mix M-30 grade cement concrete for reinforced cement concrete work, using cement content as per approved design mix, including pumping of concrete to site of laying but excluding the cost of centering, shuttering, finishing and reinforcement, including admixtures in recommended proportions as per IS: 9103 to accelerate, retard setting of concrete, improve workability without impairing strength and durability as per direction of Engineer-in-charge. @ 340 kg/cum.									DSR
		Edappally Canal	1.00	4217.86	0.50	0.50	1054.47	cum	13248.00	1,39,69,565.24	
		Chilavanoor Canal	1.00	8386.68	0.50	0.50	2096.67	cum	13248.00	2,77,76,684.16	
		Thevara Perandoor Canal	1.00	8665.72	0.50	0.50	2166.43	cum	13248.00	2,87,00,878.68	
3	5.22.A.3	Steel reinforcement for R.C.C. work including straightening, cutting, bending, placing in position and binding all complete above plinth level.									DSR
		Edappally Canal					105446.60	kg	117.00	1,23,37,251.91	
		Chilavanoor Canal					209667.00		117.00	2,45,31,039.00	
		Thevara Perandoor Canal					216643.11		117.00	2,53,47,243.40	
4	5.9.6	Centering and shuttering including strutting, propping etc. and removal of form work									DSR
		Sheet pilecap (sides) Edappally Canal	2.00	4217.86		0.50	4217.86	sqm	1026.00	43,27,528.36	
		Sheet pilecap (sides) Chilavanoor Canal	2.00	8386.68		0.50	8386.68		1026.00	86,04,733.68	
		Sheet pilecap (sides) Perandoor Canal	2.00	8665.72		0.50	8665.72		1026.00	88,91,033.07	
		Sheet pilecap (bottom) Edappally Canal	1.00	4217.86	0.42		1750.41	sqm	1026.00	17,95,924.27	
		Sheet pilecap (bottom) Chilavanoor Canal	1.00	8386.68	0.42		3480.47		1026.00	35,70,964.48	
		Sheet pilecap (bottom) Perandoor Canal	1.00	8665.72	0.42		3596.28		1026.00	36,89,778.72	
		TOTAL								**1,73,89,77,561.61**	

SHEET PILE QUANITY

Sl.No	Name of the canal	Chainage	Sheet pile length (m) (RHS)	Sheet pile length (m) (LHS)
	Edapally Canal			
1	"	CH 0-CH 600	521.27	524.82
2	"	CH 1400-CH 2100	676.12	675.67
3	"	CH 3600-CH 3900	371.44	314.14
4	"	CH 4400-CH 4550	111.61	117.60
5	"	CH 10400-CH 10900	506.05	399.14
			2186.49	**2031.37**
		RHS+LHS (m)	**4217.86**	
	Chilavanoor canal			
1	"	CH 0-CH 400	349.15	423.4
2	"	CH 2050-CH 400	1173.5	1198.77
3	"	CH 3610-CH 3800	148.85	161.92
4	"	CH 4290-CH 6150	1877.47	1858.72
5	"	CH 7190-CH 7300	179.10	132.21
6	"	CH 9300-CH 9600	245.5	638.09
			3973.57	**4413.11**
		RHS+LHS (m)	**8386.68**	
	Thevara_Perandoor canal			
1	"	CH 350-CH 500	202.97	
2	"	CH 850-CH 930	157.49	57.06
3	"	CH 1100-CH 1790	686.97	
4	"	CH 2090-CH 2250	150.64	186.63
5	"	CH 3090-CH 3110	44.51	
6	"	CH 3200-CH 3310	130.96	90.98
7	"	CH 3500-CH 5510	1967.73	1970.93
8	"	CH 6790-CH 7010	241.43	243.77
9	"	CH 8150-CH 9400	1516.07	1017.58
			5098.77	**3566.95**
		RHS+LHS (m)	**8665.72**	
	Grand Total (m)		**21270.27**	

PROJECT: IURWTS Kochi.WT-2024 Integrate Urban Rejuvenation and Water Transport System Kochi

DETAILED ESTIMATE

Sl No	Code	Description	Unit	Quantity	Rate	Amount	Remarks
1	20.5.3	Providing, driving (with vibrating pile driving hammer complete with power units & accessories) and installing driven Pre-cast reinforced cement concrete piles of specified diameter and length below the pile cap in M-25 cement concrete to carry safe working load not less than specified with a central through preformed hole with M.S. black pipe of dia, 40 mm for grouting with cement sand grouting of mix 1:2 (1cement : 2 coarse sand) under sufficient positive pressure to ensure complete filling including centring, shuttering, 1761SUB HEAD : 20- PILE WORK driving and removing the steel casing pipe and lifting casing etc. complete but excluding the cost of steel reinforcement. (Length of pile for payment shall be measured from top of the shoe to the bottom of pile cap). 400 mm dia piles	m	40	4275.45807	171018.3228	DSR
2	5.17	Providing, hoisting and fixing above plinth level up to floor five level precast reinforced cement concrete in vertical & horizontal fins, individually or forming box louvers, setting in cement mortar 1:2 (1 cement : 2 coarse sand), including the cost of required centering, shuttering but , excluding the cost of reinforcement, with 1:1.5:3 (1 cement : 1.5 coarse sand(zone-III) : 3 graded stone aggregate 20 mm nominal size).	cum	8.64	13917.37632	120246.1314	DSR
3	5.22.A.3	Steel reinforcement for R.C.C. work including straightening, cutting, bending, placing in position and binding all complete above plinth level.	kg	691.2	117	80870.4	DSR
4		Slab installation	per m of slab	45	1271	57199.5	
						429334.3542	

RATE ANALYSIS FOR SHORE PROTECTION						
2.1						
	Description	**Unit**	**Quantity**	**Rate**	**Amount**	**Remarks**
	Take Length of wall (width-700mm)	m	100.00			
	Net Height retention	m	3.50			
	Proposed sheet pile height	m	6.50			
	Proposed sheet pile	ESZ 19				
	Length for high corrosion zone		2.45			Considering 2.2m length and 0.25m extra below dredge level for safety for painting works only.
	Total qty of sheet piles	Pcs	144			width -700mm (144=((100/0.70)+1)
	Weight of sheet pile	kg/m	80.80			
	Tonnage of sheet piles	Tons	75.63			
	CIF Price at port in India (A)	USD/ton		880.00		
	Duties & taxes (35%) (B)	USD/ton		308.00		
	Cost of material (landed) ((C =A+B)	USD/ton		1,188.00		
	Cost of material (landed)	INR/ton		84,645.00		
	Total cost of material	INR	75.63	84,645.00	64,01,701.35	
	Painting area	Sq.m	650.00			
	Painting rate	INR/Sq.m		150.00		
	Total cost of painting	INR	650.00	150.00	97,500.00	
	Installation cost (Budgetary)	INR /ton		12,000.00		
	Installation cost	INR	75.63	12,000.00	9,07,545.60	
	Material + Installation only	INR			73,09,246.95	
	Material + Painting + Installation	INR			74,06,746.95	
	Cost for 100m (650 sqm)				74,06,746.95	
	Cost for 1 sqm				11,395.00	
	Say				**11,395.00**	
5.34.1	Providing and laying in position machine batched and machine mixed design mix M-30 grade cement concrete for reinforced cement concrete work, using cement content as per approved design mix, including pumping of concrete to site of laying but excluding the cost of centering, shuttering, finishing and reinforcement, including admixtures in recommended proportions as per IS: 9103 to accelerate, retard setting of concrete, improve workability without impairing strength and durability as per direction of Engineer-in-charge. @ 340 kg/cum.					
	Sheet pile cap					
	Details of cost for 1.00 cum					
	MATERIAL					
0295	Stone Aggregate (Single size) : 20 mm nominal size	CUM	0.57	1350	769.5	

0297	Stone Aggregate (Single size) : 10 mm nominal size	CUM	0.28	1350	378	
2202	Carriage of Stone aggregate below 40 mm nominal size	CUM	0.85	103.77	88.2045	
0982	Coarse sand (zone III)	CUM	0.425	1350	573.75	
2203	Carriage of Coarse sand	CUM	0.425	103.77	44.10225	
0367	Portland cement	T	0.34	4940	1679.6	
2209	Carriage of Cement	T	0.34	92.24	31.3616	
7318	Plasticizer / super plasticizer	KG	1.7	36	61.2	
0004	Production cost of concrete by batch mix plant.	CUM	1	350	350	
0009	Pumping charges of concrete including Hire charges of pump, piping work & accessories	CUM	1	210	210	
	LABOUR				0	
0155	Mason	Day	0.17	709	120.53	
0114	Beldar	Day	2	558	1116	
0101	Bhisti	Day	0.9	617	555.3	
0012	Vibrator(Needle type 40mm)	Day	0.07	370	25.9	
9999	Sundries	LS	13	2	26	
0115	Coolie	Day	1.88	558	1049.04	
	TOTAL				7078.49	
	Add 1 % Water charges				70.78	
	TOTAL				7149.27	
	Add 14.05% GST				1004.47	
	TOTAL				8153.75	
	Add 10 % Contractor's profit and 5% overheads				1223.06	
	TOTAL				9376.81	
	Add 1% Cess				93.77	
	add cost index of 39.89%				3777.81	
	Cost per 1.00 cum				13248.39	
	Say				**13248**	
5.22.A.3	Steel reinforcement for R.C.C. work including straightening, cutting, bending, placing in position and binding all complete above plinth level.					
	Details of cost for 1 quintal					
	MATERIAL					
	Deformed twisted steel bars = 1.00 q					
	Wastage 5% = 0.05 q					
	Total = 1.05q					
1005	Twisted steel / deformed bars	quintal	1.05	4600	4830	
2205	Carriage of Steel	tonne	0.105	92.24	9.6852	
9999	Cover block	L.S.	26	2	52	
	LABOUR				0	
0102	Blacksmith 1st class	Day	1	738	738	
0114	Beldar	Day	1	558	558	
9999	Sundries and binding wire	LS	26.91	2	53.82	
	TOTAL				6241.51	
	Add 1 % Water charges				62.42	
	TOTAL				6303.92	
	Add 14.05% GST				885.70	
	TOTAL				7189.62	
	Add 10 % Contractor's profit and 5% overheads				1078.44	
	TOTAL				8268.06	
	Add 1% Cess				82.68	
	add cost index of 39.89%				3331.11	

	Cost of one quintal				11681.86	
	Cost of 1 Kg				116.82	
	Say				**117**	
5.9.6	Centering and shuttering including strutting, propping etc. and removal of form work					
	Detail of cost for 4.5 sqm					
	MATERIAL					
	Deformed twisted steel bars = 1.00 q					
	Wastage 5% = 0.05 q					
	Total = 1.05q					
7331	Wall form panel 1250x450 mm	each	0.17	860	146.2	
7332	Corner angle 45x45x5 m 2.50 m long	each	0.085	255	21.675	
7333	Column clamp 450x1070 m	each	0.1063	965	102.5795	
7334	Prop 2 m (2-3.5m)	each	0.085	635	53.975	
9999	Assembly nut & bolt	LS	27.62	2	55.24	
9977	Carriage	LS	52	2	104	
	LABOUR					
0116	Fitter (grade 1)	Day	1	738	738	
0114	Beldar	Day	2	558	1116	
9999	Shuttering oil	LS	39	2	78	
9977	Carriage	LS	26	2	52	
	TOTAL				2467.67	
	Add 1 % Water charges				24.68	
	TOTAL				2492.35	
	Add 14.05% GST				350.17	
	TOTAL				2842.52	
	Add 10 % Contractor's profit and 5% overheads				426.38	
	TOTAL				3268.90	
	Add 1% Cess				32.69	
	add cost index of 39.89%				1317.00	
	Cost for 4.5 sqm				4618.59	
	Cost per sqm				1026.35	
	Say				**1026**	
OD	Dry rubble masonary for foundation and super structure of retaining wall					
	Details of cost for 1.00 cum					
	MATERIAL					
M-363	Blasted rubble, chips	CUM	1.05	900	945	
	LABOUR					
0125	Mason	Day	0.8	1200	960	
0115	Coolie	Day	0.7	700	490	
9999	Sundries	Ls	0.2	1.73	0.346	
MR446	conveyance	Hour	1.05	315	330.75	
	TOTAL				2726.10	
	Add 14.05% GST				383.02	
	TOTAL				3109.11	
	Add 10 % Contractor's profit and 5% overheads				466.37	
	TOTAL				3575.48	
	Add 1% Cess				35.75	
	Cost per 1.00 cum				3611.23	
	Say				**3611**	

	RATE ANALYSIS FOR Pile and Slab						
		Description	**Unit**	**Quantity**	**Rate**	**Amount**	**Remarks**
1	20.5.3	Providing, driving (with vibrating pile driving hammer complete with power units & accessories) and installing driven Pre-cast reinforced cement concrete piles of specified diameter and length below the pile cap in M-25 cement concrete to carry safe working load not less than specified with a central through preformed hole with M.S. black pipe of dia, 40 mm for grouting with cement sand grouting of mix 1:2 (1cement : 2 coarse sand) under sufficient positive pressure to ensure complete filling including centring, shuttering, 1761SUB HEAD : 20- PILE WORK driving and removing the steel casing pipe and lifting casing etc. complete but excluding the cost of steel reinforcement. (Length of pile for payment shall be measured from top of the shoe to the bottom of pile cap). 400 mm dia piles					
		Details of cost for 20 m length of pile					
		MATERIAL					
		Concrete -3.14/4x(0.50)²x20 = 3.925 cum					
	5.33.1	SH : RCC Work	cum	3.925	7997.3	31389.4025	
	5.19	SH : RCC	cum	3.925	13020.5	51105.4625	
	5.1.3	Deduct Rate as per item no 5.1.3 SH : RCC	cum	-3.925	7296.35	-28638.17375	
	3.7	Cement mortar 1:2 for grout Rate as per Item Number 3.7 of SH: Mortars	cum	0.025	5345.55	133.63875	
	9999	Wooden block @ 1 block per two piles	L.S.	442	2	884	
	7181	C.I. pile shoe of 80 kg per pile @ 80 kg per pile	kilogram	80	48	3840	
	7182	M.S. clamps for pile shoe	kilogram	35	43	1505	
		MACHINERY					
	0027	Hire and running charges of vibrating	day	0.38	30000	11400	
	0028	Hire and running charges of crane	day	0.06	7000	420	
		LABOUR					
	0130	Mistry	day	0.12	738	88.56	
	0114	Beldar	day	3	558	1674	
		TOTAL				73801.89	
		Add 1 % Water charges				199.45	
		TOTAL				74001.34	
		Add 14.05% GST				2830.32	
		TOTAL				76831.66	
		Add 10 % Contractor's profit and 5% overheads				3446.25	
		TOTAL				80277.91	
		Add 1% Cess				264.21	
		add cost index of 39.89%				32128.25	
		Cost for 20m				112670.37	
		cost per m				**5634**	
		MACHINERY					
	0027	Hire and running charges of vibrating	day	0.38	30000	11400	
	0028	Hire and running charges of crane	day	0.06	7000	420	
		LABOUR					
	0130	Mistry	day	0.12	738	88.56	
	0114	Beldar	day	3	558	1674	
		TOTAL				13582.56	
		Add 1 % Water charges				135.83	
		TOTAL				13718.39	
		Add 14.05% GST				1927.43	
		TOTAL				15645.82	
		Add 10 % Contractor's profit and 5% overheads				2346.87	
		TOTAL				17992.69	
		Add 1% Cess				179.93	
		add cost index of 39.89%				7249.06	
		Cost per 20 height of slab				25421.68	
		Say				**1271**	

Annexure 6.1.4

Construction of access road along the canals

Description/Canal	Quantity	Unit	Rate (INR)	Amount (INR)
Thevar-Perandoor	3181.1	m	₹ 17,208.56	₹ 5,47,42,162.83
Thevara	2818.9	m	₹ 17,208.56	₹ 4,85,09,220.97
Total	6000			**₹ 10,32,51,383.80**

Detailed Estimate: Access road along the canals

Item No	Code	Description	Unit	No.	L	B	H	Quantity	Rate (INR)	Amount (INR)	Remarks
1	2.8	**Earth work excavation** in ordinary soil for foundation of retaining wall, etc. and using the spoil for back filling with all leads and lifts involved including breaking clods, watering, ramming and sectioning of spoil bank etc. complete as per the direction of deptl. officers at site Ret. wall	m^3	4	15.00	2	1.00	120.00	₹ 352.94	₹ 42,353.10	DSR
2	OD	**Dry rubble** packing for foundation of retaining wall including all cost, conveyance and packing to proper lines and levels etc,complete as per the direction of deptl. Officers Ret wall foundation	m3	4	15.00	2	0.35	42.00	₹ 3,611.00	₹ 1,51,662.00	OD
3	7.2.1	**Random rubble** masonry with hard stone in superstructure above plinth level and upto floor five level, including leveling up with cement concrete 1:6:12 (1 cement : 6 coarse sand : 12 graded stone aggregate 20 mm nominal size) Ret .wall	m3	4	15.00	1	2.00	120.00	₹ 10,477.69	₹ 12,57,322.93	DSR
4	3.16	**Construction of embankment** with approved material obtained from borrow pits with all lifts and leads, transporting to site, spreading, grading to required slope, compacting to meet the design requirement as per the instruction of the engineer in charge									PRICE
		Approaches		4	100.00	10	1.00	4000.00			
		bridge side		2	10.00	10	1.00	200.00			
			m^3		Total			4200.00	₹ 366.88	₹ 15,40,877.16	
5	16.78.1	Construction of **Granular Sub-Base** by providing close graded Material of grading I - 53 mm to 9.5 mm @ 50 per cent, 9.5 mm to 2.36 mm @ 20 per cent and 2.36 mm below @ 30 per cent - mixing in a mechanical mix plant at OMC, carriage of mixed material to work site, spreading in uniform layers with motor grader on prepared surface and compacting with vibratory power roller to achieve the desired density, etc. complete									DSR
		approaches		2	250.00	4.00	0.25	500.00			
		bridge		1	18.00	8.00	0.25	36.00			
					Total			536.00			
			m^3		Say			536.00	₹ 3,522.01	₹ 18,87,797.64	
6	16.79	Providing, laying, spreading and compacting graded stone aggregate to **wet mix macadam** specification including premixing the Material with water at OMC in mechanical mix plant carriage of mixed Material by tipper to site, laying in uniform layers with paver in sub- base / base course on well prepared surface and compacting with vibratory roller to achieve the desired density.									DSR
		approaches		2	250.00	4.00	0.25	500.00			
		over the bridge		1	18.00	8.00	0.25	36.00			
					Total			536.00			
			m^3		Say			536.00	₹ 3,695.05	₹ 19,80,549.19	
7	16.31.1.2	Providing and **applying tack coat** with bitumen emulsion(RS) using emulsion pressure distributor at the rate of 0.20 - 0.30 kg per sqm on the prepared bituminous surface cleaned with mechanical broom.									DSR

Detailed Estimate: Access road along the canals

Item No	Code	Description	Unit	No.	L	B	H	Quantity	Rate (INR)	Amount (INR)	Remarks
		both sides		2	250.00	4.00		2000.00			
		above bridge		1	18.00	7.50		135.00			
			m2		Total			2135.00	₹ 11.26	₹ 24,042.54	
8	5.1.a	Providing and **applying primer coat** with bitumen emulsion (SS) on prepared surface of granular Base including clearing of road surface and spraying primer at the rate of 0.70 - 1.0 kg/sqm using mechanical means.									PRICE
		both sides		2	250.00	4.00		2000.00			
		above bridge		1	18.00	7.50		135.00			
			m2		Say			2135.00	₹ 57.06	₹ 1,21,825.51	
9	16.41	Mix Seal Surfacing Providing, laying and rolling of **close-graded premix surfacing materia**l of 20 mm thickness composed of 11.2 mm to 0.9 mm (Type-A) or 13.2 mm to 0.9 mm (Type-B) aggregates using penetration grade bitumen to required line, grade and level to serve as wearing course on a previously prepared base, including mixing in a suitable plant, laying and rolling with a three wheel 8-10 kN static roller and finishing to required level and grades complete									DSR
		approaches		2	250.00	4.00		2000.00			
		above bridge		1	18.00	7.50		135.00			
			m2		Total			2135.00	₹ 138.70	₹ 2,96,126.50	
10	16.69	Supplying and fixing **RCC guard stones/ guide stones** of size 0.20x0.20x1.05m with R.C.C 1:2:4 using 20mm broken stone including cost and conveyance of all materials, labour charges, watering, curing, fixing in position to lines and levels etc. complete as per the direction of Engineer in charge									DSR
		Say	Nos	40				40	₹ 492.13	₹ 19,685.32	
11	13.62	Painting with **Synthetic enamel paint** two coats using approved quality paint over a priming coat after cleaning the surface including all cost and conveyance, labour charges etc. for hand rails, kerb, guard stone etc.as directed by departmental officers at site.Hand rails, Kerb, Guard stones etc.	m^2					100.00	₹ 247.82	₹ 24,781.51	DSR
12	12.41.1	Supplying and fixing **75 mm PVC pipe** for weep holes for retaining walls	m	1	40.00			40.00	₹ 281.32	₹ 11,252.75	DSR
13	8.23.A	Providing metal crash barier	m	4	100.00			400.00	₹ 3,115.01	₹ 12,46,005.83	PRICE
		TOTAL								₹ 86,04,281.98	
		Amount per m								₹ 17,208.56	

Rate Analysis						
	Description	**Unit**	**Quantity**	**Rate**	**Amount**	**Remarks**
OD	Dry rubble masonary for foundation and super structure of retaining wall					
	Details of cost for 1.00 cum					
	MATERIAL					
M-363	Blasted rubble, chips	CUM	1.05	900	945	
	LABOUR					
0125	Mason	Day	0.8	1200	960	
0115	Coolie	Day	0.7	700	490	
9999	Sundries	Ls	0.2	1.73	0.346	
MR446	conveyance	Hour	1.05	315	330.75	
	TOTAL				2726.10	
	Add 14.05% GST				383.02	
	TOTAL				3109.11	
	Add 10 % Contractor's profit and 5% overheads				466.37	
	TOTAL				3575.48	
	Add 1% Cess				35.75	
	Cost per 1.00 cum				3611.23	
	Say				**3611**	

Annexure 6.1.5

Abstract Cost - Cross structures /Road bridges

Canal	No.of Bridges	Unit	Rate per bridge (INR)	Total Amount (INR)
Edappally	11	Nos.	₹ 1,24,02,730	₹ 13,64,30,035
Thevara-Perandoor	23	Nos.	₹ 1,24,02,730	₹ 28,52,62,800
Thevara	2	Nos.	₹ 1,24,02,730	₹ 2,48,05,461
Chilavanoor	20	Nos.	₹ 1,24,02,730	₹ 24,80,54,608
Total	**56**			**₹ 69,45,52,904**
				69.45 crores

Detailed Estimate: Road Bridges (Typical Design basis)											
S. No.	**Code**	**Description**	**Unit**	**No.**	**L**	**B**	**H**	**Qty**	**Rate (INR)**	**Amount (INR)**	**Remarks**
1	**2.3.2.A**	**Clearing and grubbing canal land** including uprooting rank vegetation, grass, bushes, shrubs, saplings and trees girth up to 300 mm, removal of stumps of trees cut earlier and disposal of unserviceable materials and stacking of serviceable material to be used or auctioned, up to a lead of 1000 metres including removal and disposal of top organic soil not exceeding 150 mm in thickness In area of light jungle - By Mechanical Means	m^2	1.00	300.00	15.00		4500.00	₹ 5.51	**₹ 24,791.24**	PRICE
2		**Putting up ring bund** of size not less than 1.00m wide at top, 3.00m wide at bottom using coconut wood 200 mm to 300 mm dia driving down for an average depth of 3.00 m and for an average height of 4.00 m (total height of 7.00m) with full grown coconut piles in two row at 50 cm c/c, half split coconut wood horizontal at 60 cm c/c, 1/3rd split coconut wood cross ties for connecting two row at 120cm c/c tied with coir yarn and wire rope, providing screening using new bamboo matt thatties with 1/6th bamboo reepers on both sides for filling with cotractor's own earth conveyed from sources of availability with all leads and lifts and maintaining the bund throughout the period of construction and dismantling and removing the bund after completion of work etc, complete as per the direction of deptl. officers at site. (3 months)	m	2	25			50.00	₹ 22,227.00	**₹ 11,11,350.00**	OD
3	**0011**	**Dewatering** for structure in soil including diversion of stream providing cofferdam, bunds etc. as may be necessary for foundation and other parts of work and bailing out and / or pumping out water below the actual initial natural water level during execution of all items of construction as required (from start till completion of bridge & retaining walls) including all leads and lifts etc, complete.	days	16.00				16.00	₹ 1,664.69	**₹ 26,635.06**	OD
4		Hire and labour Providing **sheet piles** 6m depth erecting throughvarious strata to.line and levels including erecting ,dismantling after use etc.complete (3 months)	m2	2.00	25.00		6.00	300.00	₹ 3,334.83	**₹ 10,00,449.00**	
5	**12.23.6**	Bored cast-in-situ M35 grade **R.C.C. Pile** using concrete mixer excluding Reinforcement complete as per Drawing and Technical Specifications and removal of excavated earth with all lifts and lead upto 1000 m.Pile diameter-**600 mm Dia (6 numbers on each side)**	m	2.00	6	38.000		456.00	₹ 5,293.26	**₹ 24,13,724.62**	PRICE
6	**20.6.3.2**	Vertical load testing of piles in accordance with IS 2911 (Part IV) including installation of loading platform by Kentledge/Anchor piles method and preparation of pile head or construction of test cap and dismantling of test cap after test etc. complete as per specification & the direction of Engineer incharge. Routine test (Test Load 1.5 times the Safe capacity)	no	2.00				2.00	₹ 55,213.39	**₹ 1,10,426.79**	DSR
7	**12.1.B.1**	**Earth work in excavation of foundation** of structures as per drawing and technical specification, including setting out, construction of shoring and bracing, removal of stumps and other deleterious matter, dressing of sides and bottom and backfilling with approved material. Ordinary Soil - Depth upto 3m - Mechanical Means									PRICE
		pile cap	m^3	2.00	10.00	3.00	1.30	78.00	₹ 63.80	**₹ 4,976.70**	
8	**12.39**	Providing and laying of **PCC M15 leveling course** 100 mm thick below the pile cap									PRICE
		For Arch bridge	m^3	2.00	10.20	3.10	0.30	18.97	₹ 5,910.02	**₹ 1,12,124.84**	

Detailed Estimate: Road Bridges (Typical Design basis)											
S. No.	**Code**	**Description**	**Unit**	**No.**	**L**	**B**	**H**	**Qty**	**Rate (INR)**	**Amount (INR)**	**Remarks**
9	**12.38.B.2**	Cement Concrete for Reinforced Concrete in **Pedestal / Pile Cap** complete as per Drawing and Technical Specification R C C Grade **M-25** - Using Batching Plant, Transit Mixer and Concrete Pump									PRICE
		pile cap		2.00	10.00	2.90	1.00	58.00			
		do.do.top portion		2	10	0.6	0.6	7.20			
		Total	m^3					65.20	₹ 6,678.95	**₹ 4,35,467.55**	
10	**13.5.C.q.2**	Plain / **Reinforced cement concrete in sub-structure** complete as per drawing and Technical Specifications RCC Grade **M25** - With Batching Plant, Transit Mixer and Concrete Pump - Height 5m to 10m									PRICE
		Arch bridge -face wall		2.00	24.00	0.60	6.40	184.32			
		Arch bridge - foot path		2.00	24.00	1.50	0.30	21.60			
		deduct arch portion		2.00	18.00	5.20	0.6	112.32			
		net	m^3					93.60	₹ 7,237.50	**₹ 6,77,430.27**	
11	**4.1B.2.1.**	Plain/**Reinforced cement concrete in super-structure** complete as per drawing and Technical Specifications RCC Grade **M25** - With Batching Plant, Transit Mixer and Concrete Pump - Height upto 5m RCC Grade M25 - With Batching Plant, Transit Mixer and Concrete Pump - Height upto 5m									PRICE
		Horizontals		6	18	0.250	0.200	5.40			
		Verticals posts		160	1.50	0.300	0.250	18.00			
		Total	m3					23.40	₹ 7,646.84	**₹ 1,78,935.94**	
12	12.41.1	Supplying and fixing **75mm dia PVC pipe** of 60 cm long for drainage spout in at required interval including cost, conveyance, cutting charges of pipe etc. complete as directed by the deptl. officers at site. for weep hole									DSR
		pvc pipe 75 mm dia	no.	50				50.00	₹ 281.32	**₹ 14,065.94**	
13	**13.6**	Supplying, fitting and placing **HYSD bar** reinforcement in sub-structure complete as per drawing and Technical Specifications									PRICE
		For Pile	kg		85.84	m3 @	60.00	5150.39			
		For Pile cap			36.00	m3 @	#####	3600.00			
		face wall			54.00	m3 @	#####	5400.00			
		Hand Rail			23.400	m3 @	#####	2340.00			
		Total	Kg					16490.39			
		Say	tonne					16.49	₹ 60,229.32	**₹ 9,93,204.64**	
14		Designing, fabricating, supplying and providing 8mm thick **corrugated steel plate** - galvanised complete with fabrication including labour, hire charges of equipments, crane and transportation cost of nut,bolts,water proffing ,fixing in position etc - complete.									OD
		Arch bridge		1	18.000		10.50	189.00	₹ 25,000.00	**₹ 47,25,000.00**	
15	**13.10**	Providing and laying of **Filter media** with granular materials/stone crushed aggregates satisfying the requirements laid down in clause 2504.2.2. of MoRTH specifications to a thickness of not less than 600 mm with smaller size towards the soil and bigger size towards the wall and provided over the entire surface behind abutment, wing wall and return wall to the full height compacted to a firm condition complete as per drawing and Technical Specification. bridge portion	m^3	2	20.000	1.20	0.5	24.00	₹ 2,521.76	**₹ 60,522.12**	PRICE
16	**13.16**	Filling the arch & approach side with approved material contractors own earth obtained from borrow pits with all lifts and leads, transporting to site, spreading, grading to required slope and compacting to meet requirement of table 300-2.					0.5				PRICE
		arch	m^3	1	20.000	10.00	7	1400.00	₹ 366.88	**₹ 5,13,625.72**	
		TOTAL								**₹ 1,24,02,730.42**	

Annexure 6.1.6

Abstract Cost : Construction of footover bridges

Canal	Quantity	Unit	Rate (INR)	Amount (INR)
Edappally	6	Nos.	₹ 35,00,000	₹ 2,10,00,000.00
Thevar-Perandoor	18	Nos.	₹ 35,00,000	₹ 6,30,00,000.00
Thevara	2	Nos.	₹ 35,00,000	₹ 70,00,000.00
Chilavanoor	18	Nos.	₹ 35,00,000	₹ 6,30,00,000.00
Market	2	Nos.	₹ 35,00,000	₹ 70,00,000.00
Total	**46**			**₹ 16,10,00,000.00**
			Say	**16.10 Crores**

Detailed Estimate : Footover bridges							
S. No.	**Code**	**Details**	**Unit**	**Quantity**	**Rate (INR)**	**Amount (INR)**	**Remarks**
1	OD	Supply and Erection of Prefabricated Steel bridgewith 310Mpa HR tubes and painted with Epoxy	LS	1	1430000	1430000	OD
2	20.1.1	40 cm dia RCC piles M30 mix (Auger piles) to be reinforced with 9 No's 12 mm TOR bars for full length, 8mm stirrups @18 cm c/c as lateral reinforcement for the whole length as per the structural and architectural drawings etc. complete including all labour charges, machinery hire charges, cost of all materials.	RM	84.00	3384.19	₹ 2,84,272	DSR
3	20.6	Vertical load testing of pile in accordance with IS 2911 (Part IV) including installation of loading platform, preparation of pile head etc. complete as per specification & the direction of Engineer in charge (filling materials shall be supplied by the client)	Each Test	1.00	₹ 74,866	₹ 74,866	DSR
4		Chipping and removing the top of RCC piles to line and level carefully without damage to the bottom of pile and removing the debris and disposing as directed with all & lift	Nos	8.00	₹ 1,500	₹ 12,000	
5	3.13.1.A	Earth work in ordinary soil for foundation including dressing of all sides and remming bottom and including disposal of earth as instructed with all lead lift by the Engineer in charge	M^3	10.00	₹ 430	₹ 4,300	PRICE Kerala 3.13.1.A
6	12.39	Providing plain cement concrete M 15 below pile cap using 40mm graded granite aggregate including shuttering if necessary due to site conditions with all labour and materials complete as directed	M^3	1.84	₹ 5,910	₹ 10,851	PRICE
7	5.2.2	Reinforced cement concrete work in walls (any thickness), including attached pilasters, buttresses, plinth and string courses, fillets, columns, pillars, piers, abutments, posts and struts etc. above plinth level up to floor five level, excluding cost of centering, shuttering, finishing and reinforcement : 1:1.5:3 (1 cement : 1.5 coarse sand(zone-III) : 3 graded stone aggregate 20 mm nominal size)	M^3	16.37	₹ 13,018	₹ 2,13,081	PRICE
8	5.2.2	Reinforced cement concrete work in walls (any thickness), including attached pilasters, buttresses, plinth and string courses, fillets, columns, pillars, piers, abutments, posts and struts etc. above plinth level up to floor five level, excluding cost of centering, shuttering, finishing and reinforcement : 1:1.5:3 (1 cement : 1.5 coarse sand(zone-III) : 3 graded stone aggregate 20 mm nominal size)	M^3	2.50	₹ 13,018	₹ 32,545	PRICE

9	5.2.2	Reinforced cement concrete work in walls (any thickness), including attached pilasters, buttresses, plinth and string courses, fillets, columns, pillars, piers, abutments, posts and struts etc. above plinth level up to floor five level, excluding cost of centering, shuttering, finishing and reinforcement : 1:1.5:3 (1 cement : 1.5 coarse sand(zone-III) : 3 graded stone aggregate 20 mm nominal size)	M^3	4.20	₹ 13,018	₹ 54,676	PRICE
10	5.2.2	Reinforced cement concrete work in walls (any thickness), including attached pilasters, buttresses, plinth and string courses, fillets, columns, pillars, piers, abutments, posts and struts etc. above plinth level up to floor five level, excluding cost of centering, shuttering, finishing and reinforcement : 1:1.5:3 (1 cement : 1.5 coarse sand(zone-III) : 3 graded stone aggregate 20 mm nominal size)	M^3	1.00	₹ 13,018	₹ 13,018	PRICE
11	5.22A.6	Steel reinforcement for R.C.C. work including straightening, cutting, bending, placing in position and binding all complete upto plinth level. Thermo-Mechanically Treated bars of grade Fe-500D or more.	kg	3610.20	₹ 117	₹ 4,21,701	PRICE
	5.9.1	Centering and shuttering including strutting, propping etc. and removal of form for Foundations, footings, bases of columns, etc. for mass concrete	sqm	300.00	₹ 398	₹ 1,19,543	
12		Miscellaous for Approach road (if any)	lumpsum			₹ 2,50,000	LS
		Total				**₹ 29,20,853**	
		GST			**18%**	**₹ 5,25,754**	
						₹ 34,46,607	
		Say				**₹ 35,00,000**	

Structural Steel estimate for Foot over bridge				
FOOTOVER BRIDGE			Building Length	16.5m
			Building Width	2.2m
			Building height	5
		Weight Analysis		
			36.3	
			171.668	
Quantity	Unit	Basic Building	Weight (kg)	
-	kg	Built Up Sections	0	
-	kg	Hot Rolled Sections & crane beams (if any)	5400	
-	kg	Cold Formed Sections (C & Z)	0	
0	m^2	Sheeting	0	
0	m^2	Tempcon Panels	0	
37.026	m^2	Decking Panel	293.25	
0	m	Trims&Gutters	0	
-	kg	Clips, Cables, Rods, Bolts, Misc Etc.	538.31	
0	m^2	Insulation	0	
		Total Weight (kg)	**6231.55**	

Annexure 6.1.7

Regulatory Arrangements for automatic operations and pumping

Canal	Quantity	Units	Rate (INR)	Amount (INR)
Edappally	2	no	₹ 5,00,00,000	₹ 10,00,00,000
Chilavanoor	2	no	₹ 5,00,00,000	₹ 10,00,00,000
Thevar-Perandoor	2	no	₹ 5,00,00,000	₹ 10,00,00,000
Total	**6**			**₹ 30,00,00,000**

Annexure 6.1.8

Construction of access road to road bridges abstract

Description/Canal	Quantity	Unit	Rate (INR)	Amount (INR)
Edappally	11	Nos.	₹ 62,78,779	₹ 6,90,66,564
Thevar-Perandoor	23	Nos.	₹ 62,78,779	₹ 14,44,11,907
Thevara	2	Nos.	₹ 62,78,779	₹ 1,25,57,557
Chilavanoor	20	Nos.	₹ 62,78,779	₹ 12,55,75,571
Total	**56**			**₹ 35,16,11,599**
			Say	**35.16 crores**

Detail Estimate (Typical): Approach road to bridges											
Item No	**Code**	**Description**	**Unit**	**No.**	**L**	**B**	**H**	**Quantity**	**Rate (INR)**	**Amount (INR)**	**Remarks**
1)	2.8	**Earth work excavation** in ordinary soil for foundation of retaining wall, etc. and using the spoil for back filling with all leads and lifts involved including breaking clods, watering, ramming and sectioning of spoil bank etc. complete as per the direction of deptl. officers at site Ret. wall	m^3	4	15.00	2	1.00	120.00	₹ 352.94	₹ 42,353.10	DSR
2)	OD	**Dry rubble** packing for foundation of retaining wall including all cost, conveyance and packing to proper lines and levels etc,complete as per the direction of deptl. Officers Ret wall foundation	m3	4	15.00	2	0.35	42.00	₹ 3,611.00	₹ 1,51,662.00	OD
4)	7.2.1	**Random rubble** masonry with hard stone in superstructure above plinth level and upto floor five level, including leveling up with cement concrete 1:6:12 (1 cement : 6 coarse sand : 12 graded stone aggregate 20 mm nominal size) Ret .wall	m3	4	15.00	1	2.00	120.00	₹ 10,477.69	₹ 12,57,322.93	DSR
5)	3.16	**Construction of embankment** with approved material obtained from borrow pits with all lifts and leads, transporting to site, spreading, grading to required slope, compacting to meet the design requirement as per the instruction of the engineer in charge									PRICE
		Approaches		4	70.00	10	1.00	2800.00			
		bridge side		2	10.00	10	1.00	200.00			
			m^3		Total			3000.00	₹ 366.88	₹ 11,00,626.54	
6)	16.78.1	Construction of **Granular Sub-Base** by providing close graded Material of grading I - 53 mm to 9.5 mm @ 50 per cent, 9.5 mm to 2.36 mm @ 20 per cent and 2.36 mm below @ 30 per cent - mixing in a mechanical mix plant at OMC, carriage of mixed material to work site, spreading in uniform layers with motor grader on prepared surface and compacting with vibratory power roller to achieve the desired density, etc. complete									DSR
		approaches		2	70.00	8.00	0.25	280.00			
		bridge		1	18.00	8.00	0.25	36.00			
					Total			316.00			
			m^3		Say			316.00	₹ 3,522.01	₹ 11,12,955.33	
7)	16.79	Providing, laying, spreading and compacting graded stone aggregate to **wet mix macadam** specification including premixing the Material with water at OMC in mechanical mix plant carriage of mixed Material by tipper to site, laying in uniform layers with paver in sub- base / base course on well prepared surface and compacting with vibratory roller to achieve the desired density.									DSR
		approaches		2	70.00	8.00	0.25	280.00			
		over the bridge		1	18.00	8.00	0.25	36.00			
					Total			316.00			
			m^3		Say			316.00	₹ 3,695.05	₹ 11,67,637.21	

Detail Estimate (Typical): Approach road to bridges											
Item No	**Code**	**Description**	**Unit**	**No.**	**L**	**B**	**H**	**Quantity**	**Rate (INR)**	**Amount (INR)**	**Remarks**
8)	16.31.1.2	Providing and **applying tack coat** with bitumen emulsion(RS) using emulsion pressure distributor at the rate of 0.20 - 0.30 kg per sqm on the prepared bituminous surface cleaned with mechanical broom.									DSR
		both sides		2	70.00	4.00		560.00			
		above bridge		1	18.00	8.00		144.00			
			m2		Total			704.00	₹ 11.26	₹ 7,927.85	
9)	5.1.a	Providing and **applying primer coat** with bitumen emulsion (SS) on prepared surface of granular Base including clearing of road surface and spraying primer at the rate of 0.70 - 1.0 kg/sqm using mechanical means.									PRICE
		both sides		2	70.00	4.00		560.00			
		above bridge		1	18.00	8.00		144.00			
			m2		Say			704.00	₹ 57.06	₹ 40,171.04	
10)	16.41	Mix Seal Surfacing Providing, laying and rolling of **close-graded premix surfacing materia**l of 20 mm thickness composed of 11.2 mm to 0.9 mm (Type-A) or 13.2 mm to 0.9 mm (Type-B) aggregates using penetration grade bitumen to required line, grade and level to serve as wearing course on a previously prepared base, including mixing in a suitable plant, laying and rolling with a three wheel 8-10 kN static roller and finishing to required level and grades complete									DSR
		approaches		2	70.00	4.00		560.00			
		above bridge		1	18.00	7.50		135.00			
			m2		Total			695.00	₹ 138.70	₹ 96,397.15	
11)	16.69	Supplying and fixing **RCC guard stones/ guide stones** of size 0.20x0.20x1.05m with R.C.C 1:2:4 using 20mm broken stone including cost and conveyance of all materials, labour charges, watering, curing, fixing in position to lines and levels etc. complete as per the direction of Engineer in charge									DSR
		Say	Nos	40				40	₹ 492.13	₹ 19,685.32	
12)	13.62	Painting with **Synthetic enamel paint** two coats using approved quality paint over a priming coat after cleaning the surface including all cost and conveyance, labour charges etc. for hand rails, kerb, guard stone etc.as directed by departmental officers at site.Hand rails, Kerb, Guard stones etc.	m^2					100.00	₹ 247.82	₹ 24,781.51	DSR
13)	12.41.1	Supplying and fixing **75mm PVC pipe** for weep holes for retaining walls	m	1	40.00			40.00	₹ 281.32	₹ 11,252.75	DSR
14)	8.23.A	Providing metal crash barier	m	4	100.00			400.00	₹ 3,115.01	₹ 12,46,005.83	PRICE
		TOTAL								**₹ 62,78,778.55**	

Rate Analysis						
	Description	**Unit**	**Quantity**	**Rate**	**Amount**	**Remarks**
OD	Dry rubble masonary for foundation and super structure of retaining wall					
	Details of cost for 1.00 cum					
	MATERIAL					
M-363	Blasted rubble, chips	CUM	1.05	900	945	
	LABOUR					
0125	Mason	Day	0.8	1200	960	
0115	Coolie	Day	0.7	700	490	
9999	Sundries	Ls	0.2	1.73	0.346	
MR446	conveyance	Hour	1.05	315	330.75	
	TOTAL				2726.10	
	Add 14.05% GST				383.02	
	TOTAL				3109.11	
	Add 10 % Contractor's profit and 5% overheads				466.37	
	TOTAL				3575.48	
	Add 1% Cess				35.75	
	Cost per 1.00 cum				3611.23	
	Say				**3611**	

Annexure 6.1.9

Abstract Cost : Canal bank beautification

Description	Quantity	Unit	Rate (INR)	Amount (INR)
Edappally	7000	m	₹ 71,428.57	₹ 50,00,00,000.00
All canals	1	LS	₹ 5,00,00,000.00	₹ 5,00,00,000.00
Total Amount				**₹ 55,00,00,000.00**

Detailed Estimate: Canal bank Beautification								
S. No.	**Code**	**Description**	**Unit**	**Quantity for 1km**	**Quantity for 7km**	**Rate (INR)**	**Amount (INR)**	**Remarks**
2	2.31	Clearing jungle including uprooting of rank vegetation, grass, brush wood, trees and saplings of girth up to 30 cm measured at a height of 1 m above ground level and removal of rubbish up to a distance of 50 m outside the periphery of the area cleared	sqm	15500	108500	₹ 17.55	₹ 19,04,175.00	DSR
1	2.1	Earth work in surface excavation not exceeding 30 cm in depth but exceeding1.5 m in width as well as 10 sqm on plan including disposal of excavated earth up to 50 m and lift up to 1.5 m, preserving by planting grass, and regular watering until the grass takes roots, coveying and spreading over the bioremedial zone as per directions of Engineer in Incharge: 2.1.1 All kinds of soil	sqm	15500	108500	₹ 129.50	₹ 1,40,50,750.00	DSR
2	14.23	Pumping out water caused by springs, tidal or river seepage, broken water mains or drains and the like.	kilo litre	1000	7000	₹ 236.49	₹ 16,55,398.69	DSR
	All canals	1	LS	50000000	350000000			
3	2.28	Preparation of mounds of various size and shape by available excavated / supplied earth in layers not exceeding 20 cm in depth, breaking clods, watering of each layer, dressing etc., lead upto 50 meter and lift upto 1.5 m complete as per direction of Officer-in-charge.	cum	5000	35000	₹ 592.69	₹ 2,07,44,133.04	HORTICULTURE
4	982	supply of course sand	cum	2260	15820	₹ 1,888.52	₹ 2,98,76,307.30	
5	1.1.5	carriage of course sand by Mechanical Transport including loading, unloading and stacking upto 30 km lead complete	cum	2260	15820	₹ 569.16	₹ 90,04,055.10	DSR
6	16.2	Extra for compaction of earth work in embankment under optimum moisture conditions to give at least 95% of the maximum dry density (proctor density).	cum	2500	17500	₹ 25.46	₹ 4,45,549.65	DSR
7	2.2	Supplying and stacking of good earth at site including royalty and carriage upto 5 km lead complete (earth measured in stacks will be reduced by 20% for payment).	cum	5610	39270	₹ 1,163.58	₹ 4,56,93,658.71	HORTICULTURE
8	2.8	Spreading of good earth material in required thickness as per direction of officer-in-charge (cost of sludge, dump manure and/ or good earth to be paid separately).	cum	5610	39270	₹ 64.56	₹ 25,35,241.16	HORTICULTURE
9	OD	Filling GSB for footpath properly compacted by consolidating each deposited layer by ramming and watering, lead up to 50 m and lift upto 1.5 m..	Cum	840	5880	₹ 3,704.45	₹ 2,17,82,166.00	
	4.1.2	Providing and laying in position cement concrete of specified grade excluding the cost of centering and shuttering - All work up to plinth level : 1:1.5:3 (1 cement : 1.5 coarse sand :3 graded stone aggregate20 mm nominal size): M20	Cum	420	2940	₹ 10,087.00	₹ 2,96,55,780.00	DSR
11	OD	Laying stamped cement concrete pattern of approved size, design & shape, laid in required colour and pattern over and including 50mm thick compacted bed of coarsesand, filling the joints with fine sand etc. along with labour ,all complete as per the direction of Engineer-in-charge.	sqm	4200	29400	₹ 266.65	₹ 78,39,584.43	

12	16.94	Providing and laying at or near ground level factory made kerb stone of M-25 grade cement concrete in position to the required line, level and curvature, jointed with cement mortar 1:3 (1 cement: 3 coarse sand), including making joints with or without grooves (thickness of joints except at sharp curve shall not to more than 5mm), including making drainage opening wherever required complete etc. as per direction of Engineer-in-charge (length of finished kerb edging shall be measured for payment). (Precast C.C. kerb stone shall be approved by Engineer-in-charge).	cum	180	1260	₹ 11,717.33	₹ 1,47,63,840.00	DSR
13	OD	Laying of cobble stone of aproved color, finish of size .7X.7x.15m in the apoved design inclusive of carriage, transportation labour and materials	sqm	300	2100	₹ 3,766.00	₹ 79,08,600.00	
14	16.90	Providing and laying tactile tile (for vision impaired persons as per standards) of size 300x300x9.8mm having with water absorption less than 0.5% and conforming to IS: 15622 of approved make in all colours and shades in for outdoor floors such as footpath, court yard, multi modals location etc., laid on 20mm thick base of cement mortar 1:4 (1cement : 4 coarse sand) in all shapes & patterns including grouting the joints with white cement mixed with matching pigments etc. complete as per direction of Engineer-in- Charge	sqm	450	3150	₹ 2,704.95	₹ 85,20,603.31	DSR
15	4.90	Precasting and placing in position 125 mm dia Bollards 600 mm high of required shape, including providing M.S. Pipe Sleeve 50 mm dia 300 mm long in the Bollard and M.S. Pipes 40 mm dia and 450 mm long with 150x150x6mm M.S. plate welded at bottom and embedded 150 mm in cement concrete 1:3:6 (1 Cement : 3 coarse sand : 6 graded stone aggregate 20 mm nominal size), including necessary excavation of size 250 x 250 x 450 mm deep for the same in bitumen/concrete pavement at specified spacing.	Each	100	700	₹ 1,011.00	₹ 7,07,700.00	DSR
16	OD	coconut cudgents- supplying and stacking of full size coconut poles-(avg length=7m) Rm along the canal	rm	200	1400	₹ 5,592.00	₹ 78,28,800.00	
17	OD	Driving down cocounut post(avg length=7m) Rm along the canal	rm	200	1400	₹ 13,287.36	₹ 1,86,02,304.00	
18	OD	Board walk	running m	200	1400	₹ 38,611.97	₹ 5,40,56,764.08	
19	OD	Fencing for bioremediation zone		1000	7000	₹ 345.32	₹ 24,17,240.00	
20	OD	Supplying and stacking at site dump manure from approved source, including carriage upto 50 km lead complete (manure measured in stacks will be reduced by 8% for payment) : Screened through sieve of I.S. designation 16 mm-inclusive of labour	cum	552	3864	₹ 777.27	₹ 30,03,385.91	
21	2.5	Rough dressing the trenched ground including breaking clods	sqm	5500	38500	₹ 2.14	₹ 82,477.79	HORTICULTURE
22	2.9	Mixing earth and manure in the required proportion specified or directed by the Officer-in-charge	sqm	5500	38500	₹ 52.22	₹ 20,10,423.17	HORTICULTURE
23	2.7	Fine dressing of the ground.	sqm	3000	21000	₹ 5.28	₹ 1,10,783.55	HORTICULTURE
24	2.10	Grassing with selection No. 1 grass including watering and maintenance of the lawn for 30 days or more till the grass forms a thick lawn, free from weeds and fit for mowing including supplying good earth, if needed (the grass and good earth shall be paid for separately). In rows 5 cm apart in both directions	sqm	2000	14000	₹ 25.07	₹ 3,50,910.23	HORTICULTURE

25	2.11	Renovating lawns including weeding, cheeling the grass, forking the ground, top dressing with sludge or manure, mixing the same with forked soil, watering and maintaining the lawn for 30 days or more till the grass forms a thick lawn free from weeds and fit for mowing and disposal of rubbish as directed, including supplying good earth if needed but excluding the cost of sludge or manure (the good earth shall be paid for separately).	sqm	2000	14000	₹ 49.09	₹ 6,87,199.19	HORTICULTURE
26	OD	Provision of ground covers of hight not less than 8 cm	sqm	1000	7000	₹ 70.14	₹ 4,90,985.25	
27	OD	providing Healthy shrubs of height not less than 30 cm.	no	750	5250	₹ 292.25	₹ 15,34,328.91	
28	OD	Providing of Healthy trees to site with height not less than 175 cm.	no	200	1400	₹ 3,507.04	₹ 49,09,852.50	
29	2.13	Preparation of beds for hedging and shrubbery by excavating 60 cm deep and trenching the excavated base to a further depth of 30 cm, refilling the excavated earth after breaking clodsand mixing with sludge or manure in the ratio of 8:1 (8 parts of stacked volume of earth after reduction by 20% : one part of stacked volume of sludge or manure after reduction by 8%), flooding with water, filling with earth if necessary, watering and finally fine dressing, leveling etc. including stacking and disposal of materials declared unserviceable and surplus earth by spreading and leveling as directed, within a lead of 50 m, lift up to 1.5 m complete (cost of sludge, manure or extra earth to be paid for separately).	sqm	2000	14000	₹ 318.53	₹ 44,59,484.12	HORTICULTURE
30	2.14	Digging holes in ordinary soil and refilling the same with the excavated earth mixed with manure or sludge in the ratio of 2:1 by volume (2 parts of stacked volume of earth after reduction by 20% : 1 part of stacked volume of manure after reduction by 8%) flooding with water, dressing including removal of rubbish and surplus earth, if any, with all leads and lifts (cost of manure, sludge or extra good earth if needed to be paid for separately)- Holes 1.2 m dia and 1.2 m deep	no	200	1400	₹ 496.00	₹ 6,94,400.00	HORTICULTURE
31	2.16	Providing and fixing M.S. flat iron tree guard 60 cm dia and 2 m high, above ground consisting 4 nos 25 x 6 mm, 2.25 m long and 8 nos 25 x 3 mm 2 m long verticals M.S. flats, riveted to 3 nos 25 x 6 mm M.S. flat iron rings in two halves, fixing together at site with required six numbers of 8 mm dia and 30 mm long bolts, including painting two coats with synthetic enamel paint of approved brand and manufacture over a coat of primer. One name plate of 1 mm thick M.S. sheet of size 250x100 mm shall be welded to the tree guard near the middle height and lettered CPWD / PWD/ any other approved name. The tree guard shall be suitably fixed to the ground by embedding four legs of tree guard in pits of suitable dia and to a depth of 25 cm, refilling the pits with soil and ramming, complete in all respect as per satisfaction and direction of Officer-in-charge.	no	200	1400	₹ 4,295.00	₹ 60,13,000.00	DSR
32	OD/LMR	Bollard lights	no	200	1400	₹ 7,000.00	₹ 98,00,000.00	
33	OD/LMR	Spike lights	no	200	1400	₹ 1,500.00	₹ 21,00,000.00	
34	OD/LMR	Flood lights	no	20	140	₹ 5,000.00	₹ 7,00,000.00	
35	OD/LMR	Solar powered Paedestrian Lamp	no	100	700	₹ 35,000.00	₹ 2,45,00,000.00	

36	OD	Complete plumbing system including digging of plumbing trenches, laying to plumbing lines and fixtures of required diameter, pumps, sprinklers for lawn amd ground cover areas, drip irrigation for tress and shrubs etc complete as per the requirements of the engineer in charge.	rm	1500	10500	₹ 1,136.18	₹ 1,19,29,886.46	
37	OD/LMR	kiosks	no	5	35	100000.00	₹ 35,00,000.00	
38	OD/LMR	bill bords/advertisement	no	30	210	10000.00	₹ 21,00,000.00	
39	OD/LMR	cycles	no	4	28	10000.00	₹ 2,80,000.00	
40	OD/LMR	EV chargers	no	0.25	1.75	2500000.00	₹ 43,75,000.00	
41	OD/LMR	Solar tree	no	2	14	1000000.00	₹ 1,40,00,000.00	
42	OD/LMR	Benches(gabion walls	cum	21.6	151.2	910.00	₹ 1,37,592.00	
43	OD/LMR	wooden planks	cum	0.5	3.5	75000.00	₹ 2,62,500.00	
44	OD/LMR	led strip	sqm	195	1365	1000.00	₹ 13,65,000.00	
45	OD/LMR	Benches	cum	8.25	57.75	10087.00	₹ 5,82,524.25	
46	OD/LMR	wooden planks	cum	0.5	3.5	75000.00	₹ 2,62,500.00	
47	OD/LMR	Tree Grates (1.2m x1.2m)	no	200	1400	3500.00	₹ 49,00,000.00	
48	OD/LMR	Drain grates	no	1000	7000	1500.00	₹ 1,05,00,000.00	
49	OD/LMR	TOILETS	no	2	14	200000.00	₹ 28,00,000.00	
50	ls	TOE WALL	cum	200	1400	10087.00	₹ 1,41,21,800.00	
51	OD/LMR	SIGNAGES	no	30	210	3000.00	₹ 6,30,000.00	
52	OD/LMR	Maps showing land marks	no	2	14	20000.00	₹ 2,80,000.00	
53	OD/LMR	DUST BIN	no	35	245	10000.00	₹ 24,50,000.00	
54	ls	GYM	LS	1	7	1000000.00	₹ 70,00,000.00	
55	ls	KIDS PLAY	LS	1	7	2000000.00	₹ 1,40,00,000.00	
56	OD/LMR	wire mesh fencing	m	1200	8400	2195.81	₹ 1,84,44,828.18	
57	OD/LMR	dry well	No	5	35	30000.00	₹ 10,50,000.00	
58	OD/LMR	Sculpture	LS	1	1	5000000.00	₹ 50,00,000.00	
46	LS	Unforseen items	LS	1	7	2655498.29	₹ 1,85,88,488.02	
		Total for 7km					**₹ 50,00,00,000.00**	

Sl.No	code	Description	Unit	Qty	Rate	Amount
1	2.31	Clearing jungle including uprooting of rank vegetation, grass, brush wood, trees and saplings of girth up to 30 cm measured at a height of 1 m above ground level and removal of rubbish up to a distance of 50 m outside the periphery of the area cleared				
		LABOUR				
	114	Beldar	Day	1.08	558	602.64
	115	Coolie	Day	0.6	558	334.8
	All canals	1	LS	50000000	558	
		TOTAL			1116	937.44
		Add 1 % Water charges				9.37
		TOTAL				946.81
		Add 14.05% GST				133.03
		TOTAL				1079.84
		Add 10 % Contractor's profit and 5% overheads				161.98
		TOTAL				1241.82
		Add 1% Cess				12.42
		Add 39.89% cost index				500.31
		Cost for 100sqm				1754.55
		Say for 1 sqm				**18**
2	2.1	Earth work in surface excavation not exceeding 30 cm in depth but exceeding1.5 m in width as well as 10 sqm on plan including disposal of excavated earth up to 50 m and lift up to 1.5 m, preserving by planting grass, and regular watering until the grass takes roots, coveying and spreading over the bioremedial zone as per directions of Engineer in Incharge: 2.1.1 All kinds of soil				
		Cost for 100 Sqm				
		LABOUR				
	114	Beldar	Day	6.8	558	3794.4
	115	Coolie	Day	5.6	558	3124.8
		TOTAL				6919.20
		Add 1 % Water charges				69.19
		TOTAL				6988.39
		Add 14.05% GST				981.87
		TOTAL				7970.26
		Add 10 % Contractor's profit and 5% overheads				1195.54
		TOTAL				9165.80
		Add 1% Cess				91.66
		Add 39.89% cost index				3692.80
		Cost for 100sqm				12950.26
		Say for 1 sqm				**130**
4	OD	Supplying and stacking of good earth at site including royalty and carriage upto 50 km lead complete (earth measured in stacks will be reduced by 20% for payment).				

		LABOUR				
	114	Beldar	Day	0.366	558	204.228
	101	Bhisti	Day	0.25	617	154.25
	0979	Royalty for good earth	Cum	1	40	40
	2241	Carriage of good earth by mechanical transport	Cum	1	129.71	129.71
	0017	Hire and running charges of tipper	Day	0.055	1700	93.5
		TOTAL				**622**
		Add 1 % Water charges				6.22
		TOTAL				627.90
		Add 14.05% GST				88.22
		TOTAL				716.13
		Add 10 % Contractor's profit and 5% overheads				107.42
		TOTAL				823.54
		Add 1% Cess				8.24
		Add 39.89% cost index				331.80
		Say for 1 cum				**1164**
6	OD	Supplying and stacking at site dump manure from approved source, including carriage upto 50 km lead complete (manure measured in stacks will be reduced by 8% for payment) : Screened through sieve of I.S. designation 16 mm-inclusive of labour				
		Material				
	2242	Carriage of dump manure by mechanical transport	cum	1	112.79	112.79
		LABOUR				
	114	Beldar	Day	0.38	558	212.04
	9999	Sundries	L.S	2.73	2	5.46
	017	Hire and running charges of tipper	Day	0.05	1700	85
		TOTAL				415.29
		Add 1 % Water charges				4.15
		TOTAL				419.44
		Add 14.05% GST				58.93
		TOTAL				478.37
		Add 10 % Contractor's profit and 5% overheads				71.76
		TOTAL				550.13
		Add 1% Cess				5.50
		Add 39.89% cost index				221.64
		Cost for 1 cum				777.27
		Say for 1 cum				**777**
7	2.5	Rough dressing the trenched ground including breaking clods				
		LABOUR				
	114	Beldar	Day	0.2	558	111.6
	9999	Sundries	L.S	1.43	2	2.86
		TOTAL				114.46
		Add 1 % Water charges				1.14
		TOTAL				115.60

		Add 14.05% GST				16.24
		TOTAL				131.85
		Add 10 % Contractor's profit and 5% overheads				19.78
		TOTAL				151.62
		Add 1% Cess				1.52
		Add 39.89% cost index				61.09
		Cost for 100 Sqm				214.23
		Say for 1 sqm				**2**
8	2.9	Mixing earth and manure in the required proportion specified or directed by the Officer-in-charge				
		LABOUR				
	114	Beldar	Day	0.25	558	139.5
	115	Coolie	L.S	0.25	558	139.5
		TOTAL				279.00
		Add 1 % Water charges				2.79
		TOTAL				281.79
		Add 14.05% GST				39.59
		TOTAL				321.38
		Add 10 % Contractor's profit and 5% overheads				48.21
		TOTAL				369.59
		Add 1% Cess				3.70
		Add 39.89% cost index				148.90
		Cost for 10 Cum				522.19
		Say for 1 cum				**52**
9	2.7	Fine dressing of the ground.				
		LABOUR				
	114	Beldar	Day	0.5	558	279
	9999	Sundries	L.S	1.43	2	2.86
		TOTAL				281.86
		Add 1 % Water charges				2.82
		TOTAL				284.68
		Add 14.05% GST				40.00
		TOTAL				324.68
		Add 10 % Contractor's profit and 5% overheads				48.70
		TOTAL				373.38
		Add 1% Cess				3.73
		Add 39.89% cost index				150.43
		Cost for 100 Sqm				527.54
		Say for 1 Sqm				**5**
10	2.10	Grassing with selection No. 1 grass including watering and maintenance of the lawn for 30 days or more till the grass forms a thick lawn, free from weeds and fit for mowing including supplying good earth, if needed (the grass and good earth shall be paid for separately). In rows 5 cm apart in both directions				
		LABOUR				
	114	Beldar	Day	0.8	558	446.4

	115	Coolie	Day	1.6	558	892.8
	9999	Sundries	L.S	6.76	2	13.52
		TOTAL				1339.20
		Add 1 % Water charges				13.39
		TOTAL				1352.59
		Add 14.05% GST				190.04
		TOTAL				1542.63
		Add 10 % Contractor's profit and 5% overheads				231.39
		TOTAL				1774.03
		Add 1% Cess				17.74
		Add 39.89% cost index				714.74
		Cost for 100 Sqm				2506.50
		Say for 1 Sqm				**25**
11	2.11	Renovating lawns including weeding, cheeling the grass, forking the ground, top dressing with sludge or manure, mixing the same with forked soil, watering and maintaining the lawn for 30 days or more till the grass forms a thick lawn free from weeds and fit for mowing and disposal of rubbish as directed, including supplying good earth if needed but excluding the cost of sludge or manure (the good earth shall be paid for separately).				
		LABOUR				
	114	Beldar	Day	2.7	558	1506.6
	115	Coolie	Day	2	558	1116
	9999	Sundries	L.S	2.73	2	5.46
		TOTAL				2622.60
		Add 1 % Water charges				26.23
		TOTAL				2648.83
		Add 14.05% GST				372.16
		TOTAL				3020.99
		Add 10 % Contractor's profit and 5% overheads				453.15
		TOTAL				3474.13
		Add 1% Cess				34.74
		Add 39.89% cost index				1399.69
		Cost for 100 Sqm				4908.57
		Say for 1 Sqm				**49**
12	OD	Provision of ground covers of hight not less than 8 cm				
		Plant	Each	1	60	60
		Handling Charges @ 2.5%				2
		TOTAL				61.50
		Add 14.05% GST				8.64
		Say for 1 Plant				**70.14**
13	OD	providing Healthy shrubs of height not less than 30 cm.				
		shrubs	Each	1	250	250
		Handling Charges @ 2.5%				6
		TOTAL				256.25

		Add 14.05% GST				36.00
		Say for 1 Plant				**292.25**
14	OD	Providing of Healthy trees to site with height not less than 175 cm.				
		Tree	Each	1	3000	**3000**
		Handling Charges @ 2.5%				75
		TOTAL				3075.00
		Add 14.05% GST				432.04
		Say for 1 Plant				**3507.04**
15	2.13	Preparation of beds for hedging and shrubbery by excavating 60 cm deep and trenching the excavated base to a further depth of 30 cm, refilling the excavated earth after breaking clodsand mixing with sludge or manure in the ratio of 8:1 (8 parts of stacked volume of earth after reduction by 20% : one part of stacked volume of sludge or manure after reduction by 8%), flooding with water, filling with earth if necessary, watering and finally fine dressing, leveling etc. including stacking and disposal of materials declared unserviceable and surplus earth by spreading and leveling as directed, within a lead of 50 m, lift up to 1.5 m complete (cost of sludge, manure or extra earth to be paid for separately).				
		LABOUR				
	114	Beldar	Day	1.8	558	1004.4
	115	Coolie	Day	1.25	558	697.5
		TOTAL				1701.90
		Add 1 % Water charges				17.02
		TOTAL				1718.92
		Add 14.05% GST				241.51
		TOTAL				1960.43
		Add 10 % Contractor's profit and 5% overheads				294.06
		TOTAL				2254.49
		Add 1% Cess				22.54
		Add 39.89% cost index				908.31
		Cost for 10 Cum				3185.35
		Say for 1 Cum				**319**

16	2.14	Digging holes in ordinary soil and refilling the same with the excavated earth mixed with manure or sludge in the ratio of 2:1 by volume (2 parts of stacked volume of earth after reduction by 20% : 1 part of stacked volume of manure after reduction by 8%) flooding with water, dressing including removal of rubbish and surplus earth, if any, with all leads and lifts (cost of manure, sludge or extra good earth if needed to be paid for separately)- Holes 1.2 m dia and 1.2 m deep				
		2.8.1 of SH: Earth work				
		MACHINERY				
	0020	Hydraulic Excavator	Day	0.04	7000	280
	0018	Hire and running charges	Day	0.04	5000	200
		LABOUR				
	128	Mate	Day	0.4	617	246.8
	115	Coolie	Day	2.05	558	1143.9
		TOTAL				1870.70
		Cost of 10 Cum				1870.70
		Cost of 1 Cum				187.07
		Rate as per Item Number 2.8.1	Cum	**1.36**	**187.07**	**254.42**
	9999	Refilling mixture and flooding	L.S	5.2	2	10.4
		TOTAL				264.82
		Add 1 % Water charges				2.65
		TOTAL				267.46
		Add 14.05% GST				37.58
		TOTAL				305.04
		Add 10 % Contractor's profit and 5% overheads				45.76
		TOTAL				350.80
		Add 1% Cess				3.51
		Add 39.89% cost index				141.33
		Cost for 1 hole				495.64
		Say for 1 hole				**496**

17	2.16	Providing and fixing M.S. flat iron tree guard 60 cm dia and 2 m high, above ground consisting 4 nos 25 x 6 mm, 2.25 m long and 8 nos 25 x 3 mm 2 m long verticals M.S. flats, riveted to 3 nos 25 x 6 mm M.S. flat iron rings in two halves, fixing together at site with required six numbers of 8 mm dia and 30 mm long bolts, including painting two coats with synthetic enamel paint of approved brand and manufacture over a coat of primer. One name plate of 1 mm thick M.S. sheet of size 250x100 mm shall be welded to the tree guard near the middle height and lettered CPWD / PWD/ any other approved name. The tree guard shall be suitably fixed to the ground by embedding four legs of tree guard in pits of suitable dia and to a depth of 25 cm, refilling the pits with soil and ramming, complete in all respect as per satisfaction and direction of Officer-in-charge.				
		Cost for 1 tree guard				
		MATERIAL				
	1008	Flats up to 10 mm in thickness	quintal	0.29	4500	1305
	9999	Rivets 36 Nos	L.S	40.3	2	80.6
	9999	G.I. bolts and nuts	L.S	8.06	2	16.12
	2205	carriage of Steel	tonne	0.029	92.24	2.67496
		LABOUR				
	103	Blacksmith 2nd class	Day	2	679	1358
	114	Beldar	Day	1	558	558
	13.50.3	Applying priming coat				
		MATERIAL				
	4202	Red oxide Zinc chromate primer	Litre	0.54	110	59.4
	9999	Carriage	L.S	0.52	2	1.04
		LABOUR				
	131	Painter	Day	0.24	679	162.96
	115	Coolie	Day	0.24	558	133.92
	9999	Brushes, sand paper including sundries	L.S	10.79	2	21.58
		TOTAL				378.90
		Cost for 10 sqm				378.90
		Say for 1 Sqm				**38**
	13.61.1	Painting with synthetic enamel paint of approved brand and manufacture to give an even shade:				
		MATERIAL				
	833	Synthetic enamel paint in black or chocolate shade	Litre	1.16	170	197.2
	9999	Materials for filling in holes and cracks (putty etc.)	L.S	5.33	2	10.66
	9999	Carriage	L.S	1.43	2	2.86
		LABOUR				
	131	Painter	Day	0.54	679	366.66
	115	Coolie	Day	0.54	558	301.32
	9999	Brushes, sand paper etc	L.S	6.76	2	13.52
	9999	Sundries	L.S	8.06	2	16.12
		TOTAL				908.34
		Cost for 10 sqm				908.34

		Say for 1 Sqm				**91**
		Rate as per Item Number 13.50.3 of SH: Finishing	Sqm	**1.84**	**37.9**	**69.736**
		Rate as per Item Number 13.61.1 of SH: Finishing	Sqm	**1.84**	**90.8**	**167.072**
	114	Beldar	Day	0.13	558	72.54
	9999	T & P Sundries	L.S	0.67	2	1.34
		TOTAL				3631.08
		Add 1 % Water charges				36.31
		TOTAL				3667.39
		Add 14.05% GST				515.27
		TOTAL				4182.66
		Add 10 % Contractor's profit and 5% overheads				627.40
		TOTAL				4810.06
		Add 1% Cess				48.10
		Add 39.89% cost index				1937.92
		Cost for 1 tree guard				6796.08
		Say for 1 tree guard				**4295**
18	OD	Supplying and stacking of full size coconut poles				
		MATERIAL				
		cost of full size coconut poles (6m- 9m) avg diameter .25m	Nos	36	825	29700
		conveying of coconut poles ((3.14 x .25X.25x 7.5)/4)= .3682	L.S	8.84	387.6	3426.384
		Sawing Charges for half split(@4.3 sawers per 10sqm)	Sqm	27	254.9	6882.3
		LABOUR				
		Man for stacking & Taking measurements	Nos	18	452	8136
		TOTAL				48144.68
		Add 1 % Water charges				481.45
		TOTAL				48626.13
		Add 10 % Contractor's profit and 5% overheads				7293.92
		Cost for 10 m				55920.05
		Say for 1m				**5592**
19	OD	**Driving down cocounut post(avg length=7m)**				
		Heavy load man mazdoor for handlng and fixing in lines and levels	nos	96	514.8	49420.8
		cost of full size coconut poles- 6m- 9m , avg. diameter .25m	nos	96	650	62400
		Pile drivers	nos	96	136.8	13132.8
		Hire and labour charges for fixing platform and other appliances	L.S	24	45.5	1092
		Hire charges for rope, pulley, monkeys & other appliances	L.S	24	45.5	1092
		Hire for wooden scandlings and coir for tieing the top of wooden piles	L.S	24	39	936
		Nut & Bolts	L.S	24	200	4800
		TOTAL				132873.60
		Cost for 10 m				132873.60
		Say for 1m				**13287**

20	OD	**Board walk**				
		thembakam wood/ anjili	cum	4.48	71415	319939.2
		Conveyance of material timber materials by Lorry for over 50 km	cum	4.48	486	2177.28
		Kiln seasoning of timber	cum	4.48	1020	4569.6
		Sawing Charges for cut into pieces of 20x30cmx10m size (@6 sawers per 10sqm)	Sqm	24	351.59	8438.16
		Sawing Charges for cut into pieces of 20x30cmx10m size (@5sawers per 10sqm)	Sqm	72	292.9931034	21095.50345
		Loading & Unloading of material for wooden beams and slabs	per load	1	1200	1200
		carpenters for fixing the board walk with nuts & bolts	per person	6	1200	7200
		Nut & Bolts	Ls	2	10000	20000
		Applying thermite coating		2	750	1500
		TOTAL				386119.74
		Cost for 10 m				386119.74
		Say for 1m				**38612**
21	OD	**Fencing for bioremediation zone**				
		bamboo plole of diameter not less than .06m for fencing along the cannal edge to contain the bioremendial plants in place				
		bamboo vertical post of 3 m length	nos	20	69.5	1390
		bamboo splits - horizontal connectors of length 1m	nos	40	11.58	463.2
		Nut & Bolts	LS	2	200	400
		carpenters for fixing the board walk	per person	1	1200	1200
		TOTAL				3453.20
		Cost for 10 m				3453.20
		Say for 1m				**345**
31	4.1.2	1:1½:3 (1 Cement: 1½ coarse sand(zone-III) : 3 graded stone aggregate 20 mm nominal size)				
		Cost for 1 cum.				
		MATERIAL				
	0295	Stone Aggregate(single size):20 mm nominal size	Cum	0.57	1350	769.50
	0297	Stone Aggregate(single size): 10 mm nominal size	Cum	0.28	1350	378.00
	2202	Carriage of Stone aggregate below 40 mm nominal size	Cum	0.85	103.77	88.20
	0982	Coarse sand (zone III)	Cum	0.425	1350	573.75
	2203	Carriage of Coarse sand	Cum	0.425	103.77	44.10
	0367	Portland Cement (0.2833 cum)	Tonne	0.4	4940	1976.00
	2209	Carriage of Cement	Tonne	0.4	92.24	36.90
		LABOUR				0.00
	0155	Mason (average)	Day	0.1	709	70.90
	0114	Beldar	Day	1.63	558	909.54
	0101	Bhisti	Day	0.7	617	431.90
	0002	Hire charges of Concrete Mixer 0.25 to 0.40 cum with hooper	Day	0.07	800	56.00
	0012	Vibrator(Needle type 40mm)	Day	0.07	370	25.90
	9999	Sundries	L.S	14.3	2	28.60

		TOTAL				5389.29
		Add 1 % Water charges				53.89
		TOTAL				5443.19
		Add 14.05% GST				764.77
		TOTAL				6207.95
		Add 10 % Contractor's profit and 5%overheads				931.19
		TOTAL				7139.15
		Add 1% Cess				71.39
		Add 39.89% cost index				2876.28
		Cost for 1 cum.				10086.82
		Say for 1 cum				**10087**
29	OD	Construction of granular sub-base by providing graded material, spreading in uniform layers with motor grader on prepared surface, mixing by mix in place method with rotavator at OMC, and compacting with vibratory roller to achieve the desired density, complete as per clause 401. Lead up to 50 m and lift upto 1.5 m. Mix in Place Method				
		Cost fot 300 cum				
		LABOUR				
	L-12	Mate	Day	0.48	750	360.00
	L-15	Mazdoor/Dresser/Sinker (skilled)	Day	2	700	1400.00
	L-13	Mazdoor Un skilled	Day	10	700	7000.00
		MATERIAL				
	M-015	26.5 mm to 9.5 mm	Cum	134.4	2000	268800.00
	M-017	9.5 mm to 2.36 mm	Cum	96	2000	192000.00
	M-020	2.36 mm below	Cum	153.6	2000	307200.00
	MR177	Water	Kilo litre	18	16	288.00
		Machinery				
	MR389	Motor Grader	Hour	6	3500	21000.00
	MR258	Vibratory Roller	Hour	6	2500	15000.00
	MR253	Tractor with Rotevator	Hour	12	600	7200.00
	MR259	Water Tank	Hour	3	795	2385.00
	0017	Hire and running charges of tipper	Day	2	4000	8000.00
		TOTAL				830633.00
		Add 1 % Water charges				8306.33
		TOTAL				838939.33
		Add 14.05% GST				117870.98
		TOTAL				956810.31
		Add 10 % Contractor's profit and 5% overheads				143521.55
		TOTAL				1100331.85
		Add 1% Cess				11003.32
		Cost for 300 cum				1111335.17
		Say for 1 cum				**3704**

30	16.69	Providing and laying at or near ground level factory made kerb stone of M-25 grade cement concrete in position to the required line, level and curvature, jointed with cement mortar 1:3 (1 cement: 3 coarse sand), including making joints with or without grooves (thickness of joints except at sharp curve shall not to morethan 5mm), including making drainage opening wherever required complete etc as per direction of Engineer-in-charge (length of finished kerb edging shall be measured for payment). (Precast C.C. kerb stone shall be approved by Engineerin- charge).				
		Cost of 7.50 cum				
	3.8	Cement mortar 1:3 (1 cement : 3 coarse sand)				
		Cost for 1 cum				
		MATERIAL				
	0367	Portland Cement	Tonne	0.51	4940	2519.40
	2209	Carriage of Cement	Tonne	0.51	92.24	47.04
	0982	Coarse sand (zone III)	Cum	1.07	1350	1444.50
	2203	Carriage of Coarse sand	Cum	1.07	103.77	111.03
		LABOUR				
	0114	Beldar	Day	0.75	558	418.50
	0101	Bhisti	Day	0.07	558	39.06
	9999	Hire and running charges of mechanical mixer	L.S	26.91	2	53.82
	9999	Sundries	L.S	13.52	2	27.04
		Cost for 1 cum				4660.40
		Rate as per Item Number 3.8	Cum	0.073	4660	340.21
		MATERIAL				
	8686	Precast C.C. Kerb stone	Cum	7.41	5500	40755.00
		LABOUR				
	0123	Mason (brick layer) 1st class	Cum	2.5	738	1845.00
	124	Mason (brick layer) 2nd class	Day	2.5	679	1697.50
	0114	Beldar	Day	2.5	558	1395.00
	0115	Coolie	Day	1.65	558	920.70
		TOTAL				46953.41
		Add 1 % Water charges				469.53
		TOTAL				47422.94
		Add 14.05% GST				6662.92
		TOTAL				54085.87
		Add 10 % Contractor's profit and 5% overheads				8112.88
		TOTAL				62198.75
		Add 1% Cess				621.99
		Add 39.89% cost index				25059.19
		Cost of 7.50 cum				87879.92
		Cost of 1 Cum				**11717**

31	OD	Providing and laying stamped concrete(as per approved design) of approved make in colours and shades in for outdoor floors such as footpath, courtyard, multi modals location etc. laid in 100mm thick layers and patterns including all overheads complete as per direction of Engineer in charge.				
		Cost for 10 sqm				
		MATERIAL				
	0295	Stone Aggregate (Single size) 20 mm	Cum	0.1	1350	135
	0297	Stone Aggregate (Single size) : 10 mm nominal size	Cum	0.035	1350	47.25
	2202	Carriage of Stone aggregate	Cum	0.0135	103.77	1.40
	0982	Coarse sand (zone III)	Cum	0.065	1350	87.75
	2203	Carriage of Coarse sand	Cum	0.065	103.77	6.75
	0367	Portland Cement	Tonne	0.055	4940	271.70
	2209	Portland Cement	Tonne	0.055	92.24	5.07
	0876	Colour powder Pigment	KG	4.5	56	252.00
		LABOUR				
	0124	Mason	Day	0.3	679	203.70
	0114	Beldar	Day	0.35	558	195.30
	0101	Bhisti	Day	0.3	558	167.40
	0127	Driver (for Road Roller, Concrete Mixer, Truck etc.)	Day	0.01	738	7.38
	0002	Hire charges of Concrete Mixer	Day	0.01	800	8.00
	9999	Sundries	L.S	18	2	36.00
		TOTAL				1424.70
		Add 1 % Water charges				14.25
		TOTAL				1438.95
		Add 14.05% GST				202.17
		TOTAL				1641.12
		Add 10 % Contractor's profit and 5% overheads				246.17
		TOTAL				1887.29
		Add 1% Cess				18.87
		Add 39.89% cost index				760.37
		Cost for 10 sqm				2666.53
		Cost for 1 sqm				**266.65**
32	16.90	Providing and laying tactile tile (for vision impaired persons as per standards) of size 300x300x9.8mm having with water absorption less than 0.5% and conforming to IS: 15622 of approved make in all colours and shades in for outdoor floors such as footpath, court yard, multi modals location etc., laid on 20mm thick base of cement mortar 1:4 (1 cement : 4 coarse sand) in all shapes & patterns including grouting the joints with white cement mixed with matching pigments etc. complete as per direction of Engineer-in- Charge				
		Cost for 1 sqm.				
	3.9	Cement mortar 1:4 (1 cement : 4 coarse sand).				
	0367	Portland Cement	Tonne	0.38	4940	1877.20

	2209	Carriage of Cement	Tonne	0.38	92.24	35.05
	0982	Coarse sand (zone III)	Cum	1.07	1350	1444.50
	2203	Carriage of Coarse sand	Cum	1.07	103.77	111.03
		LABOUR				
	0114	Beldar	Day	0.75	558	418.50
	0101	Bhisti	Day	0.07	558	39.06
	9999	Hire and running charges of mechanical mixer	L.S	26.91	2	53.82
	9999	Hire and running charges of mechanical mixer	L.S	13.52	2	27.04
		Cost for 1 Cum				4006.21
		Rate as per Item No.3.9	Cum	0.024	4006.2051	96.15
		MATERIAL				
	7893	Tactile tile	Sqm	1	1000	1000.00
	9977	Carriage	L.S	6.24	2	12.48
	9999	Sundries	L.S	3.64	2	7.28
	0367	Portland Cement	Tonne	0.0033	4940	16.30
		LABOUR				
	0123	Mason (brick layer) 1st class	Day	0.2	738	147.60
	0115	Coolie	Day	0.2	558	111.60
	9999	Sundries	L.S	26.91	2	53.82
		TOTAL				1445.23
		Add 1 % Water charges				14.45
		TOTAL				1459.68
		Add 14.05% GST				205.09
		TOTAL				1664.77
		Add 10 % Contractor's profit and 5% overheads				249.72
		TOTAL				1914.48
		Add 1% Cess				19.14
		Add 39.89% cost index				771.32
		Cost for 1 sqm				**2704.95**
33	4.9	Precasting and placing in position 125 mm dia Bollards 600 mm high of required shape, including providing M.S. Pipe Sleeve 50 mm dia 300 mm long in the Bollard and M.S. Pipes 40 mm dia and 450 mm long with 150x150x6mm M.S. plate welded at bottom and embedded 150 mm in cement concrete 1:3:6 (1 Cement : 3 coarse sand : 6 graded stone aggregate 20 mm nominal size), including necessary excavation of size 250 x 250 x 450 mm deep for the same in bitumen/concrete pavement at specified spacing.				
		Cost for one bollard				
	5.1.3	1:2:4 (1 cement : 2 coarse sand : 4 graded stone aggregate 20 mm nominal size)				
		MATERIAL				
	0295	Stone Aggregate(single size):20 mm nominal size	Cum	0.67	1350	905
	0297	Stone Aggregate(single size): 10 mm nominal size	Cum	0.22	1350	297
	2202	Carriage of Stone aggregate	Cum	0.89	103.77	92
	0982	Coarse sand (zone III)	Cum	0.445	1350	601

	2203	Carriage of Coarse sand	Cum	0.445	103.77	46
	0367	Portland Cement (0.2225 cum	Tonne	0.32	4940	1581
	2209	Carriage of Cement	Tonne	0.32	92.24	30
		LABOUR				
	0155	Mason (average)	Day	0.17	709	120.53
	114	Beldar	Day	2	558	1116
	101	Bhisti	Day	0.9	617	555
	0002	Hire charges of Concrete Mixer	Day	0.07	800	56.00
	0012	Vibrator(Needle type 40mm)	Day	0.07	370	25.90
	9999	Sundries	L.S	14.3	2	28.60
		TOTAL				5453.43
		Rate as per Item no. 5.1.3	Cum	0.007	5453.42975	**38.174**
	5.9.1	Centering and shuttering including strutting, propping etc. and removal of form				
		Contact area = 10.8 sqm				
		MATERIAL				
	7319	wall form panel 1250x500 mm	Each	0.34	860	292.40
	7326	Corner angle 45x45x5 mm 1.50 m long	Each	0.085	240	20.40
	7327	100 mm channel shoulder 2.5 m lon	Each	0.17	910	154.70
	7328	Double clip (bridge clip)	Each	0.34	76	25.84
	7329	Single clip	Each	0.17	59	10.03
	7330	M.S. Tube 40 mm dia	metre	0.2295	215	49.34
	9999	Assembly nuts & bolts	L.S	22.1	2	44.20
	9977	Carriage	L.S	78	2	156.00
		LABOUR				
	0116	Fitter (grade 1	Day	0.75	738	553.50
	0114	Beldar	Day	1.5	558	837.00
	9999	Shuttering oil	L.S	52	2	104.00
	9999	Sundries	L.S	26	2	52.00
		TOTAL				2299.41
		Cost 1 sqm				212.91
		Rate as per Item no. 5.9.1	Sqm	**0.24**	**212.91**	**51.10**
	10.1	Structural steel work in single section, fixed with or without connecting plate, including cutting, hoisting, fixing in position and applying a priming coat of approved steel primer all complete.				
		cost for one qunital				
		MATERIAL				
	1007	Structurals such as tees,angles channels and R.S. joists	Quintal	1.05	4600.00	4830
	2205	Carriage of Steel	tonne	0.105	92.24	10
		LABOUR				
	0116	Fitter (grade 1)	day	0.5	738	369
	0103	Blacksmith 2nd class	day	0.75	679	509
	0114	Beldar	day	1	558	558
		Rate as per Item Number 13.50.3	sqm	3	38	114
	9999	Sundries	L.S	20.67	2	41
		TOTAL				6431
		Cost for one qunital				6431
		Cost for 1 kg				64
		Rate as per Item no.10.1	Kg	**3.68**	**64.31**	**236.66**
	2.8.1	**Rate as per Item no. 2.8.1**	cum	**0.03**	**187.07**	**5.61**
	4.1.5	1:3:6 (1 Cement : 3 coarse sand (zone-III) : 6 graded stone aggregate 20 mm nominal size)				

		cost for 1 cum				
		MATERIAL				
	0295	Stone Aggregate (Single size) : 20 mm nominal size	cum	0.7	1350	945
	0297	Stone Aggregate (Single size) : 10 mm nominal size	cum	0.24	1350	324
	2202	Carriage of Stone aggregate below 40 mm nominal size	cum	0.94	103.77	97.5438
	0982	Coarse sand (zone III)	cum	0.47	1350	634.5
	2203	Carriage of Coarse sand	cum	0.47	103.77	48.7719
	0367	Portland Cement(0.15674 cum)	tonne	0.22	4940	1086.8
	2209	Carriage of Cement	tonne	0.22	92.24	20.2928
		LABOUR				
	0155	Mason (average)	day	0.1	709	70.9
	0114	Beldar	day	1.63	558	909.54
	0101	Bhisti	day	0.7	617	431.9
	0002	Hire charges of Concrete Mixer	day	0.07	800	56
	0012	Vibrator(Needle type 40mm)	day	0.07	370	25.9
	9999	Sundries	L.S	13.52	2	27.04
		TOTAL				4678.19
		cost for 1 cum				4678.19
		Rate as per Item no. 4.1.5	cum	**0.03**	**4678.19**	**140.35**
	5.23	Smooth finishing of the exposed surface of R.C.C. work with 6 mm thick cement mortar 1:3 (1 Cement : 3 fine sand).				
		cost for 10sqm				
		MATERIAL				
	3.3	Cement mortar 1:3 (1 cement : 3 fine sand).				
		MATERIAL				
		cost for 1 cum				
	0367	Portland Cement	tonne	0.51	4940	2519.4
	2209	Carriage of Cement	tonne	0.51	103.77	52.9227
	0983	Fine sand (zone IV)	Cum	1.07	900	963
	2261	Carriage of Fine sand	Cum	1.07	103.77	111.0339
		LABOUR				
	0114	Beldar	day	0.75	558	418.5
	0101	Bhisti	day	0.07	617	43.19
	9999	Hire and running charges of mechanical mixer	L.s	26.91	2	53.82
	9999	Sundries	L.s	13.52	2	27.04
		Cost for 1 cum				4188.91
		Rate as per item No 3.3 of SH: Mortars	cum	**0.072**	**4188.9066**	**301.60**
	0155	Mason (average)	day	0.51	709	361.59
	0115	Coolie	day	0.75	558	418.5
	0101	Bhisti	day	0.92	617	567.64
	9999	Extra for removing burrs, cleaning with wire brushes pock marking with pointed tool etc. complete	L.s	13.39	2	26.78
	9999	Scaffolding and Sundries	L.s	11.7	2	23.40
		TOTAL				1699.51
		cost for 10sqm				1699.51
		Say for 1 sqm				170
		Rate as per Item no. 5.23	sqm	**0.25**	**170**	**43**
	9988	Carriage and fixing charges	L.s	13	2	26
		TOTAL				**540**

		Add 1 % Water charges				5.40
		TOTAL				545.79
		Add 14.05% GST				76.68
		TOTAL				622.48
		Add 10 % Contractor's profit and 5% overheads				93.37
		TOTAL				715.85
		Add 1% Cess				7.16
		Add 39.89% cost index				288.41
		Cost for one bollard				1011.42
		Say for 1 bollard				**1011**
34	OD	Complete plumbing system including digging of plumbing trenches, laying to plumbing lines and fixtures of required diameter, pumps, sprinklers for lawn amd ground cover areas, drip irrigation for tress and shrubs etc complete as per the requirements of the engineer in charge.				
		cost for 10 meter				
		MATERIAL				
	8304	3240 mm PE-AL-PE Composite pressure pipe	Metre	10	360	3600
		50% for all fittings				1800
		LABOUR				
	116	Fitter(grade1)	Day	0.16	738	118.08
	114	Beldar	Day	0.33	558	184.14
	115	Coolie	Day	0.66	558	368.28
		TOTAL				6070.5
		Add 1 % Water charges				60.71
		TOTAL				6131.21
		Add 14.05% GST				861.43
		TOTAL				6992.64
		Add 10 % Contractor's profit and 5% overheads				1048.90
		TOTAL				8041.54
		Add 1% Cess				80.42
		Add 39.89% cost index				3239.85
		Cost for 10 meter				11361.80
		Cost for 1 meter				**1136.18**

35		Bollard lights	nos	1	7000	7000.00
36		Spike lights	nos	1	1500	1500.00
37		Flood lights	nos	1	5000	5000.00
38		Solar powered Paedestrian Lamp	nos	1	35000	35000.00
	14.23	Pumping out water caused by springs, tidal or river seepage, broken water mains or drains and the like.				
		Details for 10.91 kilolitre				
		Pumping hours 3 hrs. or 0.375 days				
	0011	Hire charges of Pumpset of capacity	day	0.375	700	262.50
	0114	Beldar	day	2	558	1116.00
		TOTAL				1378.50
		Add 1 % Water charges				13.79
		TOTAL				1392.29
		Add 14.05% GST				195.62
		TOTAL				1587.90
		Add 10 % Contractor's profit and 5% overheads				238.19
		TOTAL				1826.09
		Add 1% Cess				18.26
		Add 39.89% cost index				735.71
		Cost of 10.91 kilolitre				2580.06
		Cost of 1 kilolitre				**236.49**
	2.28	Preparation of mounds of various size and shape by available excavated / supplied earth in layers not exceeding 20 cm in depth, breaking clods, watering of each layer, dressing etc., lead upto 50 meter and lift upto 1.5 m complete as per direction of Officer-in-charge.				
		Details of cost for10 cum				
	0114	Beldar	day	2.2	553	1216.60
	0115	Coolie	day	3.6	553	1990.80
	0101	Bhisti	day	0.4	612	244.80
	9999	Sundries	LS	1.36	1.95	2.65
		TOTAL				3454.85
		Add 1 % Water charges				34.55
		TOTAL				3489.40
		Add 14.05% GST				490.26
		TOTAL				3979.66
		Add 10 % Contractor's profit and 5% overheads				596.95
		TOTAL				4576.61
		Add 1% Cess				45.77
		Add 39.89% cost index				1843.87
		Cost of 10.91 kilolitre				6466.24
		Cost of 1 kilolitre				**592.69**
	OD	Fencing using wire mesh				
		Details for 10 m length wall				
		MATERIAL				
	8577	Crates made of Mesh type 10x12 (D=100 mm) Zn+PVC coated. Mesh wire diameter 2.70/3.70 mm (ID/OD).	sqm	25	220	5500
	10.25.1	Structural steel including installation	kg	118.64	93.65	11110.636
		pedestal	Cum	0.432	₹ 6,678.95	2885.306455

		pcc	Cum	0.144	₹ 5,910.02	851.042414
		reinforcment	tonne	0.02592	₹ 60,229.32	1561.143916
		fixtures	ls	1	50	50
		for 10 m length				21958.12879
		for 1m				**2195.812879**

Annexure 6.1.10

Abstract Cost : Construction of Jetty and jetty Terminals

Description/ Canal	Quantity	Unit	Rate (INR)	Amount (INR)
Edappally Canal	9	Nos.	₹ 33,33,333	₹ 3,00,00,000
Thevar-Perandoor Canal	10	Nos.	₹ 33,33,333	₹ 3,33,33,333
Thevara Canal	2	Nos.	₹ 33,33,333	₹ 66,66,667
Chilavanoor Canal	9	Nos.	₹ 33,33,333	₹ 3,00,00,000
Total	**30**			**₹ 10,00,00,000**

IURWTS Kochi.WT-2024 Integrate Urban Rejuvenation and Water Transport System Kochi

DETAILED ESTIMATE

Sl No	Code	Description	Unit	No.	L	B	H	Qty	Rate (Rs)	Amount	Remarks
1	2.8.1	Earth work in excavation by mechanical means (Hydraulic excavator) / manual means in foundation trenches or drains (not exceeding 1.5 m in width or 10 sqm on plan), including dressing of sides and ramming of bottoms, lift upto 1.5 m, including getting out the excavated soil and disposal of surplus excavated soil as directed, within a lead of 50 m. All kinds of soil.									DSR
		For one jetty		1	11.8	3.7	0.75	32.745			
				1	3.38	3.4	0.75	8.619			
				1	10.95	4.07	0.75	33.424875			
								74.788875			
				30				2243.66625			
		For one Toilet		2	3.26	1.2	0.45	3.5208			
				1	3.38	1.2	0.45	1.8252			
				1	3.56	1.2	0.45	1.9224			
								5.346			
				3				16.038			
								2259.70425	₹ 352.94	₹ 7,97,545.60	
2	20.1.1	40 cm dia RCC piles M30 mix (Auger piles) to be reinforced with 9 No's 12 mm TOR bars for full length, 8mm stirrups @18 cm c/c as lateral reinforcement for the whole length as per the structural and architectural drawings etc. complete including all labour charges, machinery hire charges, cost of all materials.	RM					90.00	3384.19	₹ 3,04,577	DSR
2	2.27	Supplying and filling in plinth with sand under floors, including watering, ramming, consolidating and dressing complete									DSR
								760.39			
				-1.00	11.80	0.58	0.4	-2.71			
				-1.00	10.60	0.58	0.4	-2.44			
				-1.00	3.13	0.58	0.4	-0.72			
				-1.00	3.38	0.58	0.4	-0.78			
				-1.00	6.85	0.58	0.4	-1.58			
				-1.00	9.55	0.58	0.4	-2.20			
								-10.42			
				30.00				-312.64			
								447.76	₹ 2,732.12	12,23,322.63	
3	2.25	Filling available excavated earth (excluding rock) in trenches, plinth, sides of foundations etc. in layers not exceeding 20cm in depth, consolidating each deposited layer by ramming and watering, lead up to 50 m and lift upto 1.5 m.		1.00	11.80	0.58	0.4	2.71			
				1.00	10.60	0.58	0.4	2.44			
				1.00	3.13	0.58	0.4	0.72			
				1.00	3.38	0.58	0.4	0.78			
				1.00	6.85	0.58	0.4	1.58			
				1.00	9.55	0.58	0.4	2.20			
								10.42			
				30.00				312.64			
		For Toilet		1.00	1.50	1.20	0.8	1.44			
				1.00	3.56	0.80	1.6	4.56			
								6.00			
				3.00				17.99			
								17.99			
								330.63	307.27	1,01,591.96	
4	12.8.A.1	Plain/Reinforced Cement Concrete in Open Foundation complete as per Drawing and Technical Specifications.PCC Grade M15									PRICE
				1.00	11.60	1.40	0.1	1.62			
				2.00	0.70	1.40	0.1	0.20			
				2.00	3.60	1.40	0.1	1.01			
				2.00	10.75	1.40	0.1	3.01			
				2.00	1.27	1.40	0.1	0.36			
				2.00	4.00	3.00	0.15	3.60			
				1.00	2.40	3.00	0.15	1.08			
				1.00	4.80	2.00	0.15	1.44			
				1.00	9.55	2.60	0.15	3.72			
								16.04			
				30.00				481.14			
		For one Toilet		2.00	3.26	0.40	0.1	0.26			

				1.00	3.38	0.40	0.1	0.14			
				1.00	3.56	0.40	0.1	0.14			
								0.40			
				3.00				1.19			
								482.33	6152.10	29,67,346.81	
5	5.2.2	Reinforced cement concrete work in walls (any thickness), including attached pilasters, buttresses, plinth and string courses, fillets, columns, pillars, piers, abutments, posts and struts etc. above plinth level up to floor five level, excluding cost of centering, shuttering, finishing and reinforcement : 1:1.5:3 (1 cement : 1.5 coarse sand(zone-III) : 3 graded stone aggregate 20 mm nominal size)									price
				2.00	11.60	1.20	0.15	4.18			
				2.00	11.60	0.73	0.1	1.68			
				2.00	0.90	1.20	0.15	0.32			
				2.00	0.90	0.73	0.1	0.13			
				2.00	3.60	1.20	0.15	1.30			
				2.00	3.60	0.73	0.1	0.52			
				2.00	10.75	1.20	0.15	3.87			
				2.00	10.75	0.73	0.1	1.56			
				2.00	1.47	1.20	0.15	0.53			
				2.00	1.47	0.73	0.1	0.21			
								14.30			
				30.00				**429.05**	13018.16	55,85,416.97	
6	5.2.2	Reinforced cement concrete work in walls (any thickness), including attached pilasters, buttresses, plinth and string courses, fillets, columns, pillars, piers, abutments, posts and struts etc. above plinth level up to floor five level, excluding cost of centering, shuttering, finishing and reinforcement : 1:1.5:3 (1 cement : 1.5 coarse sand(zone-III) : 3 graded stone aggregate 20 mm nominal size)									
		For Jetty		2.00	10.15	0.25	0.5	2.54			
				1.00	10.60	0.25	0.5	1.33			
				1.00	4.55	0.25	0.5	0.57			
				1.00	3.13	0.25	0.5	0.39			
				2.00	9.55	0.25	0.5	2.39			
				1.00	2.42	0.25	0.5	0.30			
				1.00	12.00	2.00	0.5	12.00			
								19.51			
				30.00				585.38			
		For one Toilet		2.00	3.96	0.20	0.35	0.55			
				1.00	3.58	0.20	0.35	0.25			
				1.00	0.38	0.20	0.35	0.03			
				1.00	0.29	0.20	0.35	0.02			
								0.85			
				3.00				2.56			
								587.93	13018.16	76,53,777.92	
7		Lintel									
				2.00	3.80	0.22	0.1	0.17			
				2.00	1.80	0.22	0.1	0.08			
				1.00	2.03	0.12	0.1	0.02			
								0.27			
				3.00				0.81			
								0.81			
7	5.22.6	Steel reinforcement for R.C.C. work including straightening, cutting, bending, placing in position and binding all complete upto plinth level. TMT bards Fe500D	kg					**81,423.28**	116.81	95,10,902.52	
8	10.2	Structural steel work riveted, bolted or welded in built up sections, trusses and framed work, including cutting, hoisting, fixing in position and applying a priming coat of approved steel primer all complete.	kg	30.00			4,000.00	1,20,000.00	101.75	1,22,10,000.00	
		Roofing	1	30.00			80	2,400.00	910.00	21,84,000.00	
9	6.2.1	Brick work with common burnt clay modular bricks of class designation 7.5 in foundation and plinth in: Cement mortar 1:4 (1 cement : 4 coarse sand)Above GL	sqm								
		Block work 22cm		2.00	3.89	0.22	1.2	2.05			
				2.00	3.89	0.22	1	1.71			
				2.00	2.40	0.22	1.1	1.16			
				1.00	3.11	0.22	1	0.68			
				2.00	4.58	0.22	1.1	2.22			
				1.00	3.11	0.22	1.2	0.82			
				2.00	9.77	0.22	1.6	6.88			
				2.00	2.45	0.22	1.6	1.72			
								17.25			
				30.00				517.56			
		Toilet		1.00	3.76	0.22	1.6	1.32			
				1.00	0.38	0.22	1.6	0.13			

				1.00	0.29	0.22	1.6	0.10			
				1.00	2.26	0.22	1.6	0.80			
				1.00	3.56	0.22	2.1	1.64			
				2.00	3.80	0.22	2.3	3.85			
		Door Deduction		-1.00	1.10	0.22	2.3	-0.56			
				-1.00	0.80	0.22	2.3	-0.40			
				2.00	1.80	0.22	2.3	1.82			
				1.00	1.20	0.22	0.8	0.21			
								8.92			
				3.00				26.75			
								544.31	7687.17	41,84,190.20	
10	6.13.1	Half brick masonry with common burnt clay F.P.S. (non modular) bricks of class designation 7.5 in superstructure above plinth level up to floor V level. Cement mortar 1:3 (1 cement :3 coarse sand) Block work 12 cm	sqm								
		For Toilet		1.00	2.03	0.12	2.3	0.56			
				3.00				1.68			
				30.00				**50.43**	956.60	48,236.75	
11	11.46.2	Providing and laying Vitrified tiles in different sizes (thickness to be specified by manufacturer), with water absorption less than 0.08 % and conforming to I.S. 15622, of approved make, in all colours & shade, in skirting, riser of steps, over 12 mm thick bed of cement mortar 1:3 (1 cement: 3 coarse sand), jointing with grey cement slurry @ 3.3 kg/ sqm including grouting the joint with white cement & matching pigments etc. complete. Size of Tile 600x600 mm	sqm	30.00	10.00	4.00		1,200.00	2162.49	25,94,987.48	
12	11.56.1	Providing and laying Polished Granite stone flooring in required design and patterns, in linear as well as curvilinear portions of the building all complete as per the architectural drawings with 18 mm thick stone slab over 20 mm (average) thick base of cement mortar 1:4 (1 cement : 4 coarse sand) laid and jointed with cement slurry and pointing with white cement slurry admixed with pigment of matching shade including rubbing , curing and polishing etc. all complete as specified and as directed by the Engineer-in-Charge. Polished Granite stone slab jet Black, Cherry Red, Elite Brown, Cat Eye or equivalent.	sqm	30.00	12.00	0.60		216.00	4933.36	10,65,605.92	
13	11.36	Providing and fixing I st quality ceramic glazed wall tiles conforming to IS : 15622 (thickness to be specified by the manufacturer), of approved make, in all colours, shades except burgundy, bottle green, black of any size as approved by Engineer -in-Charge, in skirting, risers of steps and dados, over 12 mm thick bed of cement mortar 1:3 (1 cement : 3 coarse sand) and jointing with grey cement slurry @ 3.3 kg per sqm, including pointing in white cement mixed with pigment of matching shade complete.	sqm	30.00	13.00		3	1,170.00	1041.90	12,19,023.84	
	11.40	Providing and laying rectified Glazed Ceramic floor tiles of size 300x300 mm or more (thickness to be specified by the manufacturer) of Ist quality conforming to IS: 15622 of approved make in all colours, shades, except white, Ivory, Grey Fume Red Brown, laid on 20 mm thick cement mortar 1:4 (1 Cement : 4 Coarse sand) including pointing the joints with white cement and matching pigments etc., complete.	sqm	30.00	3.60	4.30		464.40	1260.48	5,85,366.38	
								-			
	13.1.1	12 mm cement plaster of mix 1:4 (1 cement: 4 fine sand)	sqm					-			
		exterior			2.00	4.00		8.00			
		interior			13.00		3	39.00			
				30.00				47.00	373.29647	5,26,348.02	
	8.9.1.1	8.9 Stone tile (polished) work for wall lining over 12 mm thick bed of cement mortar 1:3 (1 cement : 3 coarse sand) and cement slurry @ 3.3 kg/sqm including pointing in white cement complete. 8.9.1 8mm thick 8.9.1.1 Raj nagar plain white marble/ Udaipur green marble/ Zebra black marble		30.00	2.00	4.00		240.00	3518.79	8,44,510.33	
								-			
	8.32	Designing, fabricating, testing, installing and fixing in position Curtain Wall with Aluminium Composite Panel Cladding, with open grooves for linear as well as curvilinear portions of the building , for all heights and all levels etc						-			
			sqm	30.00	10.00	10.00		3,000.00	6028.98	1,80,86,937.66	

		Water tank	LS	30.00	1.00			30.00	30000.00	9,00,000.00	
		Septic tanks	LS	30.00	1.00			30.00	25000.00	7,50,000.00	
		Bathroom fittings and plumbing	LS	30.00	1.00			30.00	100000.00	30,00,000.00	
		Bathroom doors	LS	30.00	2.00			60.00	10000.00	6,00,000.00	
		Electrical Fittings	LS	30.00	1.00			30.00	100000.00	30,00,000.00	
		Bollards	no	30.00	3.00			90.00	50000.00	45,00,000.00	
								-			
	8778	Toughened glass 12 mm thickness	sqm	30.00	10.00	1.50		450.00	2443.88	10,99,745.24	
		Fixtures Transportation and installation charge	LS	30.00	1.00			30.00	3000.00	90,000.00	
		Fire fighting and safety installation	LS	30.00	1.00			30.00	100000.00	30,00,000.00	
		Landscaping	LS	30.00	1.00			30.00	150000.00	45,00,000.00	
		Sinages and advertisement hordings	LS	30.00	1.00			30.00	25000.00	7,50,000.00	
		Internal acces roads and parking space	LS	30.00	1.00			30.00	150000.00	45,00,000.00	
		Yard Lightings	LS	30.00	1.00			30.00	50000.00	15,00,000.00	
		Unforseen	LS	30.00	1.00			30.00	3885.57	1,16,567.10	
		Total for 30 jetties								**10,00,00,000.00**	
		Total for 1 jetty								**33,33,333.33**	

Annexure 6.1.11

Abstract Cost - Construction of operational control centre with CCTV installation

Description	Quantity	Units	Rate (INR)	Amount (INR)
Edappally	1	no	₹ 6,00,00,000	₹ 6,00,00,000
Total	1			**₹ 6,00,00,000**

Summary Cost - Construction of corporate office and operational control centre with CCTV installation		
Summary		
S.No.	**Description/Item**	**Amount (Rs.)**
1	Corporate office and operational control centre with CCTV installation	₹ 5,35,98,000.00
2	Development of site	₹ 21,15,890.40
3	Specialised E&M Works	₹ 9,89,290.29
6	CCTV and other lab facilities etc	₹ 32,96,819.31
	Total	**₹ 6,00,00,000.00**

Detail Estmates : Construction of corporate office and operational control centre with CCTV installation								
	CPWD PAR 2019							
S.No.	Ann-exure	S.no.	Description/Item	Unit	Quantity	Rate (INR)	Amount (INR)	Remarks
		1.0	**BUILDING COST**					
1	I	1.1	RCC Structure	sqm	1200.000	₹ 25,500.00	₹ 3,06,00,000.00	
		1.1.1	Floor height 3.60m					
		1.1.2	Floor height 2.90m					
			SUB-TOTAL-A				**₹ 3,06,00,000.00**	
		1.3	**EXTRA FOR**					
2	I	1.3.1	Every additional storey over six storeys upto twelve storeys (For RCC Framed Structure only)(till 10th floor)	sqm			₹ 0.00	
	I	1.3.1		sqm			₹ 0.00	
	I	1.3.1		sqm			₹ 0.00	
	I	1.3.1		sqm			₹ 0.00	
3	I	1.3.3	Every 0.30m higher plinth over normal plinth height of 0.45m (on G.F. area only)	sqm	0.000	₹ 335.00	₹ 0.00	
4	I	1.3.4	Every 0.30m deeper foundations over normal depth of 1.20m (on G.F. area only)	sqm	0.000	₹ 160.00	₹ 0.00	
5	I	1.3.5	Making stronger foundations to take load of one additional floor at a a later date (on area of additional one floor only)	sqm	0.000	₹ 1,470.00	₹ 0.00	
6	I	1.3.6	Resisting earthquake forces (for RCC famed structures only)	sqm	1200.000	₹ 1,200.00	₹ 14,40,000.00	
7	I	1.3.7	R.C.C. Raft foundations (Ground floor only)	sqm	0.000	₹ 5,150.00	₹ 0.00	
8	I	1.3.7	Pile Foundation (Ground floor only)	sqm	400.000	₹ 16,600.00	₹ 66,40,000.00	
	I	1.6	**FIRE ALARM SYSTEM**					
9	I	1.6.1	Automatic fire alarm system	sqm	1200.000	₹ 600.00	₹ 7,20,000.00	
			STILT PORTION					
10	I	1.8.1	Stilt portion of multistorey RCC framed structure (up to ht. of 3.60m). Applicable area only.	sqm	0.000	₹ 8,000.00	₹ 0.00	
			SUB-TOTAL-B				**₹ 88,00,000.00**	
		2.0	**SERVICES**					
11	I	2.1	Internal water supply and sanitary installations			9%	₹ 27,54,000.00	
12	I	2.2	External service connections					
13	I	2.2.1	Electrical external service connections			3.75%	₹ 11,47,500.00	
14	I	2.2.2	Civil external service connections			1.25%	₹ 3,82,500.00	
15	I	2.3	Internal electrical installations			12.5%	₹ 38,25,000.00	
			EXTRA FOR					
16	I	2.6.1	Power wiring and plugs			4%	₹ 12,24,000.00	
17	I	2.6.3	Lightning conductors			0.25%	₹ 76,500.00	
18	I	2.6.4	Telephone conduits			0.25%	₹ 76,500.00	
19	I	2.6.5	Centralized intercom system			1%	₹ 3,06,000.00	
20	I	2.6.6	Third party quality assurance			1%	₹ 3,06,000.00	
			SUB-TOTAL-C				**₹ 1,00,98,000.00**	
21	I	3.0	**LIFTS**					
22	I	3.1.2	Passenger lift (ACVVVF, 8 Pax)	2	NA	1600000	₹ 32,00,000.00	
			SUB-TOTAL-D				**₹ 32,00,000.00**	
		4.0	**WATER TANK (RCC ONLY)**					
23		4.5	Overhead tank upto staging height 20 metres	L	25000	18	₹ 4,50,000.00	
24		4.6	Underground sump	L	25000	₹18/litre	₹ 4,50,000.00	
			SUB-TOTAL-E				**₹ 9,00,000.00**	
			TOTAL				**₹ 5,35,98,000.00**	

Construction of corporate office and operational control centre with CCTV installation								
Site development								
	CPWD PAR 2019							
S.No.	Ann-exure	S.no.	Description/Item	Unit	Quantity	Rate (INR)	Amount (INR)	Remarks
			DEVELOPMENT OF SITE					
1	I	5.1	Levelling (area of plot)	sqm	2321.121	₹ 160.00	₹ 3,71,379.30	
2	I	5.2	**Internal roads & paths**					
3	I	5.2.3	CC pavement with vacuum dewatered concrete	sqm	696.336	₹ 85.00	₹ 59,188.58	
4	I	5.2.4	Footpath with kerb stone	sqm	0.000	₹ 85.00	₹ 0.00	
5	I	5.3	Sewer	sqm	2076.201	₹ 165.00	₹ 3,42,573.11	
6	I	5.4.	Filter water supply					
7	I	5.4.1	Distribution lines 100mm dia and below	sqm	2076.201	₹ 100.00	₹ 2,07,620.06	
8	I	5.4.2	Peripheral grid 150mm to 300mm dia pipes	sqm	2076.201	₹ 100.00	₹ 2,07,620.06	
9	I	5.4.3	Unfiltered water supply distribution lines (area of plot)	sqm	2076.201	₹ 65.00	₹ 1,34,953.04	
10	I	5.5	Storm water drains (area of plot)	sqm	2076.201	₹ 130.00	₹ 2,69,906.08	
11	I	5.6	Rain water harvesting (RWH)	sqm	40.000	₹ 90.00	₹ 3,600.00	
12	I	5.7	Trenches for services	m	0.000	₹ 585.00	₹ 0.00	
13	I	5.8.1	Boundary wall with 1.50m normal height from G.L. & 0.60m high MS grill, and required no. of steel gates/wicket gates etc.	m	0.000	₹ 9,000.00	₹ 0.00	
14	I	5.9.1	Horticulture operations including 30cm earth filling, grassing, tree plantation/shrubs and potted plants etc.	sqm	2076.20	₹ 250.00	₹ 5,19,050.16	
			SUB-TOTAL-F				**₹ 21,15,890.40**	

Construction of operational control centre with CCTV installation						
On-site special E&M						
S.No.	Description/Item	Unit	Rate	Quantity	Amount	Remarks
1	SITC of Compact substation (CSS)11/0.433 kV, substation equipments comprising HT panel, dry type transfo, bus trunking from transformer to LT panel, automatic power factor control (APFC), active harmonic filters, TVSS (transient voltage suppression system, SPD (surge protection device), Essential panel, Earthing, required inter-ci=onnections, sub-station safety equipments including LT cabling from sbstation to the buildings fed by the substation	KVA	₹ 9,000.00		₹ -	
	DIESEL GENERATOR SET (25 kVa)					
2	Supplying Installation testing and commissioning of Silent type DG set AMF Panel BUS trunking/Cables from DG Set to essential panel ,control cable ,Earthing of DG set and AMF Panel,DG set exhaust piping as per CPCB norms and minor allied works	per KVA	₹ 11,000.00	5	₹ 55,000.00	
	SOLAR PHOTOVOLTAIC POWER GENERATION SYSTEM					
3	Supplying Installation testing and commissioning of GRID interactive roof top solar photo voltaic power genration system i/c space frame but without battery.	per KWp	₹ 65,000.00	0	₹ -	
	SOLAR WATER HEATING SYSTEM					

On-site special E&M						
S.No.	**Description/Item**	**Unit**	**Rate**	**Quantity**	**Amount**	**Remarks**
4	Supplying, Installation testing and commissioning of solar water heating system with heat exchanger type including electrical heater backup, make up water tank but without pipingof folllowing rated capacity and regioni/c electrical heater back up and make up tank but without piping					
4.1	100 liter per day	100 litres per day	₹ 22,500.00	0	₹ -	
	BASIC HOME SECURITY FOR RESIDENTIAL COLONY					
5	Supplying and installation testing and commissioning of basic security system in the residential colony to include control room at the gate and intercom connection to each dwelling unit, and basic CC TV system to be installed at the entry and exit points, Parking areas , entry point of each dwelling unit and other common areas as required. To include CCTV control room, required UG cabling, recording system and monitor/ monitors in the control room					
5.1	CCTV System	per Sqm. Of residential Area	300	2076.20	₹ 6,22,860.19	
6	**STREET LIGHTING WITH LED**					
6.1	Supplying and installation testing and commissioning of LED Street/ Compound/ High mast/ Pathway/ Landscape Lighting for the entire Campus	per sqm.(Plot Area)	150	2076.20	₹ 3,11,430.10	
7	**STP**					
	Supplying, installation, testing and commissioning of STP of appropriate technology including Civil Works (except plant room), Tertiary Treatment etc., for the campus. Per day for plant size above 100000 LPD	per 1000 Ltr.	50000		₹ -	
Total					**₹ 9,89,290.29**	

PLOT SUBDIVISION

Sub-division	Description	Occupancy	Area (acres)
Part-1	IURWTS	OTC	0.57
Total			**0.57**

Annexure 6.1.12

Construction of access road to jetty terminals

Description	Quantity	Unit	Rate (Rs)	Amount (Rs)
Edappaly Canal	1620	m	₹ 16,363.40	₹ 2,65,08,702.84
Thevar-Perandoor	1800	m	₹ 16,363.40	₹ 2,94,54,114.27
Chilavanoor	1620	m	₹ 16,363.40	₹ 2,65,08,702.84
Thevara	360	m	₹ 16,363.40	₹ 58,90,822.85
Total	**5400**			**₹ 8,83,62,342.80**

Detail Estimate: Approach road to jetty terminals

Item No.	Code	Description	No.	L	B	H	Unit	Quantity	Rate (INR)	Amount (INR)	Remarks
		Description for 8m wide road									
1)	2.8	**Earth work excavation** in ordinary soil for foundation of retaining wall, etc. and using the spoil for back filling with all leads and lifts involved including breaking clods, watering, ramming and sectioning of spoil bank etc. complete as per the direction of deptl. officers at site Ret. wall	4	15.00	2	1.00	m^3	120.00	₹ 352.94	₹ 42,353.10	DSR
2)	OD	**Dry rubble** packing for foundation of retaining wall including all cost, conveyance and packing to proper lines and levels etc,complete as per the direction of deptl. Officers Ret wall foundation	4	15.00	2	0.35	m3	42.00	₹ 2,148.00	₹ 90,216.00	OD
4)	7.2.1	**Random rubble** masonry with hard stone in superstructure above plinth level and upto floor five level, including leveling up with cement concrete 1:6:12 (1 cement : 6 coarse sand : 12 graded stone aggregate 20 mm nominal size) Ret .wall	4	15.00	1	2.00	m3	120.00	₹ 10,477.69	₹ 12,57,322.93	DSR
5)	3.16	**Construction of embankment** with approved material obtained from borrow pits with all lifts and leads, transporting to site, spreading, grading to required slope, compacting to meet the design requirement as per the instruction of the engineer in charge									PRICE
		Approaches	4	100.00	10	1.00		4000.00			
				Total			m^3	4000.00	₹ 366.88	₹ 14,67,502.06	
6)	16.78.1	Construction of **Granular Sub-Base** by providing close graded Material of grading I - 53 mm to 9.5 mm @ 50 per cent, 9.5 mm to 2.36 mm @ 20 per cent and 2.36 mm below @ 30 per cent - mixing in a mechanical mix plant at OMC, carriage of mixed material to work site, spreading in uniform layers with motor grader on prepared surface and compacting with vibratory power roller to achieve the desired density, etc. complete									DSR
		approaches	2	250.00	4.00	0.25		500.00			
				Total				500.00			
				Say			m^3	500.00	₹ 3,522.01	₹ 17,61,005.27	
7)	16.79	Providing, laying, spreading and compacting graded stone aggregate to **wet mix macadam** specification including premixing the Material with water at OMC in mechanical mix plant carriage of mixed Material by tipper to site, laying in uniform layers with paver in sub- base / base course on well prepared surface and compacting with vibratory roller to achieve the desired density.									DSR
		approaches	2	250.00	4.00	0.25		500.00			
				Total				500.00			
				Say			m^3	500.00	₹ 3,695.05	₹ 18,47,527.23	
8)	16.31.1.2	Providing and **applying tack coat** with bitumen emulsion(RS) using emulsion pressure distributor at the rate of 0.20 - 0.30 kg per sqm on the prepared bituminous surface cleaned with mechanical broom.									DSR
		both sides	2	250.00	4.00			2000.00			

				Total			m2	2000.00	₹ 11.26	₹ 22,522.29	
9)	5.1.a	Providing and **applying primer coat** with bitumen emulsion (SS) on prepared surface of granular Base including clearing of road surface and spraying primer at the rate of 0.70 - 1.0 kg/sqm using mechanical means.									PRICE
		both sides	2	250.00	4.00			2000.00			
				Say			m2	2000.00	₹ 57.06	₹ 1,14,122.26	
10)	16.41	Mix Seal Surfacing Providing, laying and rolling of **close-graded premix surfacing materia**l of 20 mm thickness composed of 11.2 mm to 0.9 mm (Type-A) or 13.2 mm to 0.9 mm (Type-B) aggregates using penetration grade bitumen to required line, grade and level to serve as wearing course on a previously prepared base, including mixing in a suitable plant, laying and rolling with a three wheel 8-10 kN static roller and finishing to required level and grades complete									DSR
		approaches	2	250.00	4.00			2000.00			
				Total			m2	2000.00	₹ 138.70	₹ 2,77,401.87	
11)	16.69	Supplying and fixing **RCC guard stones/ guide stones** of size 0.20x0.20x1.05m with R.C.C 1:2:4 using 20mm broken stone including cost and conveyance of all materials, labour charges, watering, curing, fixing in position to lines and levels etc. complete as per the direction of Engineer in charge									DSR
		Say	40				Nos	40	₹ 492.13	₹ 19,685.32	
12)	13.62	Painting with **Synthetic enamel paint** two coats using approved quality paint over a priming coat after cleaning the surface including all cost and conveyance, labour charges etc. for hand rails, kerb, guard stone etc.as directed by departmental officers at site.Hand rails, Kerb, Guard stones etc.					m^2	100.00	₹ 247.82	₹ 24,781.51	DSR
13)	12.41.1	Supplying and fixing **75mm PVC pipe** for weep holes for retaining walls	1	40.00			m	40.00	₹ 281.32	₹ 11,252.75	DSR
14)	8.23.A	Providing metal crash barier	4	100.00			m	400.00	₹ 3,115.01	₹ 12,46,005.83	PRICE
		TOTAL								**₹ 81,81,698.41**	
		Amount per m								**₹ 16,363.40**	

	Description	Unit	Quantity	Rate	Amount	Remarks
OD	Dry rubble masonary for foundation and super structure of retaining wall					
	Details of cost for 1.00 cum					
	MATERIAL					
M-363	Blasted rubble, chips	CUM	1.05	900	945	
	LABOUR					
0125	Mason	Day	0.8	1200	960	
0115	Coolie	Day	0.7	700	490	
9999	Sundries	Ls	0.2	1.73	0.346	
MR446	conveyance	Hour	1.05	315	330.75	
	TOTAL				2726.10	
	Add 14.05% GST				383.02	
	TOTAL				3109.11	
	Add 10 % Contractor's profit and 5% overheads				466.37	
	TOTAL				3575.48	
	Add 1% Cess				35.75	
	Cost per 1.00 cum				3611.23	
	Say				**3611**	

Annexure 6.1.13

Abstract :Purchase of Vessels / Boats for navigation of passengers and tourism

Description	Quantity	Unit	Rate (Rs)	Amount (Rs)
For all canals	Ls	1	₹ 10,00,00,000.00	₹ 10,00,00,000.00
Total				**₹ 10,00,00,000.00**

Detail Estimate : Purchase of Vessels / Boats for navigation of passengers and tourism

			Phase1		
Type	**Cost Header**	**Unit**	**Quantity**	**Rate (INR)**	**Amount (INR)**
12m Catamaran (30 pax)	Luxury tourist (Phase1,2)	no	3	₹ 3,00,00,000	₹ 9,00,00,000
Support system	Software	LS	1	₹ 40,00,000	₹ 40,00,000
	hardware	LS	1	₹ 10,00,000	₹ 10,00,000
Wash, Traffic study	Studies	LS	1	₹ 50,00,000	₹ 50,00,000
	Grand Total				**₹ 10,00,00,000**

Annexure 6.1.14

Abstrcat - Navigational aids (5 Canals) Signages, Markers and Way finding signage

	Item	Quantity	Price	Amount (Rs)	Remarks
Sign Boards	Turn Sign board	50	₹ 5,000	₹ 2,50,000	2 sign boards for every turn
	Speed limit Sign board	40	₹ 5,000	₹ 2,00,000	in every 500 m
	Hazard Sign board	20	₹ 5,000	₹ 1,00,000	as per site conditions
	General Information Sign	50	₹ 8,000	₹ 4,00,000	as per site conditions
	Jetty Sign board/Name boards	150	₹ 7,500	₹ 11,25,000	4 sign boards for every Jetty
Buoys	Centre line buoys in water way	120	₹ 20,000	₹ 24,00,000	in every 300m
	In Jetties	60	₹ 25,000	₹ 15,00,000	2 in every jetties
	Water way intersections	40	₹ 35,000	₹ 14,00,000	in every intersections
	Emergency& reserve deployable Buoys	10	₹ 35,000	₹ 3,50,000	as per site conditions
Over head arch sign boards	Low air draft warnings	100	₹ 1,00,000	₹ 1,00,00,000	2 in every low draft bridgs
	Direction sign boards	70	₹ 1,00,000	₹ 70,00,000	in every 500m
	Navigation System cost			**₹ 2,47,25,000**	

Note;
This cost estimation covers the conventional navigation system cost only.
Electronic/IT based systems which are used on board the vessels and jetties

Annexure 6.1.15

Abstract Cost - Miscellaneous purchase of goods (Solar Installations, EV chargers and electrical systems)

Description	Quantity	Unit	Rate (Rs)	Amount (Rs)
Edappally	1	LS	₹ 1,70,00,000.00	₹ 1,70,00,000.00
Thevar-Perandoor	1	LS	₹ 1,00,00,000.00	₹ 1,00,00,000.00
Thevara	1	LS	₹ 60,00,000.00	₹ 60,00,000.00
Chilavanoor	1	LS	₹ 1,70,00,000.00	₹ 1,70,00,000.00
Total				**₹ 5,00,00,000.00**

Annexure 6.1.15

Detail Estimate - Miscellaneous purchase of goods
(Solar Installations, EV chargers and electrical systems) *

S. No.	Description	Canal	Quantity	Unit	Rate (INR)	Amount (INR)	Remarks
1	Solar Installations	Edappally canal	1	LS	₹ 1,00,00,000	₹ 1,00,00,000	
		Thevara Perandoor canal	1	LS	₹ 1,00,00,000	₹ 1,00,00,000	
		Chilavanoor canal	1	LS	₹ 1,00,00,000	₹ 1,00,00,000	
	Total					**₹ 3,00,00,000**	
2	EV chargers and electrical systems	Edappally canal	1	LS	₹ 70,00,000	₹ 70,00,000	
		Thevara Canal	1	LS	₹ 60,00,000	₹ 60,00,000	
		Chilavanoor canal	1	LS	₹ 70,00,000	₹ 70,00,000	
	Total					**₹ 2,00,00,000**	
	Grand total					**₹ 5,00,00,000**	
*** rates to be assumed with the help of competitive market rates							

Annexure 6.2.1 a		
Construction of Sewer network including interceptor, pumping stations, manholes		
SL No	**Description/Canal**	**Amount (INR)**
1	Cost of Elamkulam Plant Network	₹ 62,90,77,190.01
2	Cost of Vennala Plant Network	₹ 45,94,30,267.67
3	Cost of Muttar Plant Network	₹ 13,74,30,942.99
4	Cost of Perandoor Plant Network	₹ 16,90,41,122.45
5	Cost of Puthukkalavattom Plant Network	₹ 22,33,50,690.19
	Total	**₹ 1,61,83,30,213.31**
Annexure 6.2.1 b		
Construction of Sewer network for households		
SL No	**Description/Canal**	**Amount (INR)**
1	Cost of sewer Network for IURWTS catchment	**₹ 98,86,42,107.82**
Annexure 6.2.2		
Sanitation facilities in catctment area		
SL No	**Description/Canal**	**Amount (INR)**
1	Edappally Canal	₹ 10,07,01,613.49
2	Thevara-Perandoor Canal	₹ 6,17,12,622.78
3	Thevara Canal	₹ 1,40,93,884.70
4	Chilavanoor Canal	₹ 8,08,11,398.13
5	Market Canal	₹ 92,05,670.84
	Total	**₹ 26,65,25,189.96**
Annexure 6.2.3a		
Sewage Treatment Plants and its pumping systems		
SL No	**Description/Canal**	**Amount (INR)**
1	Cost of Elamkulam Plant Network	₹ 22,73,30,000.00
2	Cost of Vennala Plant Network	₹ 21,39,96,666.67
3	Cost of Muttar Plant Network	₹ 5,85,99,333.33
4	Cost of Perandoor Plant Network	₹ 10,93,03,333.33
5	Cost of Puthukkalavattom Plant Network	₹ 9,38,63,333.33
	Total	**₹ 70,30,92,666.67**
Annexure 6.2.3b		
Operation & Maintenace 15 years - Sewage Treatment Plants		
SL No	**Description/Canal**	**Amount (INR)**
1	Cost of Elamkulam Plant Network	₹ 10,21,20,000.00
2	Cost of Vennala Plant Network	₹ 10,21,20,000.00
3	Cost of Muttar Plant Network	₹ 2,04,24,000.00
4	Cost of Perandoor Plant Network	₹ 5,10,60,000.00
5	Cost of Puthukkalavattom Plant Network	₹ 4,08,48,000.00
	Total	**₹ 31,65,72,000.00**

Summery of Cost Abstract of STP Plants - IURWTS Canal System			
S.No.	**Name of STPs and Locations**	**Proposed Capacity of STPs**	**Costs in Lakhs**
1	Elamkulam STP - Chilavanoor & TP south (Chilavanoor canal)	10.00 MLD	INR 2273.3 Lakhs
2	Vennala STP - Edapally south (edappally canal)	10.00 MLD	INR 2140.0 Lakhs
3	Muttar STP-Edapally north (Edappally canal)	2.00 MLD	INR 586.0 Lakhs
4	Puthukkalavattom STP - Chilavanoor north (Chilavanoor Canal)	5.00 MLD	INR 1093.0 Lakhs
5	Perandoor STP - TP north (Thevara Perandoor canal)	4.00 MLD	INR 938.6 Lakhs
	Total	31.00 MLD	7030.9 Lakhs
O&M cost, including repair and chemical charges for the STPs			
S.No.	**Name of STPs and Locations**	**Proposed Capacity of STPs**	**Costs in Lakhs**
1	Elamkulam STP - Chilavanoor & TP south (Chilavanoor canal)	10.00 MLD	INR 1021.2 Lakhs
2	Vennala STP - Edapally south (edappally canal)	10.00 MLD	INR 1021.2 Lakhs
3	Muttar STP-Edapally north (Edappally canal)	2.00 MLD	INR 204.2 Lakhs
4	Puthukkalavattom STP - Chilavanoor north (Chilavanoor Canal)	5.00 MLD	INR 510.6 Lakhs
5	Perandoor STP - TP north (Thevara Perandoor canal)	4.00 MLD	INR 408.5 Lakhs
	Total	31.00 MLD	3165.7 Lakhs

Final- Cost-Sewerage-IURWTS Canals		
Sl	**Name of Items.**	**Cost in Lakhs**
1	Sewerage Distribution Network Cost	
a)	Cost of Elamkulam Plant Network	6290.77
b)	Cost of Vennala Plant Network	4594.30
C)	Cost of Muttar Plant Network	1374.31
d)	Cost of Perandoor Plant Network	1690.41
e)	Cost of Puthukkalavattom Plant Network	2233.51
	Total Cost of Network	**16183.30**
2		
a)	Elamkulam STP - Chilavanoor & TP south	2964.20
b)	Vennala STP - Edapally south	2830.87
C)	Muttar STP-Edapally north	724.57
d)	Puthukkalavattom STP - Chilavanoor north	1437.93
e)	Perandoor STP - TP north	1214.81
	Total Cost of STP	**9172.39**
	Total Cost Estimate for Sewerage Components	**25355.69**

Annexure 6.2.1a

IURWTS Project sewer network for catchment: Estimate for entire catchment		
General Abstract		
S no	**Description**	**Total Amount**
1	Collection System	₹ 31,15,25,246
2	House Service Connections from Manhole to Property Boundary assuming a length of 6 m per Connection	₹ 6,73,13,561
3	Construction of Inspection Chambers for House Service Connections Within the Property Boundary assuming 1 Nos of Chamber per Connection	₹ 17,27,46,408
4	Road Restoration for Street Sewers in Roads belonging to Corporation Roads and HSC	₹ 7,39,50,000
5	Pumping Station (1 Nos) / Lifting Station (2 Nos) Works	₹ 3,35,59,524
	Total (Including GST 12%) for 40000 households	₹ 65,90,94,739
	Total amount for 60000 households	₹ 98,86,42,108
	TOTAL IN CRORES	98.86

IURWTS Project sewer networks for catchment :: Total Abstract Estimate for 40000 households					
SL No	Item Description	UOM	Qty	Rate (Including 12% GST)	Amount
	Collecting System				
1	Earth work excavation and depositing on bank with an initial lead of 10m and initial lift of 2m in Hard stiff clay, stiff black cotton, hard red earth, shales, murrams, gravel, stoney earth, and earth mixed with small size boulders and hard gravelly soil -SS20B for 0 - 1.5m Depth	Cum	144360.99	172	24830090
2	Supply and Delivery of DWC Structured Wall Polyethylene Piping Systems (Pipe with online/offline coupler and elastomeric sealing ring) with required specials non-smooth external annular corrugated and smooth internal surface (Double wall) (SN 8 Class) for non-pressure underground sewerage, drainage application generally as per IS-16098 (Part-2) type B of standard length of 6 m, including Laying and jointing, Testing etc. complete				
	a) 200 mm Dia	Rmt	61658.70	841	51854967
4	Supplying and conveying, lowering, laying and jointing of following sizes of C.I. SPUN PIPES - LA class AS PER IS 1536/2001 , most recent version Pipes to site, for standard length including cost of pipes, testing charges at factory, labour charges for loading, unloading and stacking at site etc.				
	200mm Dia	Rmt	4418.00	3962	17504116
5	B Bedding uisng stone dust screened not more than 2 mm clean, uncoated and free from injurious amount of dust, soft particles, organic matter, loam or other deleterious substances, properly compacted in 10 cm thick as per the standard specifications as directed by the Corporation Engineer	Cum	5920.40	1331	7880052
6	Refilling the trenches with suitable excavated earth available in layers of 150 mm thick, watering, ramming & consolidation complete as directed by the Corporation Engineer.	Cum	113407.66	40	4536306
7	Barricading - Casurina poles 8 to 10 cm dia 1.5m long fixed at 1.5m centers, Adopting 5 uses, cost per use, While PVC tapes 50mm wide with red stripes printed-2 rowsx150 LR, Red reflectors 75mm dia each L R, Danger lights 2 Nos-hire charges for danger lights including energy/battery for 15 days LR, including labours etc.,	Rmt	112289.60	80	8983168
8	Disposing the Surplus earth Including Lifting, Loading, Unloading and Lead etc Complete.	Cum	30350.72	93	2822617
9	Road Cutting				
10	Sewer Lines				
11	Cutting of cement concrete road up to 0.3m depth	Cum	508.36	1923	977576
12	Cutting of BT Road upto0.150m depth	Cum	9450.40	743	7021647
13	House service connections				
14	Cutting of cement concrete road 6m X 0.7m X 0.15m	Cum	446.12	1923	857889
15	Cutting of BT road 6m X 0.7m X 0.15m	Cum	10000.00	743	7430000
	Construction of Manholes				
16	Earth work excavation and depositing on bank with an initial lead of 10m and initial lift of 2m in Hard stiff clay, stiff black cotton, hard red earth, shales, murrams, gravel, stoney earth, and earth mixed with small size boulders and hard gravelly soil -SS20B for 0 - 1.5m Depth For Manholes	Cum	60027.24	172	10324685
	1.00 - 1.50 m depth	Cum	27152.19		
	1.50 - 2.00 m depth	Cum	15634.71		
	2.00 - 2.50 m depth	Cum	10243.74		
	2.50 - 3.00 m depth	Cum	6996.60		
#REF!	Construction of RCC Manholes using Plain Cement Concrete 1:4:8 (using 40 mm HBG), Plain Cement Concrete 1:2:4 (using 20 mm HBG), Reinforced Cement Concrete M30 using machine crushed hard broken granite stone jelly 20 mm for RCC works, Shuttering, Steel, FRC cover, Steps and Refilling etc				
31	1.00 - 1.50 m depth	Nos	1284.00	47012	60363408
32	1.50 - 2.00 m depth	Nos	601.00	57176	34362776
33	2.00 - 2.50 m depth	Nos	362.00	59864	21670768
34	2.50 - 3.00 m depth	Nos	232.00	103011	23898552
35	3.00 - 3.50 m depth	Nos	181.00	144788	26206628
	Collection System Amount				**₹ 31,15,25,246**
	House Service Connection from Boundary to Inspection Chamber				
1	Earth work excavation for sewer line trench & depositing on bank with an initial lead of 10 m & lift of 2 m for depths in hard stiff clay, stiff black cotton, hard gravely soil including dewatering of water as an and when required, barricading with safety lamps etc all complete as per standard specification as directed by the departmental Engineer.	Cum	40118.00	120	4814160
	Domestic Connextions		36018.00		
	Non Domestic Connections		4100.00		

SL No	Item Description	UOM	Qty	Rate (Including 12% GST)	Amount
2	Supplying & laying of 110 mm dia UPVC pipes & lowering in to trenches, laying to proper grade & alignment & jointing the pipes & specials with PVC couplers with cement paste both dry & wet condition, testing the lines as directed by the Departmental Engineer. House service connection to manholes.	Rmt	100050.00	234	23411700
3	Supplying & laying of 160 mm dia UPVC pipes & lowering in to trenches, laying to proper grade & alignment & jointing the pipes & specials with PVC couplers with cement paste both dry & wet condition, testing the lines as directed by the Departmental Engineer. House service connection to manholes.	Rmt	8200.00	480	3936000
4	Refilling the trenches with suitable excavated earth available in layers of 150 mm thick, watering, ramming & consolidation complete as directed by the Corporation Engineer.	Cum	39002.89	52	2028150
	Total Earth Work Quantity		40118.00		
	Deduction of Pipe Volume				
	Domestic Connextions (110mm Dia)		-950.32		
	Non Domestic Connections (160mm Dia)		-164.79		
	House Service Connection from Manhole to Boundary				
1	Earth work excavation for sewer line trench & depositing on bank with an initial lead of 10 m & lift of 2 m for depths in hard stiff clay, stiff black cotton, hard gravely soil including dewatering of water as an and when required, barricading with safety lamps etc all complete as per standard specification as directed by the departmental Engineer.	Cum	40118.00	108	4332744
	Domestic Connextions		36018.00		
	Non Domestic Connections		4100.00		
2	Supplying & laying of 110 mm dia UPVC pipes & lowering in to trenches, laying to proper grade & alignment & jointing the pipes & specials with PVC couplers with cement paste both dry & wet condition, testing the lines as directed by the Departmental Engineer. House service connection to manholes.	Rmt	100050.00	234	23411700
3	Supplying & laying of 160 mm dia UPVC pipes & lowering in to trenches, laying to proper grade & alignment & jointing the pipes & specials with PVC couplers with cement paste both dry & wet condition, testing the lines as directed by the Departmental Engineer. House service connection to manholes.	Rmt	8200.00	480	3936000
4	Refilling the trenches with suitable excavated earth available in layers of 150 mm thick, watering, ramming & consolidation complete as directed by the Corporation Engineer.	Cum	39002.89	37	1443107
	Total Earth Work Quantity		40118.00		
	Deduction of Pipe Volume				
	Domestic Connextions (110mm Dia)		-950.32		
	Non Domestic Connections (160mm Dia)		-164.79		
	House Service Connection Amount				**₹ 6,73,13,561**
	Construction/Erection of Inspection Chamber				
1	Inspection Chambers 0.6m x 0.6x 0.6m for House service Connections				
2	Construction of RCC Inspection Chambers Size (0.6 x 0.6 x 0.6 m) including Earth work, Steel and refilling etc.. Including Precast Top Slab	Nos	36200.00	4772	172746408
	Inspection Chambers				**₹ 17,27,46,408**
	Restoration of Roads				
1	Earth work excavation for trenches and depositing on bank with an initial lead of 10m and lift of 2m for depths in hard stiff clay, stiff black cotton, hard red earth mixed with small sized boulders & hard gravely soil including dewatering of water as and when required, barricading with safety lamps etc all complete as per standard specification as directed by the Departmental Engineer.	Sqm	75000.00	986	73950000
2	Providing and laying PCC 1:5:10 using 40mm metal Upto 100mm tk as bottom layer and PCC 1:2:4 using 20mm metal Upto 100mm tk as top layer etc all complete as per standard specification as directed by the Departmental Engineer. Disposing of Surplus Earth at lead of 5 Kms				
	Restoration of Roads				**₹ 7,39,50,000**
	Lifting Station No 9, 10 and Pumping Station No 2				
1	Pumping Station –Screen Well				
2	Earth work excavation and depositing on bank with an initial lead of 10m and initial lift of 2m in				

SL No	Item Description	UOM	Qty	Rate (Including 12% GST)	Amount
3	Hard stiff clay, stiff black cotton, hard red earth, shales, murrams, gravel, stoney earth, and earth mixed with small size boulders and hard gravelly soil -SS20B				
4	First depth of 2 m	m^3	88.31	212	18722
5	Soft disintegrated rock, laterite, soft rock, kankar not requiring blasting.				
6	First depth of 2 m	m^3	88.31	212	18722
7	Medium rock, and Dense Medium Rock not requiring Blasting.				
8	Second depth of 1 m	m^3	44.16	522	23050
9	Removing hard rock by wedging, chiselling and trimming to proper shape where blasting is prohibited.				
10	Third depth of 1 m	m^3	44.16	1492	65881
11	Fourth depth of 1 m	m^3	44.16	1593	70341
12	Fifth depth of 1 m	m^3	44.16	1986	87694
13	Sixth depth of 1 m	m^3	44.16	2477	109375
14	P.C.C 1:4:8 (one cement, four sand and eight coarse aggregate) using Sulphate Resistant cement and 40 mm H.B.G stone including mixing concrete, laying, curing and compacting of concrete etc.,.				
15	From 4.5m to 9 m below G.L	m^3	4.42	5828	25734
16	M-30 CONCRETE - Providing and laying in position, standarised design mix M-30 Grade using 20mm and down graded hard broken granite stone jelly for all RCC items of works with minimum cement content of 400Kg/m3 and maximum water cement ratio of 0.55, including admixture (plasticizer/super plasticizer) in recommended proportions as per IS:9103 to accelerate, retard setting of concrete, improve workability without impairing strength and durability with about (5.70 cu.m.)940.50Kg of 20mm machine crushed stone jelly and with about (2.80 cu.m.)462.00Kg of 10-12mm machine crushed jelly and with about (4.25 cu.m.)701.25Kg of sand, but excluding cost of reinforcement grill and fabricating charges, centering and shuttering and also including laying, vibrating with mechanical vibrators, finishing, curing, etc and providing fixtures like fan clamps in the RCC floor/roof slabs wherever necessary without clamping extra, etc. complete complying with standard specification and as directed by the departmental officers. The coarse and fine aggregates to be used should comply with the requirements of IS 383-2016. (No separate payment will be made by the department for the excess usage of materials as per design mix.) using Sulphate Resistance Cement				
17	Above G.L	m^3	5.14	8976	46152
18	Below GL				
19	Upto 1.5 m	m^3	7.71	8976	69229
20	From 1.5 m to 4.5 m	m^3	15.43	9036	139383
21	From 4.5m to 9 m	m^3	23.14	9136	211388
22	Supplying, fabricating and placing in position of TMT Fe-500 rods at all heights for reinforcement including the cost of steel and binding wire, labour charges, labor for steel handling, bending, placement of cover blocks etc. including cost of all items as per standard specifications etc., complete for all RCC works				
23	upto 16mm dia.	Qtl	76.73	9733	746764
24	Above 16 mm dia	Qtl	9.52	9733	92658
25	Supply and erection of steel centering, shuttering for soffits and sides including necessary supports and strutting for all RCC works using MS sheets of suitable size of BG 10 stiffened with MS angle of size 25 X 25 X 3mm for boarding laid over Silver Oak joists of size 10cm X 6.5cm spaced at 90cm c/c and supported by Casuarina Props 10cm - 13cm spaced at 75cm c/c etc.(Retrieved Materials should be taken back by the contractor.)				
26	Curved surface - Outer				
27	From 0 m to 3.3 m	m^2	70.46	1000	70462
28	From 3.3 m to 4.3 m	m^2	21.35	1020	21779
29	From 4.3 m to 5.3 m	m^2	21.35	1040	22206
30	From 5.3 m to 6.3 m	m^2	21.35	1060	22633
31	From 6.3 m to 7.3 m	m^2	21.35	1080	23060
32	From 7.3 m to 8.3 m	m^2	21.35	1100	23487
33	Curved surface - Inner				
34	From 0 m to 3.3 m	m^2	70.46	1000	70462
35	From 3.3 m to 4.3 m	m^2	21.35	1020	21779
36	From 4.3 m to 5.3 m	m^2	21.35	1040	22206
37	From 5.3 m to 6.3 m	m^2	21.35	1060	22633

SL No	Item Description	UOM	Qty	Rate (Including 12% GST)	Amount
38	From 6.3 m to 7.3 m	m^2	21.35	1080	23060
39	From 7.3 m to 8.3 m	m^2	21.35	1100	23487
40	Applying two coats of cement paint of approved colour and quality over the outer exposed cement plastered wall surfaces including cleaning, preparing the surface area and including cost of all materials, labour charges, curing etc.,	m^2	23.79	100	2379
41	Refilling the outside of the well with excavated earth (other then sand) complying with standard specification for filling the foundation including watering consolidation etc.,.	m^3	179.62	52	9340
42	Earth Quantity	m^3	397.41		
43	Deduction for Structure	m^3	217.79		
44	Conveyance of excess earth to a distance not exceeding 5km as directed by the Corporation Engineer including cost of loading, transportation and unloading charges etc complete	m^3	217.79	93	20255
45	Hire charges for dieasel pumpset above 3 HP to 7.5 HP with fuel and crew charges including transportation	Hrs	122.15	370	45196
46	Supplying and fixing of encapsulated P.V.C. steps inside the well	No	21.50	300	6450
47	Providing Construction Joints using 150 mm vide PVC water bar with single bulb (in metre)	m	110.50	395	43648
48	Supplying and fixing 600 mm dia CI puddle pipe in the well (in Kg)	Kg	903.90	104	94006
49	Supply & fabrication of 2 numbers of SS304 SS screen arrangements of size 1.25 m x 0.6 m with 12mm bars at 25 mm spacing and fixing at an angle of 60 deg. and welded to an angle frame of 100 x 100 x 8 mm .	Kg	129.60	900	116640
50	Supply, delivery and erection of Penstock Valve for 600 mm dia at a depth of 6m into screen well including necessary SS driving shaft supporting with clamps on the wall, bevel gear arrangement assembly with hand wheel arrangement at site of work for screen well inlet including all taxes, duties, loading, freight, stocking and transit and insurance charges etc..	No	1.00	550240	550240
51	PS - GRID WELL				
52	Earth work excavation and depositing on bank with an initial lead of 10m and initial lift of 2m in				
53	Hard stiff clay, stiff black cotton, hard red earth, shales, murrams, gravel, stoney earth, and earth mixed with small size boulders and hard gravelly soil -SS20B				
54	First depth of 2 m	m^3	20.35	212	4314
55	Soft disentegrated rock, laterite, soft rock, kankar not requiring blasting.				
56	First depth of 2 m	m^3	20.35	212	4314
57	Medium rock, and Dense Medium Rock not requiring Blasting.				
58	Second depth of 1 m	m^3	10.17	522	5311
59	Removing hard rock by wedging, chiselling and trimming to proper shape where blasting is prohibited.				
60	Third depth of 1 m	m^3	10.17	1492	15179
61	Fourth depth of 1 m	m^3	10.17	1593	16207
62	Fifth depth of 1 m	m^3	10.17	1986	20205
63	Sixth depth of 1 m	m^3	10.17	2477	25200
64	Seventh depth of 1 m	m^3	10.17	3092	31457
65	P.C.C 1:4:8 (one cement, four sand and eight coarse aggregate) using Sulphate Resistant cement and 40 mm H.B.G stone including mixing concrete, laying, curing and compacting of concrete etc.,.	m^3	1.02	5828	5929
66	M-30 CONCRETE - Providing and laying in position, standarised design mix M-30 Grade using 20mm and down graded hard broken granite stone jelly for all RCC items of works with minimum cement content of 400Kg/m3 and maximum water cement ratio of 0.55, including admixture (plasticizer/super plasticizer) in recommended proportions as per IS:9103 to accelerate, retard setting of concrete, improve workability without impairing strength and durability with about (5.70 cu.m.)940.50Kg of 20mm machine crushed stone jelly and with about (2.80 cu.m.)462.00Kg of 10-12mm machine crushed jelly and with about (4.25 cu.m.)701.25Kg of sand, but excluding cost of reinforcement grill and fabricating charges, centering and shuttering and also including laying, vibrating with mechanical vibrators, finishing, curing, etc and providing fixtures like fan clamps in the RCC floor/roof slabs wherever necessary without clamping extra, etc. complete complying with standard specification and as directed by the departmental officers. The coarse and fine aggregates to be used should comply with the requirements of IS 383-2016. (No separate payment will be made by the department for the excess usage of materials as per design mix.) Sulphate Resistance Cement				
67	Above G.L	m^3	2.63	8976	23605

SL No	Item Description	UOM	Qty	Rate (Including 12% GST)	Amount
68	Below GL				#VALUE!
69	Upto 1.5 m	m^3	3.94	8976	35407
70	From 1.5 m to 4.5 m	m^3	7.89	9036	71287
71	From 4.5m to 9 m	m^3	11.83	9136	108114
72	Supplying, fabricating and placing in position of TMT Fe-500 rods at all heights for reinforcement including the cost of steel and binding wire, labour charges, labor for steel handling, bending, placement of cover blocks etc. including cost of all items as per standard specifications etc., complete for all RCC works				#VALUE!
73	upto 16mm dia.	Qtl	65.24	9733	634981
74	Supply and erection of steel centering, shuttering for soffits and sides including necessary supports and strutting for all RCC works using MS sheets of suitable size of BG 10 stiffened with MS angle of size 25 X 25 X 3mm for boarding laid over Silver Oak joists of size 10cm X 6.5cm spaced at 90cm c/c and supported by Casuarina Props 10cm - 13cm spaced at 75cm c/c etc., Retrieved Materials should be taken back by the contractor.)				
75	Curved surface - Outer Surface				
76	From 0 m to 3.3 m	m^2	37.30	1000	37303
77	From 3.3 m to 4.3 m	m^2	11.30	1020	11530
78	From 4.3 m to 5.3 m	m^2	31.57	1040	32833
79	From 5.3 m to 6.3 m	m^2	31.57	1060	33464
80	From 6.3 m to 7.3 m	m^2	31.05	1080	33534
81	From 7.3 m to 8.3 m	m^2	14.14	1100	15549
82	From 8.3 m to 9.3 m	m^2	6.51	1120	7286
83	Curved surface - Inner Surface				
84	From 0 m to 3.3 m	m^2	32.12	1000	32122
85	From 3.3 m to 4.3 m	m^2	9.73	1020	9929
86	From 4.3 m to 5.3 m	m^2	31.57	1040	32833
87	From 5.3 m to 6.3 m	m^2	31.57	1060	33464
88	From 6.3 m to 7.3 m	m^2	31.05	1080	33534
89	From 7.3 m to 8.3 m	m^2	14.14	1100	15549
90	From 8.3 m to 9.3 m	m^2	6.51	1120	7286
91	Applying two coats of cement paint of approved colour and quality over the outer exposed cement plastered wall surfaces including cleaning, preparing the surface area and including cost of all materials, labour charges, curing etc.,.	m^2	16.57	100	1657
92	Refilling the outside of the well with excavated earth (other then sand) complying with standard specification for filling the foundation including watering consolidation etc.,.	m^3	81.95	52	4262
93	Earthwork Quantity	m^3	101.74		
94	Deduction for Structure	m^3	19.78		
95	Conveyance of excess earth to a distance not exceeding 5km as directed by the Corporation Engineer including cost of loading, transportation and unloading charges etc complete	m^3	81.95	93	7622
96	Hire charges for dieasel pumpset above 3 HP to 7.5 HP with fuel and crew charges including transportation	Hrs	89.95	370	33282
97	Supplying and fixing of encapsulated P.V.C. steps inside the well	No	25.50	300	7650
98	Providing Construction Joints using 150 mm vide PVC water bar with single bulb (in metre)	M	89.50	395	35353
99	Supplying and fixing 600 & 700mm dia CI puddle pipe in the well (in Kg)	Kg	904.10	104	94026
100	Supply, delvery, fixing and commissioning of submersible electrical grit pumpset capable of discharging 20m3 / hr liquid at 10m head with agitator connected to the extended shaft of the pump to keep the silt in suspension including 25m cable, skirt base, 100mm dia elbow, lifting chain, control panel etc. complete with 100mm dia discharging piping to grit pit as per drawing. Piping to be og CI D/F pipes and specials.	No	1.00	440002	440002
101	Pumpimg Station- Suction well				
102	Earth work excavation and depositing on bank with an initial lead of 10m and initial lift of 2m in				
103	Hard stiff clay, stiff black cotton, hard red earth, shales, murrams, gravel, stoney earth, and earth mixed with small size boulders and hard gravelly soil -SS20B				
104	First depth of 2 m	m^3	121.58	212	25775
105	Soft disentegrated rock, laterite, soft rock, kankar not requiring blasting.				
106	First depth of 2 m	m^3	121.58	212	25775
107	Medium rock, and Dense Medium Rock not requiring Blasting.				

SL No	Item Description	UOM	Qty	Rate (Including 12% GST)	Amount
108	Second depth of 1 m	m^3	60.79	522	31733
109	Removing hard rock by wedging, chiselling and trimming to proper shape where blasting is prohibited.				
110	Third depth of 1 m	m^3	60.79	1492	90699
111	Fourth depth of 1 m	m^3	60.79	1593	96839
112	Fifth depth of 1 m	m^3	60.79	1986	120730
113	Sixth depth of 1 m	m^3	60.79	2477	150578
114	Seventh depth of 1 m	m^3	60.79	3092	187964
115	Eighth depth of 1 m	m^3	60.79	3592	218359
116	Nineth depth of 1 m	m^3	60.79	4092	248754
117	Tenth depth of 1 m	m^3	60.79	4592	279150
118	Eleventh depth of 1 m	m3	60.79	5092	309545
119	P.C.C 1:4:8 (one cement, four sand and eight coarse aggregate) using Sulphate Resistant cement and 40 mm H.B.G stone including mixing concrete, laying, curing and compacting of concrete etc.,	m^3	6.08	5828	35429
120	M-30 CONCRETE - Providing and laying in position, standarised design mix M-30 Grade using 20mm and down graded hard broken granite stone jelly for all RCC items of works with minimum cement content of 400Kg/m3 and maximum water cement ratio of 0.55, including admixture (plasticizer/super plasticizer) in recommended proportions as per IS:9103 to accelerate, retard setting of concrete, improve workability without impairing strength and durability with about (5.70 cu.m.)940.50Kg of 20mm machine crushed stone jelly and with about (2.80 cu.m.)462.00Kg of 10-12mm machine crushed jelly and with about (4.25 cu.m.)701.25Kg of sand, but excluding cost of reinforcement grill and fabricating charges, centering and shuttering and also including laying, vibrating with mechanical vibrators, finishing, curing, etc and providing fixtures like fan clamps in the RCC floor/roof slabs wherever necessary without clamping extra, etc. complete complying with standard specification and as directed by the departmental officers. The coarse and fine aggregates to be used should comply with the requirements of IS 383-2016. (No separate payment will be made by the department for the excess usage of materials as per design mix.) Sulphate Resistance Cement				
121	Above G.L	m^3	6.71	8976	60245
122	Below GL				
123	Upto 1.5 m	m^3	10.07	8976	90367
124	From 1.5 m to 4.5 m	m^3	20.14	9036	181942
125	From 4.5m to 9 m	m^3	30.20	9136	275933
126	From 9m to 13.5 m	m^3	30.20	9261	279709
127	Supplying, fabricating and placing in position of TMT Fe-500 rods at all heights for reinforcement including the cost of steel and binding wire, labour charges, labor for steel handling, bending, placement of cover blocks etc. including cost of all items as per standard specifications etc., Complete				
128	upto 16mm dia.	Qtl	152.80	9733	1487202
129	Above 16 mm dia	Qtl	182.93	9733	1780458
130	Supply and erection of steel centering, shuttering for soffits and sides including necessary supports and strutting for all RCC works using MS sheets of suitable size of BG 10 stiffened with MS angle of size 25 X 25 X 3mm for boarding laid over Silver Oak joists of size 10cm X 6.5cm spaced at 90cm c/c and supported by Casuarina Props 10cm - 13cm spaced at 75cm c/c etc.,(Retrieved Materials should be taken back by the contractor.)				
131	Curved surface - Outer Surface				
132	From 0 m to 3.3 m	m^2	200.61	1000	200608
133	From 3.3 m to 4.3 m	m^2	60.79	1020	62006
134	From 4.3 m to 5.3 m	m^2	60.79	1040	63222
135	From 5.3 m to 6.3 m	m^2	60.79	1060	64438
136	From 6.3 m to 7.3 m	m^2	60.79	1080	65654
137	From 7.3 m to 8.3 m	m^2	60.79	1100	66869
138	From 8.3 m to 9.3 m	m^2	60.79	1120	68085
139	From 9.3 m to 10.3 m	m^2	60.79	1140	69301
140	From 10.3 m to 11.3 m	m^2	60.79	1160	70517
141	From 11.3 m to 12.3 m	m^2	60.79	1180	71733
142	From 12.3 m to 13.3 m	m^2	60.79	1200	72948

SL No	Item Description	UOM	Qty	Rate (Including 12% GST)	Amount
143	Curved surface - Inner Surface				
144	From 0 m to 3.3 m	m^2	178.46	1000	178460
145	From 3.3 m to 4.3 m	m^2	54.08	1020	55160
146	From 4.3 m to 5.3 m	m^2	54.08	1040	56242
147	From 5.3 m to 6.3 m	m^2	54.08	1060	57323
148	From 6.3 m to 7.3 m	m^2	54.08	1080	58405
149	From 7.3 m to 8.3 m	m^2	54.08	1100	59487
150	From 8.3 m to 9.3 m	m^2	54.08	1120	60568
151	From 9.3 m to 10.3 m	m^2	54.08	1140	61650
152	From 10.3 m to 11.3 m	m^2	54.08	1160	62731
153	From 11.3 m to 12.3 m	m^2	54.08	1180	63813
154	From 12.3 m to 13.3 m	m^2	54.08	1200	64894
155	Applying two coats of cement paint of approved colour and quality over the outer exposed cement plastered wall surfaces including cleaning, preparing the surface area and including cost of all materials, labour charges, curing etc.	m^2	31.42	100	3142
156	Refilling the outside of the well with excavated earth (other then sand) complying with standard specification for filling the foundation including watering consolidation etc.,.	m^3	243.16	52	12644
157	Earth Work Quantity	m^3	851.07		
158	Deduction for Structure	m^3	607.90		
159	Conveyance of excess earth to a distance not exceeding 5km as directed by the Corporation Engineer including cost of loading, transportation and unloading charges etc complete	m^3	607.90	93	56535
160	Hire charges for dieasel pump set above 3 HP to 7.5 HP with fuel and crew charges including transportation	Hrs	753.70	370	278869
161	Supplying and fixing of encapsulated P.V.C. steps inside the well	No	38.00	300	11400
162	Providing Construction Joints using 150 mm vide PVC water bar with single bulb (in metre)	m	239.50	395	94603
163	Supplying and fixing 600 mm dia CI puddle pipe in the well (in Kg)	Kg	452.05	104	47013
164	Supplying, delivery and installation of SS304 stainless steel chequered plates using 10mm thick and also for outer frame including suitable steel arrangement to carry the chequered plate mesh (half the top areaof the suction well)	Kg	2454.50	750	1840875
165	Providing R.S.J.Support as per I.S.M.B.450 & I.S.M.B.200	Kg.	1172.00	80	93760
166	Lifting station - Suction Well				
167	Earth work excavation and depositing on bank with an initial lead of 10m and initial lift of 2m in				
168	Hard stiff clay, stiff black cotton, hard red earth, shales, murrams, gravel, stoney earth, and earth mixed with small size boulders and hard gravelly soil -SS20B				
169	First depth of 2 m	m^3	20.35	212	4314
170	Soft disentegrated rock, laterite, soft rock, kankar not requiring blasting.				
171	First depth of 2 m	m^3	20.35	212	4314
172	Medium rock and Dense Medium Rock not requiring Blasting.				
173	Second depth of 1 m	m^3	10.17	522	5311
174	Removing hard rock by wedging, chiselling and trimming to proper shape where blasting is prohibited.				
175	Third depth of 1 m	m^3	10.17	1492	15179
176	Fourth depth of 1 m	m^3	10.17	1593	16207
177	Fifth depth of 1 m	m^3	10.17	1986	20205
178	Sixth depth of 1 m	m^3	10.17	2477	25200
179	Seventh depth of 1 m	m^3	10.17	3092	31457
180	Eighth depth of 1 m	m^3	10.17	3592	36544
181	Nineth depth of 1 m	m^3	10.17	3069	31223
182	P.C.C 1:4:8 (one cement, four sand and eight coarse aggregate) using Sulphate Resistant cement and 40 mm H.B.G stone including mixing concrete, laying, curing and compacting of concrete etc.,				
183	From 9m to 13.5 m below G.L	m^3	1.02	4371	4447

SL No	Item Description	UOM	Qty	Rate (Including 12% GST)	Amount
184	M-30 CONCRETE - Providing and laying in position, standarised design mix M-30 Grade using 20mm and down graded hard broken granite stone jelly for all RCC items of works with minimum cement content of 400Kg/m3 and maximum water cement ratio of 0.55, including admixture (plasticizer/super plasticizer) in recommended proportions as per IS:9103 to accelerate, retard setting of concrete, improve workability without impairing strength and durability with about (5.70 cu.m.)940.50Kg of 20mm machine crushed stone jelly and with about (2.80 cu.m.)462.00Kg of 10-12mm machine crushed jelly and with about (4.25 cu.m.)701.25Kg of sand, but excluding cost of reinforcement grill and fabricating charges, centering and shuttering and also including laying, vibrating with mechanical vibrators, finishing, curing, etc and providing fixtures like fan clamps in the RCC floor/roof slabs wherever necessary without clamping extra, etc. complete complying with standard specification and as directed by the departmental officers. The coarse and fine aggregates to be used should comply with the requirements of IS 383-2016. (No separate payment will be made by the department for the excess usage of materials as per design mix.) Using Sulphate resistance Cement				
185	Above G.L	m^3	2.63	8976	23605
186	Below GL				
187	Upto 1.5 m	m^3	3.94	8976	35407
188	From 1.5 m to 4.5 m	m^3	7.89	9036	71287
189	From 4.5m to 9 m	m^3	9.20	9136	84089
190	From 9m to 13.5 m	m^3	11.83	9261	109594
191	Supplying, fabricating and placing in position of TMT Fe-500 rods at all heights for reinforcement including the cost of steel and binding wire, labour charges, labor for steel handling, bending, placement of cover blocks etc. including cost of all items as per standard specifications etc., complete for all RCC works				
192	upto 16mm dia.	Qtl	45.35	9733	441418
193	Supply and erection of steel centering, shuttering for soffits and sides including necessary supports and strutting for all RCC works using MS sheets of suitable size of BG 10 stiffened with MS angle of size 25 X 25 X 3mm for boarding laid over Silver Oak joists of size 10cm X 6.5cm spaced at 90cm c/c and supported by Casuarina Props 10cm - 13cm spaced at 75cm c/c etc.(Retrieved Materials should be taken back by the contractor.)				
194	Curved surface - Outer Surface				
195	From 0 m to 3.3 m	m^2	41.45	1000	41448
196	From 3.3 m to 4.3 m	m^2	12.56	1020	12811
197	From 4.3 m to 5.3 m	m^2	12.56	1040	13062
198	From 5.3 m to 6.3 m	m^2	12.56	1060	13314
199	From 6.3 m to 7.3 m	m^2	12.56	1080	13565
200	From 7.3 m to 8.3 m	m^2	12.56	1100	13816
201	From 8.3 m to 9.3 m	m^2	12.56	1120	14067
202	From 9.3 m to 10.3 m	m^2	12.56	1140	14318
203	From 10.3 m to 11.3 m	m^2	12.56	1160	14570
204	Curved surface - Inner Surface				
205	From 0 m to 3.3 m	m^2	31.09	1000	31086
206	From 3.3 m to 4.3 m	m^2	9.42	1020	9608
207	From 4.3 m to 5.3 m	m^2	9.42	1040	9797
208	From 5.3 m to 6.3 m	m^2	9.42	1060	9985
209	From 6.3 m to 7.3 m	m^2	9.42	1080	10174
210	From 7.3 m to 8.3 m	m^2	9.42	1100	10362
211	From 8.3 m to 9.3 m	m^2	9.42	1120	10550
212	From 9.3 m to 10.3 m	m^2	9.42	1140	10739
213	From 10.3 m to 11.3 m	m^2	9.42	1160	10927
214	Applying two coats of cement paint of approved colour and quality over the outer exposed cement plastered wall surfaces including cleaning, preparing the surface area and including cost of all materials, labour charges, curing etc.,.	m^2	19.65	100	1965
215	Refilling the outside of the well with excavated earth (other then sand) complying with standard specification for filling the foundation including watering consolidation etc.	m^3	21.60	39	843
216	Earthwork Quantity	m^3	122.08		
217	Deduction for Structure	m^3	100.48		

SL No	Item Description	UOM	Qty	Rate (Including 12% GST)	Amount
218	Conveyance of excess earth to a distance not exceeding 5km as directed by the Corporation Engineer including cost of loading, transportation and unloading charges etc complete	m^3	100.48	93	9345
219	Hire charges for dieasel pumpset above 3 HP to 7.5 HP with fuel and crew charges including transportation	Hrs	58.20	370	21534
220	Supplying and fixing of encapsulated P.V.C. steps inside the well	No	52.73	300	15818
221	Providing Construction Joints using 150 mm vide PVC water bar with single bulb (in metre)	m	242.91	395	95949
222	Supplying and fixing 200 mm dia CI puddle pipe in the well (in Kg)	Kg	1344.21	104	139798
223	Supplying, delivery and installation of SS304 stainless steel chequered plates using 10mm thick and also for outer frame including suitable steel arrangement to carry the chequered plate mesh (half the top areaof the suction well)	Kg	178.50	750	133875
224	Providing R.S.J.Support as per I.S.M.B.450 & I.S.M.B.200	Kg	1278.11	80	102249
225	Lifting Station – Electro-Mechanical				
226	Mechanical Works				
227	Supply and delivery of submersible centrifugal sewage non-clog pumps, vertical spindle type pump , wear resistance with submersible motor for the various duty conditions as stated in the annexure. Pump shall be capable of handling min 100 mm solid size with sewage specific gravity of up to 1.05. Pump shall be of robust construction . Liquid passages shall be finished smooth and designed as to allow free passage to solids. Pump Impeller should be of Non-clog semi open type , single vane / multi vane preferably contra bloc or vortex impeller design. Double mechanical seal with silicon carbide faces should be provided to protect the motor from ingress of sewage along the shaft. The critical speed of the rotor shall be at least 30% above the operating speed. Pumps to have double bearings between the pump & motor. The bearings life shall be minimum 100,000 hrs of operation with greased for life. Pump should be provided with automatic coupling device including pedestal, duck foot bend, stainless steel guide pipe or related accessories of suitable size to facilitate lifting and lowering into guide rails for easy maintenance. Pump shall be provided with a stainless steel lifting chain conforming to BS 970 Gr 304. Pump speed shall be of 960 for high duty pumps and 960/1450 rpm for low duty pumpsets . Casing and impeller should be of CI Gr. FG 260 :IS210 more preferably with hardened impeller capable of admitting up to 100-mm dia solids, cutting-tearing. Shaft should be of stainless steel AISI 410. All the fasteners and bolts shall be of AISI 410.The submersible motor shall be operated with 3 ph , 415 V(+ or – 10 %) , 50 Hz (+ or - 5 %) dry induction type. Motor shall be capable of giving rated output without reduction in the expected life span when operated continuously . The rotating assembly shall be dynamically balanced				
228	Insulation class shall be of “Class H” and degree of protection shall be of IP 68 as per IS 4691. Motor shall be suitable for continuous operation in fully submerged or partially submerged condition.The pumpset shall be supplied with power cable of PVC insulated and PVC sheathed , copper , flexible ,round type with required conductor size and number of cores as per starting method and of specified length for continuous use under water and air. The control cable of PVC insulated , PVC sheathed , flexible for stator winding temperature sensor 3 core x 1.5 sq.mm copper conductor and for bimetallic switches 2 core x 1.5 sqmm copper conductor shall be provided. Motor shall be supplied with 10 mts of round submersible copper cable of suitable size.				
229	Three Phase Panel Board - DOL with 2 level guard and auto start	No.	4.00	28000	112000
230	419 LPM X 18 m	No.	2.00	412503	825006
231	542 LPM X 24m	No.	2.00	412503	825006
232	Supply and delivery of double, flanged, CI sluice valves non rising spindle type to pressure rating of 1.6 PN to be used in Pumphouses				
233	100 DN Sluice valve	No.	44.00	15113	664972
234	The non return valve (Waffle type (dual place check valve)) shall be flanged and as confirming to IS and suitable for PN1.6. Valve shall be quick closing type with non-slam characteristics and without any external damping arrangement or counter weights. The body and door shall be of cast iron.				
235	100DN Non return valve	No.	4.00	30327	121308
236	Supply, delivery and fixing of CI pipes & specials from delivery (upto common manifold connecting point at outside the wet well) including 2 coats of anti-corrosive paint.	Kg	1207.97	201	242802
237	Level controller (float type) with necessary switches to control operation of motors with indicators.	No.	4.00	9900	39600
238	Electrical and mechanical items tool box				
239	6” Chain wrench best India make	No.	2.00	1634	3268
240	8”Chain Wrench Best India Make	No.	2.00	2209	4418
241	Connector Screw Driver 901 Taparia Make	No.	2.00	143	286
242	200mm Screw Driver 825 Taparia Make	No.	2.00	235	470

SL No	Item Description	UOM	Qty	Rate (Including 12% GST)	Amount
243	300mm Screw Driver 829 Taparia Make	No.	2.00	435	870
244	400mm Screw Driver 930 Taparia Make	No.	2.00	632	1264
245	200mm Cutting Plier Taparia Make	No.	2.00	770	1540
246	800gm Ball Pane Hammer with Handle Taparia Make	No.	2.00	969	1938
247	Digital Tong Tester CE Make	No.	2.00	8573	17146
248	Digital Multi Meter CE Make	No.	2.00	5759	11518
249	15" Screw Spanner Taparia Make	No.	2.00	1995	3990
250	12" Bearing Puller	No.	2.00	1979	3958
251	Lever Type Grease Gun	No.	2.00	1620	3240
252	12"Screw Spanner	No.	2.00	1466	2932
253	Crow Bar 5"	No.	2.00	1431	2862
254	1" Cold Chisel	No.	2.00	524	1048
255	Hacksaw Frame with Blade	No.	2.00	324	648
256	Electrical Air Blower	No.	2.00	7428	14856
257	Digital Tachometer	No.	2.00	4992	9984
258	Hand Crimpling Tool 8"	No.	2.00	1350	2700
259	DE Spanner set 6 to 32 Jhalani Make	No.	2.00	2584	5168
260	Rings spanner set 6 to 32 Jhalani Make	No.	2.00	5783	11566
261	Pipe Wrench 24" Jhalani Make	No.	2.00	3310	6620
262	Pipe Wrench 14" Jhalani Make	No.	2.00	1634	3268
263	12" Flat rough File Scissors Make	No.	2.00	815	1630
264	12" Flat smooth File Scissors Make	No.	2.00	1226	2452
265	12"Round File Rough Scissors	No.	2.00	948	1896
266	12" Round File Smooth Scissors Make	No.	2.00	1131	2262
267	12"Half Round File Rough Scissors Make	No.	2.00	1655	3310
268	12"Half Round File Smooth Scissors Make	No.	2.00	1655	3310
269	Electrical Works				
270	Rate for Provision for LT Metering box				
271	Supplying, fixing, erection, testing, comissioning at site Tamper proof LT metering cubicle with suitable rating CTs, bus bar, fuse cut out as per TNEB specifications for accomodating 1No energy meter supplied by TNEB including all accessories complete as directed by the Engineer.The metering cubicle shall have a suitable size glass window for veiwing the meter reading without opening the front cover.(including all lead and lift).	No	2.00	67200	134400
272	Designing and preparation of CEIG drawings, obtaining approval and safety certifcate including submission of completion report and rectification report.	Lot	2.00	14000	28000
273	Outdoor type - LT Power Distribution Board				
274	Supply, erection, testing and commissioning at site sheet steel fabricated 16(gauge), vermin proof, medium voltage panel, cubicle type with hinged double front door with rainhood cover suitable for IP-55 with locking arrangements.the panel shall be supplied, fixed and wired including interconnections as required.with the list of equipment as shown in the Single line diagram enclosed with technical specifications. The panel shall be provide with detachable plate at top and bottom of cable alley , having adequate knockouts for fabricating conduit/cable entries.	No	2.00	100352	200704
275	The panel shall be finished with two coats of redoxide primer paint and finally finished with approved colour epoxy based paint complete.The panel fabrication shall conform with I.S specification and I.E rules.The board shall be erected on a steel stand at operable height using suitable size angle iron and flat if required and fixed with foundation bolts and nuts using 1:2:4CC for their leg support civil work and provision for operator safety shelter etc, including all earthing connections complete.as per tender specification and Single line diagram(including all lead and lift)(Standard rate&Market rate)				
276	Supplying shunt capacitor bank conforming to IS 2834, 3 phase 400/440 Volts grade for power factor improvement.(including all lead and lift)				
277	a)2 KVAR or suitable capacity.(Panel Inbuilt) - 2nos.	Kvar	8.00	8400	67200
278	Fixing a shunt capacitor with necessary clamps, bolts and nuts to an existing wooden or metal board including banking of more than one capacitor and making all connections using suitable size cables.				
279	a) 2 KVAR or suitable capacity.	No	8.00	123	984
280	LT Cable				
281	Providing at site inclusive of all lead and lift of brand new approved make aluminium/copper conductor PVC insulated, sheathed flat/wire steel armoured cable with PVC outer sheathing 1.1 KV class (confirming to ISS 1554.)(including all lead and lift)				
282	a)4CX4Sqmm (Aluminium)(Incoming)-	Rmtr	60.00	140	8400
283	b) 3CX2.5Sqmm (copper) (To LS Pumps CP)	Rmtr	80.00	281	22480
284	c)PVC insulated single core multi strand fire retardant flexible copper cable with ISI confirming to IS 694 /990	Rmtr	40.00	147	5880

SL No	Item Description	UOM	Qty	Rate (Including 12% GST)	Amount
285	36/0.3 (2.5 sq.mm)				
286	LT Cable Terminations				
287	Supplying and fixing tinned copper lugs and crimping and fixing to terminal points for wires of the following sizes including all accessories such as cable glands of proper sizes etc complete as directed by the engineer.				
288	a)4CX4Sqmm (Aluminium)(Incoming)-	Rmtr	8.00	140	1120
289	c) 3CX2.5Sqmm (copper) (To LS Pumps CP)	Rmtr	8.00	210	1680
290	c)PVC insulated single core multi strand fire retardant flexible copper cable with ISI confirming to IS 694 /990	Rmtr	40.00	147	5880
291	36/0.3 (2.5 sq.mm)				
292	Laying of LT cables in trench or ducts.:				
293	laying of 1.1 KV class LT UG cable incl. earth work in existing trench / GI pipe / stoneware pipe / on wall / on pole as required.and as directed by engineer. (including all lead and lift).				
294	a) 4CX4Sqmm (Aluminium)(Incoming)-	Nos.	60.00	35	2100
295	b) 3CX2.5Sqmm (copper) (To LS Pumps CP)	Nos.	80.00	281	22480
296	c)PVC insulated single core multi strand fire retardant flexible copper cable with ISI confirming to IS 694 /990	Nos.	40.00	147	5880
297	36/0.3 (2.5 sq.mm)				
298	Supply and installation of LT cable route indicator..	Nos.	10.00	123	1230
299	Supplying and laying of Class B GI pipe on pole /wall/drain crossing with necessary clamping arrangements for UG cable of 1.1KV class				
300	40mm dia size	Rmtr	40.00	308	12320
301	Earthing:(For Motors, LT Switch Board, Starters, etc.)				
302	Supplying , fixing and wiring earth electrode as per IS:3043 for grounding all equipments using 40mm dia, 2.9mm thick GI pipe 2.5m long buried in a pit with GI funnel with mesh and suitable size reducer fixed on top of the earth electrode. The funnel should be enclosed in a CC chamber300X300X300mm size with a cast iron cover. The pit should be filled with equal proportion of salt and charcoal 150mm around the pipe to complete depth. The connection from the pipe to the conduit etc., is to be established through GI wire/ strip of size as per IS specification 732.using 12mm dia bolts, nuts, washers and checknuts etc. The pipe shall have 16 through holes of 12mm dia.(including all lead and lift)	Nos	4.00	7000	28000
303	Supplying and running GI Wire / Strip for grounding using suitable size clamps, bolts, nuts and washers, etc.as per IS 732.Double earthing to be done for Transformers, Motors, PCC and MCC Panels.(including all lead and lift) Market rate				
304	c: 12SWG GI Wire	Rmtr	60.00	28	1680
305	Internal/External Electrification				
306	a)Fabricating, supplying and erecting GI tubular pole of height 3 metre and M.S base plate of size 300mmX300mmX 6mm thick welded at the bottom of the pole 18Guage M.S control box of size 300mmX300MmX125mm with front opening cover, with locking arrangements, 30amps porcelain fuse cut-out/DP switch, 1No. of 4 way connector for cable looping. market rate	Nos	6.00	9408	56448
307	b)Supplying and fixing telescopic M.S.bracket fabricated by using 0.5m length 4" dia telescopic M.S. pipe with 2" dia 1.5m long M.S.bracket all are welded with suitable angle using 6mm thick M.S.sheet , grip bolts & nuts as required suitable for M.S Tubular pole with necessary two coats of approved painting, with all other accessories etc,wiring and fixing the light fitting complete.				
308	For single bracket 1.5 metre long	Nos	6.00	3528	21168
309	Safety Equipment:				
310	1) Supplying at site 3 nos. of fire buckets with round bottom made of GI sheet 24 SWG, 9 litres capacity painted inside white and outside red with a word 'FIRE' on the face of the bucket alongwith MS stand	No	2.00	4200	8400
311	2) Supplying and fixing at site 5 kg capacity ISI marked Dry Chemical powder fire extingusher with initial charge and with connected accessories and suitable brackets for mounting on wall complete ready to use	No	2.00	9800	19600
312	3) Supply and fixing of shock treatment chart on the wall with inside plastic sheet cover and plywood backplate framework complete	No	2.00	1400	2800
313	4) Supplying and fixing at site of DANGER/NO ADMISSION/NO SMOKING board made out of MS sheet metal with two coats of non corrosive enamelled paint.	No	2.00	1400	2800
314	5) Supplying at site rubber gloves of electrical quality tested to 22KV with ISI mark grooved	Pair	4.00	2800	11200
315	6) Supplying at site First aid box of suitable size containing medicines to give first aid treatment.	No	2.00	7000	14000
316	7)Electrical quality 6mm thick rubber mat	No	2.00	4200	8400
317	8)Rechargeable Emergency lamp(600mm fluorescent lamp)	No	2.00	5600	11200

SL No	Item Description	UOM	Qty	Rate (Including 12% GST)	Amount
318	TNEB registration cum processing fee,Issue of NOC, Initial security deposits, Meter security deposits, supervision, inspection charges,etc Including liaison with power supply authorities , electrical inspectorate, transmission of relevant documents, arranging for power supply,pollution control board acceptances for Genset installation and other charges including generator installation also.	Job	2.00	60000	120000
319	PUMPING STATIONS - INTERCONNECTION - WELLS				
320	SUCTION WELL COLUMN				
321	Earth work open well excavation for foundation & depositing on bank with an initial lead of 10 m & lift of 2 m for depths in hard stiff clay, stiff black cotton, hard red earth mixed with small sized boulders & hard gravely soil including dewatering of water as and when required, barricading with safety lamps etc all complete as per standard specification as directed by the Departmental Engineer.				
322	For Footing upto 2m depth	cum	6.62	168	1112
323	For 2m to 3.0 m depth	cum	2.21	188	415
324	Providing & laying PCC 1:3:6 as levelling course including curing etc all complete as per standard specification as directed by the Departmental Engineer.	cum	0.88	6612	5819
325	Supplying & laying Reinforced Cement Concrete of M30 grade using machine crushed hard broken granite stone jelly 20 mm for RCC works in all types of foundations, floor slabs of all shapes (Excluding cost of providing centering & fabrication of reinforcement which shall be measured & paid under seperate items) including curing, complying with standard specifications as directed by the Departmental Engineer using sulphate resisting cement.				
326	RCC	cum	3.55	8976	31865
327	Supplying & erecting centering for sides & walls of well including supports & strutting for plain surfaces with all cross bracings using 25 mm thick boards suitable purlined over silver oak (country wood) joists of size 10 x 6.5 cm spaced at about 90 cm centre to centre & supported by causarina props 10 to 13 cm diameter spaced at about 75 cm centre to centre etc. complete complying with standard specifications. Centering for RCC works below GL (wall).				
328	Columns up to 3.3m	Sqm	9.24	560	5174
329	Columns above 3.3 to 4.3m	Sqm	2.80	580	1624
330	Columns above 4.3 to 5.3m	Sqm	1.96	600	1176
331	Column footing Mat	Sqm	4.84	600	2904
332	Column footing	Sqm	4.91	600	2946
333	Supplying, fabricating & placing in position MS or deformed steel bars for all RCC items of work including cost of steel transporting, straightening, cutting, bending, cranking, binding etc. including cost of binding wire charids, laps to fix the reinforcement in all positions, all labour & materials complete complying with standard specifications & drawings as directed by the Departmental Engineer.	kg	355.00	97	34435
334	Refilling the sides of well with suitable excavated earth available in layers of 150 mm thick, watering, ramming & consolidation as directed by the Departmental Engineer.	cum	6.47	52	336
335	Conveyance of excess earth to a distance not exceeding 5km as directed by the Departmental Engineer including cost of loading, transportation and unloading charges etc complete	cum	1.08	93	100
336	GRIT PIT (1 X 1 m)				
337	Earth work open well excavation for foundation & depositing on bank with an initial lead of 10 m & lift of 2 m for depths in hard stiff clay, stiff black cotton, hard red earth mixed with small sized boulders & hard gravely soil including dewatering of water as and when required, barricading with safety lamps etc all complete as per standard specification as directed by the Departmental Engineer.				
338	Upto 1.56 m depth	cum	2.76	168	464
339	Providing & laying PCC 1:3:6 as levelling course including curing etc all complete as per standard specification as directed by the Departmental Engineer.	cum	0.18	6612	1190
340	Supplying & laying Reinforced Cement Concrete of M20 grade using machine crushed hard broken granite stone jelly 20 mm for RCC works in all types of foundations, floor slabs of all shapes (Excluding cost of providing centering & fabrication of reinforcement which shall be measured & paid under separate items) including curing, complying with standard specifications as directed by the Departmental Engineer using sulphate resisting cement. (Bottom Slab)	cum	0.18	8154	1468

SL No	Item Description	UOM	Qty	Rate (Including 12% GST)	Amount
341	Construction of brick masonry with ground moulded chamber bricks in CM 1:5 in side walls including curing etc all complete as per standard specifications.	cum	2.10	11924	25040
342	Plastering (Inside & Outside) in CM 1:5, 12 mm thick including necessary scaffolding, water the surface etc all complete as per standard specification.	sqm	18.25	492	8979
343	Supplying, fabricating & placing in position MS or deformed steel bars for all RCC items of work including cost of steel transporting, straightening, cutting, bending, cranking, binding etc. including cost of binding wire charids, laps to fix the reinforcement in all positions, all labour & materials complete complying with standard specifications & drawings as directed by the Departmental Engineer.	kg	18.00	97	1746
344	Refilling the sides of well with suitable excavated earth available in layers of 150 mm thick, watering, ramming & consolidation as directed by the Departmental Engineer.	cum	0.79	52	41
345	Conveyance of excess earth to a distance not exceeding 5km as directed by the Departmental Engineer including cost of loading, transportation and unloading charges etc complete	cum	1.97	93	183
346	INTERCONNECTION PIPES BETWEEN WELLS & GRIT PIT				
347	Earth work excavation for trenches & depositing on bank with an initial lead of 10 m & lift of 2 m for depths in hard stiff clay, stiff black cotton, hard red earth mixed with small sized boulders & hard gravely soil including dewatering of water as and when required, barricading with safety lamps etc all complete as per standard specification as directed by the Departmental Engineer.				
348	Connecting pipe 600mm diameter between Screen Chambers and Grit wells (upto 1.5m depth)	cum	15.75	168	2646
349	Connecting pipe 600 mm diameter between Grit wells and Suction well (upto 1.5m depth)	cum	23.63	168	3969
350		cum	6.00	168	1008
351	Connecting pipe 110 mm diameter between grit pit & screen well (upto 1.5m depth)	cum	10.65	168	1789
352	Earth work open well excavation for foundation for the following depth with initial lead of 10 m and initial lift of 2m in hard rock required blasting including barricading with safety lamps etc all complete				
353	Connecting pipe 200 mm diameter between grit well & grit pit (1.5 m to 2 m depth)	cum	2.00	1172	2344
354	Connecting pipe 110 mm diameter between grit pit & screen well (1.5 m to 2 m depth)	cum	3.55	1172	4161
355	Connecting pipe 600 mm & 700mm diameter between Screen Chambers and Grit wells (1.5 m to 2 m depth)	cum	5.25	1172	6153
356	Connecting pipe 600 mm & 700mm diameter between Screen Chambers and Grit wells (2 m to 3 m depth)	cum	10.50	1272	13356
357	Connecting pipe 600 mm & 700mm diameter between Screen Chambers and Grit wells (3 m to 4 m depth)	cum	10.50	1372	14406
358	Connecting pipe 600 mm & 700mm diameter between Screen Chambers and Grit wells (4 m to 5 m depth)	cum	10.50	1472	15456
359	Connecting pipe 600 mm& 700mm diameter between Screen Chambers and Grit wells (5 m to 6 m depth)	cum	5.25	1572	8253
360	Connecting pipe 600 mm & 700mm diameter between Grit wells and Suction well (1.5 m to 2 m depth)	cum	7.88	1172	9230
361	Connecting pipe 600 mm & 700mm diameter between Grit wells and Suction well (2 m to 3 m depth)	cum	15.75	1272	20034
362	Connecting pipe 600 mm & 700mm diameter between Grit wells and Suction well (3 m to 4 m depth)	cum	15.75	1372	21609
363	Connecting pipe 600 mm diameter & 700mm between Grit wells and Suction well (4 m to 5 m depth)	cum	15.75	1472	23184
364	Connecting pipe 600 mm & 700mm diameter between Grit wells and Suction well (5 m to 6 m depth)	cum	15.75	1572	24759
365	Connecting pipe 600 mm & 700mm diameter between Grit wells and Suction well (6 m to 7 m depth)	cum	15.75	1672	26334
366	Supplying & delivering of following RCC non pressure spun pipe with socket and spigot ends as per IS 458/2003 manufactured with sulphate resistence cement with 12 mm HI -alumina lining with rubber ring jointsetc all complete as per standard specification and as directed by Departmental Engineer.				
367	700mm diameter	m	10.00	11679	116790
368	600 mm diameter	m	10.00	8175	81750
369	200 mm diameter	m	5.00	2200	11000

SL No	Item Description	UOM	Qty	Rate (Including 12% GST)	Amount
370	Supplying & delivering of 110 mm diameter HDPE pipes as per IS for connecting the grit pit & screen well including necessary fittings like bends, etc, lowering into trenching, jointing, pressure testing as per the required pressure etc all complete as per standard specification and as directed by Departmental Engineer.	m	10.00	600	6000
371	Supplying and providing CI D/F sluice valve (450 mm diameter) of wall thimble mounted as per IS:1536 (PN 1) including all specials etc all complete as per standard specification and as directed by Departmental Engineer.	Nos.	4.00	153330	613320
372	Refilling the trenches with suitable excavated earth available in layers of 150 mm thick, watering, ramming & consolidation as directed by the Departmental Engineer.	Cum	15.75	52	819
373	**PS- ELECTRICAL MECHANICAL**				
374	**Mechanical**				
375	Supply and delivery of submersible centrifugal sewage non-clog pumps, vertical spindle type pump , wear resistance with submersible motor for the various duty conditions as stated in the annexure. Pump shall be capable of handling min 100 mm solid size with sewage specific gravity of up to 1.05. Pump shall be of robust construction . Liquid passages shall be finished smooth and designed as to allow free passage to solids. Pump Impeller should be of Non-clog semi open type , single vane / multi vane preferably contra bloc or vortex impeller design. Double mechanical seal with silicon carbide faces should be provided to protect the motor from ingress of sewage along the shaft.				
376	Pump shall be of robust construction . Liquid passages shall be finished smooth and designed as to allow free passage to solids. Pump Impeller should be of Non-clog semi open type , single vane / multi vane preferably contra bloc or vortex impeller design. Double mechanical seal with silicon carbide faces should be provided to protect the motor from ingress of sewage along the shaft.				
377	The critical speed of the rotor shall be at least 30% above the operating speed. Pumps to have double bearings between the pump & motor. The bearings life shall be minimum 100,000 hrs of operation with greased for life. Pump should be provided with automatic coupling device including pedestal, duck foot bend, stainless steel guide pipe or related accessories of suitable size to facilitate lifting and lowering into guide rails for easy maintenance. Pump shall be provided with a stainless steel lifting chain conforming to BS 970 Gr 304. Pump speed shall be of 960 for high duty pumps and 960/1450 rpm for low duty pumpsets . Casing and impeller should be of CI Gr. FG 260 :IS210 more preferably with hardened impeller capable of admitting up to 100-mm dia solids, cutting-tearing. Shaft should be of stainless steel AISI 410. All the fasteners and bolts shall be of AISI 410.The submersible motor shall be operated with 3 ph , 415 V(+ or – 10 %) , 50 Hz (+ or - 5 %) dry induction type. Motor shall be capable of giving rated output without reduction in the expected life span when operated continuously . The rotating assembly shall be dynamically balanced as per standards. The starting current of the motor shall not exceed 200% of rated full load current for Star / Delta or ATS starting under any circumstances .The motor shall be suitable for full voltage star delta / ATS starting. The locked rotor current of the motor shall not exceed 600% of full load current unless otherwise specified. Motor shall be designed to withstand 120 % of rated speed for two minutes without any mechanical damage , in either direction of rotation. The motor vibration shall be within the limit specified in applicable standards . Motor should be of IE2, explosion proof compatible for VFD operation together with star-Delta / ATS				
378	duty pumpsets . Casing and impeller should be of CI Gr. FG 260 :IS210 more preferably with hardened impeller capable of admitting up to 100-mm dia solids, cutting-tearing. Shaft should be of stainless steel AISI 410. All the fasteners and bolts shall be of AISI 410.The submersible motor shall be operated with 3 ph , 415 V(+ or – 10 %) , 50 Hz (+ or - 5 %) dry induction type. Motor shall be capable of giving rated output without reduction in the expected life span when operated continuously . The rotating assembly shall be dynamically balanced as per standards. The starting current of the motor shall not exceed 200% of rated full load current for Star / Delta or ATS starting under any circumstances .The motor shall be suitable for full voltage star delta / ATS starting. The locked rotor current of the motor shall not exceed 600% of full load current unless otherwise specified. Motor shall be designed to withstand 120 % of rated speed for two minutes without any mechanical damage , in either direction				

SL No	Item Description	UOM	Qty	Rate (Including 12% GST)	Amount
379	of rotation. The motor vibration shall be within the limit specified in applicable standards . Motor should be of IE2, explosion proof compatible for VFD operation together with star-Delta / ATS starter, protection against increase in stator winding temperature (15 deg Celsius) , bearing temperature, leakage in the stator housing and terminal box shall be provided and to be suitably interlocked with the control panel for tripping the pump in case of increase in temperature beyond set limit.				
380	Insulation class shall be of "Class H" and degree of protection shall be of IP 68 as per IS 4691. Motor shall be suitable for continuous operation in fully submerged or partially submerged condition.The pumpset shall be supplied with power cable of PVC insulated and PVC sheathed , copper , flexible ,round type with required conductor size and number of cores as per starting method and of specified length for continuous use under water and air. The control cable of PVC insulated , PVC sheathed , flexible for stator winding temperature sensor 3 core x 1.5 sq.mm copper conductor and for bimetallic switches 2 core x 1.5 sqmm copper conductor shall be provided. Motor shall be supplied with 10 mts of round submersible copper cable of suitable size.				
381	sheathed , flexible for stator winding temperature sensor 3 core x 1.5 sq.mm copper conductor and for bimetallic switches 2 core x 1.5 sqmm copper conductor shall be provided. Motor shall be supplied with 10 mts of round submersible copper cable of suitable size.				
382	The non clog submersible pumpset shall be provided with suitable starter control panel having all protections as mentioned above. (upto 5 HP - DOL Starter, above 5 HP to 25 HP -Star Delta Panel and beyond 25 HP shall be ATS) Fully automatic air brake star delta strater confirming to IS 139:47 /2004 with auto restart facility.	No.	3.00	2403069	7209207
383	with auto restart facility. PS2- 8811 Lpm x 35 m head				
384	Supply and delivery of double, flanged, sluice valves as per IS: 780 / IS:2906 and suitable for 10 bar rating. The body and door shall be of cast iron, spindle SS AISI 410. Seat rings - SS AISI 304, back seat bush-bronze.				
385	350 DN Sluice valve	No.	3.00	102456	307368
386	The non return valve shall be flanged and as per IS:5312 and suitable for 10bar rating. Valve shall be quick closing type with non-slam characteristics and without any external damping arrangement or counter weights. The body and door shall be of cast iron.				
387	350DN Non return valve	No.	3.00	117720	353160
388	Supply, delivery and fixing of 350mm CI pipes & specials from delivery (upto common manifold connecting point at outside the wet well) including 2 coats of anti-corrosive paint.	Kg	3198.00	166	530868
389	Level controller (float type) with necessary switches to control operation of motors with indicators.	No.	3.00	9900	29700
390	2 MT capacity hand operated over head Travelling (HOT) crane suitable for a span upto 8 mts span and travelling length uptp 10Mts with clear lift upto 6 Mts including gear type chain pulley block and geared Travelling trolley complete with all accessories.				
391	Electrical and mechanical items tool box – 1				
392	6" Chain wrench best India make	No.	1.00	1634	1634
393	8"Chain Wrench Best India Make	No.	1.00	2209	2209
394	Connector Screw Driver 901 Taparia Make	No.	1.00	143	143
395	200mm Screw Driver 825 Taparia Make	No.	1.00	235	235
396	300mm Screw Driver 829 Taparia Make	No.	1.00	435	435
397	400mm Screw Driver 930 Taparia Make	No.	2.00	632	1264
398	200mm Cutting Plier Taparia Make	No.	1.00	770	770
399	800gm Ball Pane Hammer with Handle Taparia Make	No.	1.00	969	969
400	Digital Tong Tester CE Make	No.	1.00	8573	8573
401	Digital Multi Meter CE Make	No.	1.00	5759	5759
402	15" Screw Spanner Taparia Make	No.	1.00	1995	1995
403	12" Bearing Puller	No.	1.00	1979	1979
404	Lever Type Grease Gun	No.	1.00	1620	1620
405	12"Screw Spanner	No.	1.00	1466	1466
406	Crow Bar 5"	No.	1.00	1431	1431
407	1" Cold Chisel	No.	1.00	524	524
408	Hacksaw Frame with Blade	No.	1.00	324	324
409	Electrical Air Blower	No.	1.00	7428	7428
410	Digital Tachometer	No.	1.00	4992	4992
411	Hand Crimpling Tool 8"	No.	1.00	1350	1350
412	DE Spanner set 6 to 32 Jhalani Make	No.	1.00	2584	2584
413	Rings spanner set 6 to 32 Jhalani Make	No.	1.00	5783	5783

SL No	Item Description	UOM	Qty	Rate (Including 12% GST)	Amount
414	Pipe Wrench 24" Jhalani Make	No.	1.00	3310	3310
415	Pipe Wrench 14" Jhalani Make	No.	1.00	1634	1634
416	12" Flat rough File Scissors Make	No.	1.00	815	815
417	12" Flat smooth File Scissors Make	No.	1.00	1226	1226
418	12"Round File Rough Scissors	No.	1.00	948	948
419	12" Round File Smooth Scissors Make	No.	1.00	1131	1131
420	12"Half Round File Rough Scissors Make	No.	1.00	1655	1655
421	12"Half Round File Smooth Scissors Make	No.	1.00	1655	1655
422	B. Electrical Works				
423	**LT Metering box**				
424	Supplying, fixing, erection, testing, comissioning at site Tamper proof LT metering cubicle with suitable rating CTs, bus bar, fuse cut out as per TNEB specifications for accomodating 1No energy meter supplied by TNEB including all accessories complete as directed by the Engineer.The metering cubicle shall have a suitable size glass window for veiwing the meter reading without opening the front cover.(including all lead and lift).	No	1.00		
425	Designing and preparation of CEIG drawings, obtaining approval and safety certifcate including submission of completion report and rectification report	Lot	1.00	12600	12600
426	M.V Control panel				
427	The M.V control panel shall be of floor mounting type, vermin and dust proof, modular type consisting of the following accessories and controls. The control panel shall be of enclosed type and built with compartmentalised modular type cubical. All cubicals shall be constructed from 14 SWG, MS sheet at the bottom and rear and 12 SWG MS sheet at front. The panel Board shall have removable rear cover hinged front door fitted with knobs. Ther interior and exterior of the panels and compartment shall be treated with one coat of primer and two coats of stove enamelled light grey shades. The SB is to be supplied with 4Nos of aluminium bus-bars with ample carrying capacity, properly sleeved with colour code.				
428	Incoming				
429	63 A TPN MCCB, 35KA with overload, short circuit protection & mechanically interlocked - 2 No.	each	1.00	14280	14280
430	Voltmeter with selector switch 1no	each	1.00	3080	3080
431	Ammeter with selevtor switch 1no.	each	1.00	3080	3080
432	3 Phase 4 wire KWH meter 1no.	each	1.00	7000	7000
433	Set of indicating lamps 1no.	each	1.00	420	420
434	Set of control fuses 1no.	each	1.00	420	420
435	Set of CT's 1no.	each	1.00	12320	12320
436	Outgoing				
437	32 A TP MCCB to control supply to the 3 HP motors - 2 nos	each	1.00	26880	26880
438	32 A TPN MCB with all accessories for lighting - 1no.	each	1.00	26880	26880
439	32A TPN MCCB as spare - 1no	each	1.00	26880	26880
440	Fabrication works	each	1.00	70000	70000
441	Outdoor type - LT Power Distribution Board				
442	Supply, erection, testing and commissioning at site sheet steel fabricated 16(gauge), vermin proof, medium voltage panel, cubicle type with hinged double front door with rainhood cover suitable for IP-55 with locking arrangements.the panel shall be supplied, fixed and wired including interconnections as required.with the list of equipment as shown in the Single line diagram enclosed with technical specifications. The panel shall be provide with detachable plate at top and bottom of cable alley, having adequate knockouts for fabricating conduit/cable entries.	No	1.00	184800	184800
443	The panel shall be finished with two coats of redoxide primer paint and finally finished with approved colour epoxy based paint complete.The panel fabrication shall conform with I.S specification and I.E rules.The board shall be erected on a steel stand at operable height using suitable size angle iron and flat if required and fixed with foundation bolts and nuts using 1:2:4 CC for their leg support civil work and provision for operator safety shelter etc, including all earthing connections complete.as per tender specification and Single line diagram(including all lead and lift)(Standard rate&Market rate)				
444	Supplying shunt capacitor bank conforming to IS 2834, 3 phase 400/440 Volts grade for power factor improvement.(including all lead and lift)				
445	a) 20 KVAR or suitable capacity.(Panel Inbuilt) - 3nos.	Kvar	99.00	1232	121968
446	Fixing a shunt capacitor with necessary clamps, bolts and nuts to an existing wooden or metal board including banking of more than one capacitor and making all connections using suitable size cables.				
447	a) 20 KVAR or suitable capacity.	No	1.00	370	370
448	a) 7 KVAR or suitable capacity.	No	2.00	370	740

SL No	Item Description	UOM	Qty	Rate (Including 12% GST)	Amount
449	LT Cable				
450	Providing at site inclusive of all lead and lift of brand new approved make aluminium/copper conductor PVC insulated, sheathed flat/wire steel armoured cable with PVC outer sheathing 1.1 KV class (confirming to ISS 1554.)(including all lead and lift)				
451	a) 3.5CX150Sqmm (Aluminium)(Incoming)-	Rmtr	75.00	543	40725
452	b)3.5CX50Sqmm (Aluminum) (To Pumps CP)	Rmtr	90.00	302	27180
453	a) 3.5CX240Sqmm (Aluminium)(Incoming)-	Rmtr	150.00	854	128100
454	b)3.5CX 185Sqmm (Aluminum) (To Pumps CP)	Rmtr	90.00	678	61020
455	c)PVC insulated single core multi strand fire retardant flexible copper cable with ISI confirming to IS 694 /990	Rmtr	100.00	147	14700
456	36/0.3 (2.5 sq.mm)				
457	LT Cable Terminations				
458	Supplying and fixing tinned copper lugs and crimping and fixing to terminal points for wires of the following sizes including all accessories such as cable glands of proper sizes etc complete as directed by the engineer.				
459	a) 3.5CX150Sqmm (Aluminium)(Incoming)-	Nos.	4.00	543	2172
460	b)3.5CX50Sqmm (Aluminum) (To Pumps CP)	Nos.	4.00	630	2520
461	a) 3.5CX240Sqmm (Aluminium)(Incoming)-	Nos.	4.00	854	3416
462	b)3.5CX185Sqmm (Aluminum) (To Pumps CP)	Nos.	4.00	1890	7560
463	c)PVC insulated single core multi strand fire retardant flexible copper cable with ISI confirming to IS 694 /990	Nos.	18.00	147	2646
464	36/0.3 (2.5 sq.mm)				
465	Laying of LT cables in trench or ducts.:				
466	laying of 1.1 KV class LT UG cable incl. earth work in existing trench / GI pipe / stoneware pipe / on wall / on pole as required.and as directed by engineer. (including all lead and lift).				
467	a) 3.5CX150Sqmm (Aluminium)(Incoming)-	m	75.00	543	40725
468	b)3.5CX50Sqmm (Aluminum) (To Pumps CP)	m	90.00	630	56700
469	a) 3.5CX240Sqmm (Aluminium)(Incoming)-	m	150.00	854	128100
470	b)3.5CX185Sqmm (Aluminum) (To Pumps CP)	m	90.00	1890	170100
471	c)PVC insulated single core multi strand fire retardant flexible copper cable with ISI confirming to IS 694 /990	Nos.	100.00	147	14700
472	36/0.3 (2.5 sq.mm)				
473	Supply and installation of LT cable route indicator	Nos.	5.00	1232	6160
474	To supply & installation following Structural Steel such as MS channal, MS Angle, MS Flat for installation of Cable Tray, Cable Supports, Lighting Fixture, P.B. Stn. Support etc.	Ton	0.50	98000	49000
475	Supplying and laying of Class B GI pipe on pole /wall/drain crossing with necessary clamping arrangements for UG cable of 1.1KV class.				
476	40mm dia size	Rmtr	20.00	308	6160
477	50mm dia size	Rmtr	10.00	441	4410
478	80mm dia size	Rmtr	10.00	742	7420
479	Earthing:(For Motors, LT Switch Board, Starters, etc.)				
480	Supplying , fixing and wiring earth electrode as per IS:3043 for grounding all equipments using 40mm dia, 2.9mm thick GI pipe 2.5m long buried in a pit with GI funnel with mesh and suitable size reducer fixed on top of the earth electrode. The funnel should be enclosed in a CC chamber300X300X300mm size with a cast iron cover. The pit should be filled with equal proportion of salt and charcoal 150mm around the pipe to complete depth. The connection from the pipe to the conduit etc., is to be established through GI wire/ strip of size as per IS specification 732.using 12mm dia bolts, nuts, washers and checknuts etc. The pipe shall have 16 through holes of 12mm dia.(including all lead and lift)	Nos	3.00	7336	22008
481	Supplying and running GI Wire / Strip for grounding using suitable size clamps, bolts, nuts and washers, etc.as per IS 732.Double earthing to be done for Transformers, Motors, PCC and MCC Panels.(including all lead and lift) Market rate				
482	a: 25 x 3 mm GI Strip	Rmtr	150.00	105	15750
483	b: 8SWG GI Wire	Rmtr	20.00	35	700
484	c: 12SWG GI Wire	Rmtr	20.00	28	560
485	Internal/External Electrification				
486	a)Fabricating, supplying and erecting GI tubular pole of height 3 metre and M.S base plate of size 300mmX300mmX 6mm thick welded at the bottom of the pole 18Guage M.S control box of size 300mmX300MmX125mm with front opening cover, with locking arrangements, 30amps porcelain fuse cut-out/DP switch, 1No. of 4 way connector for cable looping. market rate	Nos	3.00	9408	28224

SL No	Item Description	UOM	Qty	Rate (Including 12% GST)	Amount
487	b)Supplying and fixing telescopic M.S.bracket fabricated by using 0.5m length 4" dia telescopic M.S. pipe with 2" dia 1.5m long M.S.bracket all are welded with suitable angle using 6mm thick M.S.sheet , grip bolts & nuts as required suitable for M.S Tubular pole with necessary two coats of approved painting, with all other accessories etc,wiring and fixing the light fitting complete.				
488	M.S Tubular pole with necessary two coats of approved painting, with all other accessories etc,wiring and fixing the light fitting complete.				
489	For single bracket 1.5 metre long	Nos	3.00	3528	10584
490	Safety Equipment:				
491	1) Supplying at site 3 nos. of fire buckets with round bottom made of GI sheet 24 SWG, 9 litres capacity painted inside white and outside red with a word 'FIRE' on the face of the bucket alongwith MS stand	No	1.00	4200	4200
492	2) Supplying and fixing at site 5 kg capacity ISI marked Dry Chemical powder fire extingusher with initial charge and with connected accessories and suitable brackets for mounting on wall complete ready to use .	No	1.00	8624	8624
493	3) Supply and fixing of shock treatment chart on the wall with inside plastic sheet cover and plywood backplate framework complete	No	1.00	1400	1400
494	4) Supplying and fixing at site of DANGER/NO ADMISSION/NO SMOKING board made out of MS sheet metal with two coats of non corrosive enamelled paint.	No	1.00	1400	1400
495	5) Supplying at site rubber gloves of electrical quality tested to 22KV with ISI mark grooved	Pair	2.00	2800	5600
496	6) Supplying at site First aid box of suitable size containing medicines to give first aid treatment.	No	1.00	7000	7000
497	7)Electrical quality 6mm thick rubber mat	No	1.00	4200	4200
498	8)Rechargeable Emergency lamp(600mm fluorescent lamp)	No	1.00	5600	5600
499	TNEB registration cum processing fee,Issue of NOC, Initial security deposits, Meter security deposits, supervision, inspection charges,etc Including liaison with power supply authorities , electrical inspectorate, transmission of relevant documents, arranging for power supply,pollution control board acceptances for Genset installation and other charges including generator installation also.	no.	1.00	400000	400000
500	Supply and delivery and erection of Silent AMF Diesel Gensets following capacity /3 phase water cooled 240/415 V + 5% 0.8 P.F at 50 Hertz AC generator set should be rated for continous running with an over load provision of 10% for a period not exceeding one hour for every eleven hours at full load, The Diesel Gensets shall comprise diesel engine as per RELEVANT IS CODES AND STANDARDS at 1500 PM with standard accessories and the generator with suitable, AME conrol panel including supply,delivery,laying and jointing of relevant cable,earthing the electrical equipment, erection, testing and commissioning as for standard specifications and terms and conditions . Proper installation of exhaust stack as per norms and obtaining necessary consent/ NOC from PCB and CEIG including providing changeover panel				
501	150 KVA Genset	Set	1.00	1512000	1512000
502	**Compound Wall for 2 Nos of PS, 10 Nos of LS.**				
503	Earthwork excavation in all soils for foundation except hard rock that requires blasting with initial lead and lift etc. as per standard specifications complete	m3	261.42	126	32939
504	Providing PCC 1:4:8, 75 mm thick using 40 mm ISS HBG metal including cost and conveyance of all materials to site and handling charges, leveling, compacting, curing etc. complete as per standard specifications for foundation.	m3	14.62	4295	62807
505	Brick work in CM 1:5 (one cement &three sand) using country brick of size 9" x 4 3/8" x 2 3/4" including finishing, curing,etc., complete complying with standard specification	m3	120.61	8922	1076082
506	Providing steel formwork, centering with cross bracing to the required height and shuttering (steel/ply wood) as directed by the Engineer in-charge, for the following works (IS 456: 2000). Tie rods shall be provided to hold the shuttering in position wherever required by the engineer-in-charge				
507	For Raft				
508	Below G.L 5 x (1 x 4)	m2	71.10	420	29862
509	For Column				
510	Below G.L (0 - 3.30 m Depth) (0.23 x 4)	m2	130.82	495	64758
511	Above G.L (0 - 3.30 m Depth) (0.23 x 4)	m2	272.55	495	134912
512	For Plinth Beam				
513	Below G.L (0 - 3.30 m Depth) (0.23 x 2)	m2	144.81	420	60819

SL No	Item Description	UOM	Qty	Rate (Including 12% GST)	Amount
514	Providing RCC 1:2:4 using 20 mm ISS HSB metal including cost and conveyance of all materials to site, including all necessary labour charges and all other incidental charges such as laying concrete etc., excluding the cost of reinforcements. for foundation Beam				
515	For footing Below G.L (0 - 1.50m Depth)				
516	First Layer	m3	17.78	5655	100518
517	Sloped Portion	m3	9.36	5655	52940
518	For Column				
519	Below G.L (0 - 1.50m Depth)	m3	7.51	5655	42488
520	Above G.L (0 - 4.50m Depth)	m3	15.67	5693	89181
521	For Plinth Beam				
522	Below G.L (0 - 1.50 m Depth)	m3	11.09	5655	62723
523	Plastering with CM 1:5, 12 mm thick including cost and conveyance of all materials to site and labour charges etc. complete as per standard specifications	m2	1239.51	369	457379
524	Supply and fabrication of HSD (TMT Fe-500) reinforcements including cost and conveyance to site and fabrication charges including cost of binding wires, , labor for steel handling, bending, placement of cover blocks etc. including cost of all items as per standard specifications etc. placing in position complete as per standard specifications.	MT	6.16	97333	599734
525	White washing with freshly burnt shell lime white in colour in all floors including cost of lime and other materials brushes scaffolding charges etc. complete complying with standard specification . and as directed.	m2	1239.51	30	37185
526	Refilling the trenches with excavated soil/earth (other than sand) including compacting, complying with the standard specification.	m3	201.05	49	9851
527	Disposing of Surplus Earth at lead of 5 Kms	m3	60.36	93	5614
528	PS				
529	Footing column				
530	Earth Work open well excavation complying with relevant clauses of T.N.D.S.S. Well sinking and with lead upto 10 metre in sand, silt or other loose soil, Wet sand or silt not under water, light black cotton soil, sandy loam and ordinary soil				
531	0 - 1.50 m Depth	m3	71.87	168	12074
532	Supplying and placing in position PCC 1:4:8 upto a thickness of 75 mm for leveling course including centering & shuttering, compaction, curing etc. and dewatering wherever necessary. Below G.L				
533	For Walls	m3	8.15	6393	52082
534	Brickwork in 1:5 cement mortar using Second Class Country bricks of size 9" x 4 3/8" x 2 3/4" including curing etc. complete	m3	22.56	8943	201754
535	Providing 12mm thick Cement plaster in 1:3 cement mortar including cost and conveyance of all materials to site and labour charges etc. complete as per standard specifications	m2	94.01	372	34973
536	Providing 20 mm thick Cement plaster in 1:3 cement mortar including cost and conveyance of all materials to site and labour charges etc. complete as per standard specifications	m2	39.48	500	19740
537	Providing 10 mm thick Cement plaster in 1:3 cement mortar for ceiling including cost and conveyance of all materials to site and labour charges etc. complete as per standard specifications	m2	12.00	460	5520
538	Providing Granolithic flooring 40 mm thick in cement concrete 1:2:4 mix using 10mm to 12mm HBG metal & floor finish etc., complete as per standard specification.	m3	0.48	362	174
539	Supplying and placing in position PCC 1:4:8 upto a thickness of 150 mm for leveling course including centering & shuttering, compaction, curing etc. and dewatering wherever necessary. Above G.L (0 - 4.5m)	m3	1.80	8524	15343
540	Providing sand filling for basement for using river sand, spreading, leveling, compacting etc complete in layers of 100mm thickness including cost & conveyance of sand.	m3	1.80	8489	15280
541	Providing earth filling in basement, 300mm thick including spreading, leveling, compacting, water saturation etc complete	m3	3.60	956	3442

SL No	Item Description	UOM	Qty	Rate (Including 12% GST)	Amount
542	M-30 CONCRETE - Providing and laying in position, standarised design mix M-30 Grade using 20mm and down graded hard broken granite stone jelly for all RCC items of works with minimum cement content of 400Kg/m3 and maximum water cement ratio of 0.55, including admixture (plasticizer/super plasticizer) in recommended proportions as per IS:9103 to accelerate, retard setting of concrete, improve workability without impairing strength and durability with about (5.70 cu.m.)940.50Kg of 20mm machine crushed stone jelly and with about (2.80 cu.m.)462.00Kg of 10-12mm machine crushed jelly and with about (4.25 cu.m.)701.25Kg of sand, but excluding cost of reinforcement grill and fabricating charges, centering and shuttering and also including laying, vibrating with mechanical vibrators, finishing, curing, etc and providing fixtures like fan clamps in the RCC floor/roof slabs wherever necessary without clamping extra, etc. complete complying with standard specification and as directed by the departmental officers. The coarse and fine aggregates to be used should comply with the requirements of IS 383-2016. (No separate payment will be made by the department for the excess usage of materials as per design mix.)	m3	4.24	6636	28137
543	Providing steel form work, centering with cross bracing to the required height and shuttering (steel/ply wood) as directed by the Engineer in-charge, for the following works (IS 456: 2000).				
544	Roof Slab Above G.L (3.3-4.3 m depth)	m2	30.75	675	20754
545	Lintels Above (0 - 3.30 m depth)	m2	4.56	675	3078
546	Supplying, fabricating and placing in position HSD (TMT Fe-500) reinforcements including cost and conveyance to site and provision of cover blocks including the fabrication charges, cost of binding wires, labour, transportation, cutting, bending, cranking, welding etc., placing in position complete as per standard specifications.	Kg	329.39	97	31951
547	Providing and fixing doors, windows and Ventilator				
548	Fully Paneled Double Leaf doors (1.00 x 2000 mm)	Nos.	1.33	5910	7880
549	Fully Paneled Double Leaf Windows (1.20 x 0.90m)	Nos.	2.67	4381	11683
550	White washing with freshly burnt shell lime white in colour in all floors including cost of lime and other materials brushes scaffolding charges etc. complete complying with standard specification . and as directed.	m2	94.01	40	3761
551	Distempering, two coats in all floors including brushes etc., complete	m2	51.48	80	4118
552	Refilling the trenches with excavated soil/earth (other than sand) including compacting, complying with the standard specification.	m3	63.25	52	3289
553	Removal of surplus earth upto a lead of 5km.	m3	8.61	230	1981
	Pumping Station (1 Nos) / Lifting Station (2 Nos) Works				**₹ 3,35,59,524**
GRAND TOTAL AMOUNT (Rs.)					**₹ 65,90,94,739**

Summery of Cost - Muttar, Puthukkalavattom and Perandoor Interceptor Trunk Main Network and Pumping Station		
Sl	**Name of Items.**	**Cost in Lakhs**
1	Total Cost of Muttar Plant Network	1374.31
2	Total Cost of Perandoor Plant Network	1690.41
3	Total Cost of Puthukkalavattom Plant Network	2233.51
Total Cost of Distribution Network of Northen STP Units		5298.23

Summery of Cost - Elamkulam and Vennala Interceptor Trunk Main Network and Pumping Station		
Sl	**Name of Items.**	**Cost in Lakhs**
1	Total Cost of Elamkulam Plant Network	6290.77
2	Total Cost of Vennala Plant Network	4594.30
Total Cost of Distribution Network of Northen STP Units		10885.07

BLOCK ESTIMATE FOR 10 MLD SEWAGE TREATMENT PLANT AT ELAMKULAM, KERALA BASED ON SBR / CYCLIC ACTIVATED SLUDGE PROCESS			
Sr. No	Description	Unit	Rate (2019- 20)
	Designing, providing, constructing,hydraulic testing, commissioning and giving satisfactory trials of STP based on SBR technology consisting of Inlet Chamber, Screen Chamber, Detritus Tanks, Distribution Chamber and Biological CASP Basins, Sludge Sump, Chlorine Contact Tank, Chlorinator Room/Shed, Sludge Centrifuge necessary piping work with required valves, gates, drains, pathways Administration Block cum Laboratory, Laboratory Equipments, Tools and Plants, Spare Parts, etc. complete as turnkey job with all involved civil, electrical and mechanical works inclusive of following items, units as per detailed specification for civil, electrical and mechanical components with all duties and taxes, etc. complete to achieve **BOD < 5 ppm, COD < 100 ppm, TSS < 10 ppm**, to get recyclable quality of water for industrial / agricultural purposes. (In Case Cyclic activated sludge plant is designed for N, P outlet parameters shall also include TN < 10 ppm, Nh3N < 2 ppm and TP < 1 ppm)		
	1. Inlet Chamber		
	2. Screen Chamber		
	3. Detritus Tank		
	4. CASP Basins		
	5. Chlorine Contact Tank		
	6. Chlorinator and Chlorinator Room /Tonner Room:		
	7. Sludge Sump		
	8. Sludge Centrifuge Platform With Centrifuges		
	9. Outfall Sewer		
	10. Piping Work in CI-LA class including Sluice Valves, Reflux Valves, MS Gates Providing, laying and jointing pipes		
	11. Administrative Building cum Laboratory (G+1)		
	Elamkulam STP - Chilavanoor & TP south		Rate / MLD Rs. In Lakhs
	10.00 MLD	per MLD	100
	Notes :--		
a	Description		
b	Water table is considered at 5m below ground level		
c	Soil Bearing Capacity considered as 20 T/m^2 at l.5m below ground level		
d	OPC has been considered for casting purpose		
e	All civil items,electrical,piping,valves,pumps,motors,blowers etc.are considered as per Schedule of rates		
f	Upto 5 MLD sludge drying beds, and above 5 MLD of sludge centrifuge and DWPE dosing system		
g	Upto 5 MLD , and above 5 MLD NaOCl dosing system instead of Gas chlorination		
h	Lab euipments for above 5 MLD STP's.		
i	O & M cost shall be added extra.		
j	No Piling, dewatering, soil improvement, de-silting considered in the cost.		
k	Site is clear, flat and levelled. No site development works, filling, dewatering considered.		
l	Peak factor is considered as 2 times of average flow. For every 25% increase in peak factor , 10% extra cost shall be added over the above rates.		
m	OPC Tor Steel considered .		
n	Treated Water Disposal up to 50 m considered.		
o	N & P reduction not considered.		
p	HT Electrical Works shall be added as per case specific conditions.		
q	Raw Sewage Pumping Works shall be added as per case specific conditions.		
r	In case TN < 10 & TP < 1 quality is required, above rates shall be increased by 10%.		
	Calculating Rates for 1 MLD STP based on SBR Technology:		
	Per MLD Rate for 1STP	per MLD	100.00
	Adding 5% extra for Nitrogen & Phosphorous removal	per MLD	5.00
	Add 5% cost considering peak factor 2.25 as against 2 SOR	per MLD	5.00
	Total	**per MLD**	**110.00**
	Add 5% for work in Corporation Area on per MLD rate in above total	per MLD	5.50

	Total	**per MLD**	**115.50**
A	**Total Cost of 10 MLD Plant based on above calculated rate = 120.75 x 10**	**Rs. Lacs**	**1155.00**
	Say	**Rs. Lacs**	**1,155.00**
B	**Cost for Additional Items not covered in per MLD MJP DSR rate**	**Rs Lacs**	**400**
1	HT SUBSTATION		
2	DG ROOM INCLUDING DG SET		
3	Internal ROAD		
4	COMPOUND WALL		
5	LANDSCAPING		
C	**Cost for turbo blower (3 Nos.)**	**Rs Lacs**	**135**
D	**Cost for pumping station (MPS) capable of handling peak flow (Peak flow 33.75 MLD) = 10 MLD * 20 Lakhs/MLD**	**Rs. Lacs**	**200**
	Sub Total Cost of 10 MLD STP (A+B)	**Rs Lacs**	**1,890.00**
E	**Additional cost for piling works (Dia of piles = XX mm and NO of piles =)**		**383.3**
	Total		**2,273.30**
	Summary - Cost Estimate for STP - O & M		
	(12 Years of 15 year life cycle cost and intial 3 year shall be by tech provider)		
F	**Yearly Power Cost,lacs pa/MLD for SBR Technology**		
	(Yearly Power Cost,lacs pa/MLD= 3.37)	Rs	**404.40**
G	**Annual repairs costs, Lacs pa/MLD for SBR Technology**		
	(Annual repairs costs, Lacs pa/MLD = 1.84)	Rs	**220.80**
H	**Chemical Cost (Per MLD) for SBR Technology**		
	(Chemical Cost (Per MLD) = 3.3)	Rs	**396.00**
	Total O&M, Repair and chemical cost		**1,021.20**
	Total Cost of 10 MLD STP (E+F+G+H)		**3,294.50**

BLOCK ESTIMATE FOR 10 MLD SEWAGE TREATMENT PLANT
AT ELAMKULAM, KERALA BASED ON SBR / CYCLIC ACTIVATED SLUDGE PROCESS

Sr. No	Description	Unit	Rate (2019- 20)
	Designing, providing, constructing,hydraulic testing, commissioning and giving satisfactory trials of STP based on SBR technology consisting of Inlet Chamber, Screen Chamber, Detritus Tanks, Distribution Chamber and Biological CASP Basins, Sludge Sump, Chlorine Contact Tank, Chlorinator Room/Shed, Sludge Centrifuge necessary piping work with required valves, gates, drains, pathways Administration Block cum Laboratory, Laboratory Equipments, Tools and Plants, Spare Parts, etc. complete as turnkey job with all involved civil, electrical and mechanical works inclusive of following items, units as per detailed specification for civil, electrical and mechanical components with all duties and taxes, etc. complete to achieve **BOD < 5 ppm, COD < 100 ppm, TSS < 10 ppm**, to get recyclable quality of water for industrial / agricultural purposes. (In Case Cyclic activated sludge plant is designed for N, P outlet parameters shall also include TN < 10 ppm, Nh3N < 2 ppm and TP < 1 ppm)		
	1. Inlet Chamber		
	2. Screen Chamber		
	3. Detritus Tank		
	4. CASP Basins		
	5. Chlorine Contact Tank		
	6. Chlorinator and Chlorinator Room /Tonner Room:		
	7. Sludge Sump		
	8. Sludge Centrifuge Platform With Centrifuges		
	9. Outfall Sewer		
	10. Piping Work in CI-LA class including Sluice Valves, Reflux Valves, MS Gates Providing, laying and jointing pipes		
	11. Administrative Building cum Laboratory (G+1)		
	Vennala STP - Edapally south		Rate / MLD Rs. In Lakhs
	10.00 MLD	per MLD	100
	Notes :--		
a	Description		
b	Water table is considered at 5m below ground level		
c	Soil Bearing Capacity considered as 20 T/m^2 at l.5m below ground level		
d	OPC has been considered for casting purpose		
e	All civil items,electrical,piping,valves,pumps,motors,blowers etc.are considered as per Schedule of rates		
f	Upto 5 MLD sludge drying beds, and above 5 MLD of sludge centrifuge and DWPE dosing system		
g	Upto 5 MLD , and above 5 MLD NaOCl dosing system instead of Gas chlorination		
h	Lab euipments for above 5 MLD STP's.		
i	O & M cost shall be added extra.		
j	No Piling, dewatering, soil improvement, de-silting considered in the cost.		
k	Site is clear, flat and levelled. No site development works, filling, dewatering considered.		
l	Peak factor is considered as 2 times of average flow. For every 25% increase in peak factor , 10% extra cost shall be added over the above rates.		
m	OPC Tor Steel considered .		
n	Treated Water Disposal up to 50 m considered.		
o	N & P reduction not considered.		
p	HT Electrical Works shall be added as per case specific conditions.		
q	Raw Sewage Pumping Works shall be added as per case specific conditions.		
r	In case TN < 10 & TP < 1 quality is required, above rates shall be increased by 10%.		
	Calculating Rates for 1 MLD STP based on SBR Technology:		
	Per MLD Rate for 1STP	per MLD	100.00
	Adding 5% extra for Nitrogen & Phosphorous removal	per MLD	5.00
	Add 5% cost considering peak factor 2.25 as against 2 SOR	per MLD	5.00
	Total	**per MLD**	**110.00**
	Add 5% for work in Corporation Area on per MLD rate in above total	per MLD	5.50

	Total	**per MLD**	**115.50**
A	**Total Cost of 10 MLD Plant based on above calculated rate = 120.75 x 10**	**Rs. Lacs**	**1155.00**
	Say	**Rs. Lacs**	**1,155.00**
B	**Cost for Additional Items not covered in per MLD MJP DSR rate**	**Rs Lacs**	**267**
1	HT SUBSTATION		
2	DG ROOM INCLUDING DG SET		
3	Internal ROAD		
4	COMPOUND WALL		
5	LANDSCAPING		
C	**Cost for turbo blower (3 Nos.)**	**Rs Lacs**	**135**
D	**Cost for pumping station (MPS) capable of handling peak flow (Peak flow 33.75 MLD) = 10 MLD * 20 Lakhs/MLD**	**Rs. Lacs**	**200**
	Sub Total Cost of 10 MLD STP (A+B)	**Rs Lacs**	**1,756.67**
E	**Additional cost for piling works (Dia of piles = XX mm and NO of piles =)**		**383.3**
	Total		**2,139.97**
	Summary - Cost Estimate for STP - O & M		
	(12 Years of 15 year life cycle cost and intial 3 year shall be by tech provider)		
F	**Yearly Power Cost,lacs pa/MLD for SBR Technology**		
	(Yearly Power Cost,lacs pa/MLD= 3.37)	Rs	**404.40**
G	**Annual repairs costs, Lacs pa/MLD for SBR Technology**		
	(Annual repairs costs, Lacs pa/MLD = 1.84)	Rs	**220.80**
H	**Chemical Cost (Per MLD) for SBR Technology**		
	(Chemical Cost (Per MLD) = 3.3)	Rs	**396.00**
	Total O&M, Repair and chemical cost		**1,021.20**
	Total Cost of 10 MLD STP (E+F+G+H)		**3,161.17**

BLOCK ESTIMATE FOR 10 MLD SEWAGE TREATMENT PLANT AT ELAMKULAM, KERALA BASED ON SBR / CYCLIC ACTIVATED SLUDGE PROCESS			
Sr. No	Description	Unit	Rate (2019- 20)
	Designing, providing, constructing,hydraulic testing, commissioning and giving satisfactory trials of STP based on SBR technology consisting of Inlet Chamber, Screen Chamber, Detritus Tanks, Distribution Chamber and Biological CASP Basins, Sludge Sump, Chlorine Contact Tank, Chlorinator Room/Shed, Sludge Centrifuge necessary piping work with required valves, gates, drains, pathways Administration Block cum Laboratory, Laboratory Equipments, Tools and Plants, Spare Parts, etc. complete as turnkey job with all involved civil, electrical and mechanical works inclusive of following items, units as per detailed specification for civil, electrical and mechanical components with all duties and taxes, etc. complete to achieve **BOD < 5 ppm, COD < 100 ppm, TSS < 10 ppm**, to get recyclable quality of water for industrial / agricultural purposes. (In Case Cyclic activated sludge plant is designed for N, P outlet parameters shall also include TN < 10 ppm, Nh3N < 2 ppm and TP < 1 ppm)		
	1. Inlet Chamber		
	2. Screen Chamber		
	3. Detritus Tank		
	4. CASP Basins		
	5. Chlorine Contact Tank		
	6. Chlorinator and Chlorinator Room /Tonner Room:		
	7. Sludge Sump		
	8. Sludge Centrifuge Platform With Centrifuges		
	9. Outfall Sewer		
	10. Piping Work in CI-LA class including Sluice Valves, Reflux Valves, MS Gates Providing, laying and jointing pipes		
	11. Administrative Building cum Laboratory (G+1)		
	Muttar STP-Edapally north		Rate / MLD Rs. In Lakhs
	2.00 MLD	per MLD	100
	Notes :--		
a	Description		
b	Water table is considered at 5m below ground level		
c	Soil Bearing Capacity considered as 20 T/m^2 at l.5m below ground level		
d	OPC has been considered for casting purpose		
e	All civil items,electrical,piping,valves,pumps,motors,blowers etc.are considered as per Schedule of rates		
f	Upto 5 MLD sludge drying beds, and above 5 MLD of sludge centrifuge and DWPE dosing system		
g	Upto 5 MLD , and above 5 MLD NaOCl dosing system instead of Gas chlorination		
h	Lab euipments for above 5 MLD STP's.		
i	O & M cost shall be added extra.		
j	No Piling, dewatering, soil improvement, de-silting considered in the cost.		
k	Site is clear, flat and levelled. No site development works, filling, dewatering considered.		
l	Peak factor is considered as 2 times of average flow. For every 25% increase in peak factor , 10% extra cost shall be added over the above rates.		
m	OPC Tor Steel considered .		
n	Treated Water Disposal up to 50 m considered.		
o	N & P reduction not considered.		
p	HT Electrical Works shall be added as per case specific conditions.		
q	Raw Sewage Pumping Works shall be added as per case specific conditions.		
r	In case TN < 10 & TP < 1 quality is required, above rates shall be increased by 10%.		
	Calculating Rates for 1 MLD STP based on SBR Technology:		
	Per MLD Rate for 1STP	per MLD	100.00
	Adding 5% extra for Nitrogen & Phosphorous removal	per MLD	5.00
	Add 5% cost considering peak factor 2.25 as against 2 SOR	per MLD	5.00
	Total	**per MLD**	**110.00**
	Add 5% for work in Corporation Area on per MLD rate in above total	per MLD	5.50

	Total	**per MLD**	**115.50**
A	**Total Cost of 10 MLD Plant based on above calculated rate = 120.75 x 2**	**Rs. Lacs**	**231.00**
	Say	**Rs. Lacs**	**231.00**
B	**Cost for Additional Items not covered in per MLD MJP DSR rate**	**Rs Lacs**	**133**
1	HT SUBSTATION		
2	DG ROOM INCLUDING DG SET		
3	Internal ROAD		
4	COMPOUND WALL		
5	LANDSCAPING		
C	**Cost for turbo blower (1 Nos.)**	**Rs Lacs**	**45**
D	**Cost for pumping station (MPS) capable of handling peak flow = 5 MLD * 20 Lakhs/MLD**	**Rs. Lacs**	**100**
	Sub Total Cost of 10 MLD STP (A+B)	**Rs Lacs**	**509.33**
E	**Additional cost for piling works (Dia of piles = XX mm and NO of piles =)**		**76.66**
	Total		**585.99**
	Summary - Cost Estimate for STP - O & M		
	(12 Years of 15 year life cycle cost and intial 3 year shall be by tech provider)		
F	**Yearly Power Cost,lacs pa/MLD for SBR Technology**		
	(Yearly Power Cost,lacs pa/MLD= 3.37)	Rs	**80.88**
G	**Annual repairs costs, Lacs pa/MLD for SBR Technology**		
	(Annual repairs costs, Lacs pa/MLD = 1.84)	Rs	**44.16**
H	**Chemical Cost (Per MLD) for SBR Technology**		
	(Chemical Cost (Per MLD) = 3.3)	Rs	**79.20**
	Total O&M, Repair and chemical cost		**204.24**
	Total Cost of 2 MLD STP (E+F+G+H)		**790.23**

BLOCK ESTIMATE FOR 10 MLD SEWAGE TREATMENT PLANT AT ELAMKULAM, KERALA BASED ON SBR / CYCLIC ACTIVATED SLUDGE PROCESS			
Sr. No	Description	Unit	Rate (2019- 20)
	Designing, providing, constructing,hydraulic testing, commissioning and giving satisfactory trials of STP based on SBR technology consisting of Inlet Chamber, Screen Chamber, Detritus Tanks, Distribution Chamber and Biological CASP Basins, Sludge Sump, Chlorine Contact Tank, Chlorinator Room/Shed, Sludge Centrifuge necessary piping work with required valves, gates, drains, pathways Administration Block cum Laboratory, Laboratory Equipments, Tools and Plants, Spare Parts, etc. complete as turnkey job with all involved civil, electrical and mechanical works inclusive of following items, units as per detailed specification for civil, electrical and mechanical components with all duties and taxes, etc. complete to achieve **BOD < 5 ppm, COD < 100 ppm, TSS < 10 ppm**, to get recyclable quality of water for industrial / agricultural purposes. (In Case Cyclic activated sludge plant is designed for N, P outlet parameters shall also include TN < 10 ppm, Nh3N < 2 ppm and TP < 1 ppm)		
	1. Inlet Chamber		
	2. Screen Chamber		
	3. Detritus Tank		
	4. CASP Basins		
	5. Chlorine Contact Tank		
	6. Chlorinator and Chlorinator Room /Tonner Room:		
	7. Sludge Sump		
	8. Sludge Centrifuge Platform With Centrifuges		
	9. Outfall Sewer		
	10. Piping Work in CI-LA class including Sluice Valves, Reflux Valves, MS Gates Providing, laying and jointing pipes		
	11. Administrative Building cum Laboratory (G+1)		
	Puthukkalavattom STP - Chilavanoor north		Rate / MLD Rs. In Lakhs
	5.00 MLD	per MLD	100
	Notes :--		
a	Description		
b	Water table is considered at 5m below ground level		
c	Soil Bearing Capacity considered as 20 T/m^2 at l.5m below ground level		
d	OPC has been considered for casting purpose		
e	All civil items,electrical,piping,valves,pumps,motors,blowers etc.are considered as per Schedule of rates		
f	Upto 5 MLD sludge drying beds, and above 5 MLD of sludge centrifuge and DWPE dosing system		
g	Upto 5 MLD , and above 5 MLD NaOCl dosing system instead of Gas chlorination		
h	Lab euipments for above 5 MLD STP's.		
i	O & M cost shall be added extra.		
j	No Piling, dewatering, soil improvement, de-silting considered in the cost.		
k	Site is clear, flat and levelled. No site development works, filling, dewatering considered.		
l	Peak factor is considered as 2 times of average flow. For every 25% increase in peak factor , 10% extra cost shall be added over the above rates.		
m	OPC Tor Steel considered .		
n	Treated Water Disposal up to 50 m considered.		
o	N & P reduction not considered.		
p	HT Electrical Works shall be added as per case specific conditions.		
q	Raw Sewage Pumping Works shall be added as per case specific conditions.		
r	In case TN < 10 & TP < 1 quality is required, above rates shall be increased by 10%.		
	Calculating Rates for 1 MLD STP based on SBR Technology:		
	Per MLD Rate for 1STP	per MLD	100.00
	Adding 5% extra for Nitrogen & Phosphorous removal	per MLD	5.00
	Add 5% cost considering peak factor 2.25 as against 2 SOR	per MLD	5.00
	Total	**per MLD**	**110.00**
	Add 5% for work in Corporation Area on per MLD rate in above total	per MLD	5.50

	Total	**per MLD**	**115.50**
A	**Total Cost of 10 MLD Plant based on above calculated rate = 120.75 x 5**	**Rs. Lacs**	**577.50**
	Say	**Rs. Lacs**	**578.00**
B	**Cost for Additional Items not covered in per MLD MJP DSR rate**	**Rs Lacs**	**133**
1	HT SUBSTATION		
2	DG ROOM INCLUDING DG SET		
3	Internal ROAD		
4	COMPOUND WALL		
5	LANDSCAPING		
C	**Cost for turbo blower (2 Nos.)**	**Rs Lacs**	**90**
D	**Cost for pumping station (MPS) capable of handling peak flow = 5 MLD * 20 Lakhs/MLD**	**Rs. Lacs**	**100**
	Sub Total Cost of 10 MLD STP (A+B)	**Rs Lacs**	**901.33**
E	**Additional cost for piling works (Dia of piles = XX mm and NO of piles =)**		**191.7**
	Total		**1,093.03**
	Summary - Cost Estimate for STP - O & M		
	(12 Years of 15 year life cycle cost and intial 3 year shall be by tech provider)		
F	**Yearly Power Cost,lacs pa/MLD for SBR Technology**		
	(Yearly Power Cost,lacs pa/MLD= 3.37)	Rs	**202.20**
G	**Annual repairs costs, Lacs pa/MLD for SBR Technology**		
	(Annual repairs costs, Lacs pa/MLD = 1.84)	Rs	**110.40**
H	**Chemical Cost (Per MLD) for SBR Technology**		
	(Chemical Cost (Per MLD) = 3.3)	Rs	**198.00**
	Total O&M, Repair and chemical cost		**510.60**
	Total Cost of 5 MLD STP (E+F+G+H)		**1,603.63**

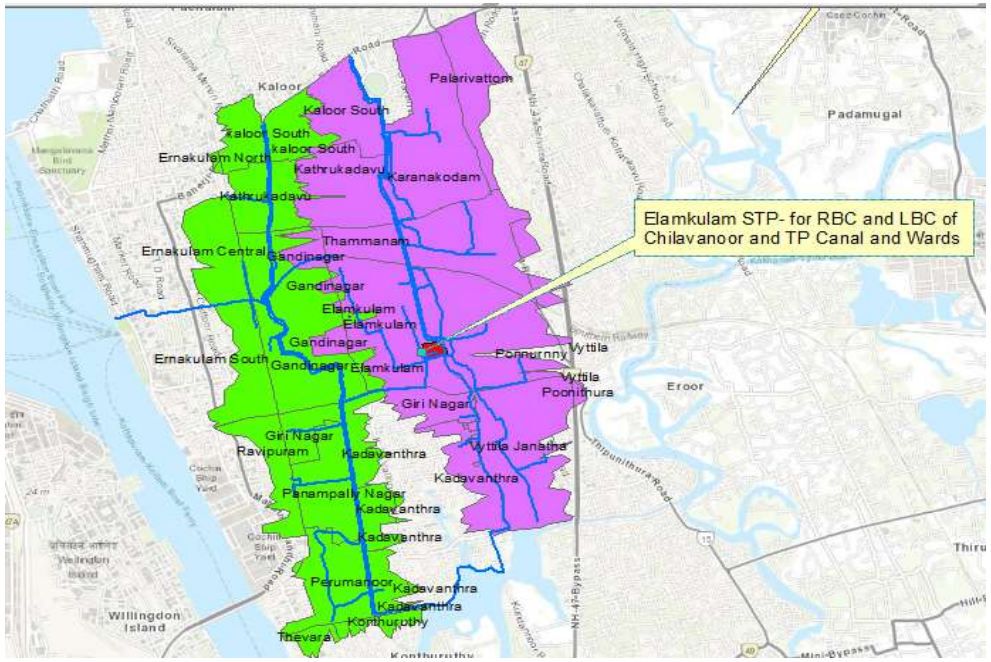
BLOCK ESTIMATE FOR 10 MLD SEWAGE TREATMENT PLANT AT ELAMKULAM, KERALA BASED ON SBR / CYCLIC ACTIVATED SLUDGE PROCESS			
Sr. No	Description	Unit	Rate (2019- 20)
	Designing, providing, constructing,hydraulic testing, commissioning and giving satisfactory trials of STP based on SBR technology consisting of Inlet Chamber, Screen Chamber, Detritus Tanks, Distribution Chamber and Biological CASP Basins, Sludge Sump, Chlorine Contact Tank, Chlorinator Room/Shed, Sludge Centrifuge necessary piping work with required valves, gates, drains, pathways Administration Block cum Laboratory, Laboratory Equipments, Tools and Plants, Spare Parts, etc. complete as turnkey job with all involved civil, electrical and mechanical works inclusive of following items, units as per detailed specification for civil, electrical and mechanical components with all duties and taxes, etc. complete to achieve **BOD < 5 ppm, COD < 100 ppm, TSS < 10 ppm**, to get recyclable quality of water for industrial / agricultural purposes. (In Case Cyclic activated sludge plant is designed for N, P outlet parameters shall also include TN < 10 ppm, Nh3N < 2 ppm and TP < 1 ppm)		
	1. Inlet Chamber		
	2. Screen Chamber		
	3. Detritus Tank		
	4. CASP Basins		
	5. Chlorine Contact Tank		
	6. Chlorinator and Chlorinator Room /Tonner Room:		
	7. Sludge Sump		
	8. Sludge Centrifuge Platform With Centrifuges		
	9. Outfall Sewer		
	10. Piping Work in CI-LA class including Sluice Valves, Reflux Valves, MS Gates Providing, laying and jointing pipes		
	11. Administrative Building cum Laboratory (G+1)		
	Perandoor STP - TP north		Rate / MLD Rs. In Lakhs
	4.00 MLD	per MLD	100
	Notes :--		
a	Description		
b	Water table is considered at 5m below ground level		
c	Soil Bearing Capacity considered as 20 T/m^2 at l.5m below ground level		
d	OPC has been considered for casting purpose		
e	All civil items,electrical,piping,valves,pumps,motors,blowers etc.are considered as per Schedule of rates		
f	Upto 5 MLD sludge drying beds, and above 5 MLD of sludge centrifuge and DWPE dosing system		
g	Upto 5 MLD , and above 5 MLD NaOCl dosing system instead of Gas chlorination		
h	Lab euipments for above 5 MLD STP's.		
i	O & M cost shall be added extra.		
j	No Piling, dewatering, soil improvement, de-silting considered in the cost.		
k	Site is clear, flat and levelled. No site development works, filling, dewatering considered.		
l	Peak factor is considered as 2 times of average flow. For every 25% increase in peak factor , 10% extra cost shall be added over the above rates.		
m	OPC Tor Steel considered .		
n	Treated Water Disposal up to 50 m considered.		
o	N & P reduction not considered.		
p	HT Electrical Works shall be added as per case specific conditions.		
q	Raw Sewage Pumping Works shall be added as per case specific conditions.		
r	In case TN < 10 & TP < 1 quality is required, above rates shall be increased by 10%.		
	Calculating Rates for 1 MLD STP based on SBR Technology:		
	Per MLD Rate for 1STP	per MLD	100.00
	Adding 5% extra for Nitrogen & Phosphorous removal	per MLD	5.00
	Add 5% cost considering peak factor 2.25 as against 2 SOR	per MLD	5.00
	Total	**per MLD**	**110.00**
	Add 5% for work in Corporation Area on per MLD rate in above total	per MLD	5.50

	Total	**per MLD**	**115.50**
A	**Total Cost of 10 MLD Plant based on above calculated rate = 120.75 x 4**	**Rs. Lacs**	**462.00**
	Say	**Rs. Lacs**	**462.00**
B	**Cost for Additional Items not covered in per MLD MJP DSR rate**	**Rs Lacs**	**133**
1	HT SUBSTATION		
2	DG ROOM INCLUDING DG SET		
3	Internal ROAD		
4	COMPOUND WALL		
5	LANDSCAPING		
C	**Cost for turbo blower (2 Nos.)**	**Rs Lacs**	**90**
D	**Cost for pumping station (MPS) capable of handling peak flow = 5 MLD * 20 Lakhs/MLD**	**Rs. Lacs**	**100**
	Sub Total Cost of 10 MLD STP (A+B)	**Rs Lacs**	**785.33**
E	**Additional cost for piling works (Dia of piles = XX mm and NO of piles =)**		**153.3**
	Total		**938.63**
	Summary - Cost Estimate for STP - O & M		
	(12 Years of 15 year life cycle cost and intial 3 year shall be by tech provider)		
F	**Yearly Power Cost,lacs pa/MLD for SBR Technology**		
	(Yearly Power Cost,lacs pa/MLD= 3.37)	Rs	**161.76**
G	**Annual repairs costs, Lacs pa/MLD for SBR Technology**		
	(Annual repairs costs, Lacs pa/MLD = 1.84)	Rs	**88.32**
H	**Chemical Cost (Per MLD) for SBR Technology**		
	(Chemical Cost (Per MLD) = 3.3)	Rs	**158.40**
	Total O&M, Repair and chemical cost		**408.48**
	Total Cost of 4 MLD STP (E+F+G+H)		**1,347.11**

Summary - Cost Estimate for STP - O & M							
1	Total Capital Cost (Secondary + Tertiary) `. Lacs/MLD	108	108	108	108	108	108
2	Civil Works, % of total capital costs	60	60	60	60	60	60
3	E & M Works, % of total capital costs	40	40	40	40	40	40
4	Total Area, m2 per MLD	1000	550	550	1100	450	6100
5	(Secondary + Tertiary Treatment)						
Sl No	Operation & Maintenance Costs						
1	Energy Costs (Per MLD)	ASP	MBBR	SBR	UASB+ASP	MBR	WSP
2	Total Daily Power Requirement (avg.), kWh/d /MLD	185.7	223.7	153.7	125.7	302.5	5.7
3	Daily Power Cost (@6.0 per KWh)/MLD/h ((Including Standby power cost))	46.43	55.93	38.43	31.43	75.93	1.43
4	Yearly Power Cost,lacs pa/MLD	4.07	4.9	3.37	2.75	6.65	0.49
Sl No	Repairs cost (Per MLD)	ASP	MBBR	SBR	UASB+ASP	MBR	WSP
1	Civil Works per Annum, as % of Civil Works Cost	3	3	3	3	na	3
2	E&M Works, as % of E&M Works Cost	1	1	1	1	na	1
3	Civil Works Maintenance,Lacs pa /MLD	1.94	1.3	1.04	2.11	na	1.7
4	E & M Works Maintenance, Lacs pa/MLD	0.43	0.65	0.81	0.38	na	0.06
6	Annual repairs costs, Lacs pa/MLD	2.38	1.94	1.84	2.48	na	1.76
Sl No	Chemical Cost (Per MLD)	ASP	MBBR	SBR	UASB+ASP	MBR	WSP
1	Total Chemical Cost, Lacs pa/MLD	5.3	5.3	3.3	6.3	na	7.2

Summery of Sewerage Flow/Sewage- New Plan							
S.No.	STPs	Sewerage Flow					
		Sewage (2021) in MLD	Sewage (2031) In MLD	Sewage (2041) in MLD	Sewage (2051) in MLD	Proposed STP	Remarks
1	Elamkulam STP - Chilavanoor & TP south	13.48	13.84	13.86	13.68	10.00 MLD	5 MLD for AMRUT Scheme
2	Vennala STP - Edapally south	9.13	9.38	9.33	9.27	10.00 MLD	
3	Muttar STP-Edapally north	2.40	2.46	2.45	2.44	2.00 MLD	Moderated the yeild of the catchment because most of the area having appartment and have own STPs.
4	Puthukkalavattom STP - Chilavanoor north	5.56	5.70	5.76	5.64	5.00 MLD	
5	Perandoor STP - TP north	4.35	4.46	4.51	4.41	4.00 MLD	
	Total	**34.92**	**35.86**	**35.90**	**35.45**	31.00 MLD	

Total Network Length 27.17 KM



TP-Catchment								
FID	Shape *	ward_no	SHAPE_Len	Shape_Le_	ward_name	Shape_Le_	Shape_Area in Ha	
0	Polygon ZM	65	0	5620.49	Ernakulam North	5620.49	1.178607	
1	Polygon ZM	64	0	5810.65	Ernakulam Central	5810.65	52.02395	
2	Polygon ZM	60	0	5172.966	Ernakulam South	5172.966	48.09505	
3	Polygon ZM	59	0	5362.038	Ravipuram	5362.038	38.52385	
4	Polygon ZM	57	0	5654.236	Thevara	5654.236	9.722975	
5	Polygon ZM	63	0	5755.793	kaloor South	5755.793	60.30173	
6	Polygon ZM	62	0	4961.405	Kathrukadavu	4961.405	49.25982	
7	Polygon ZM	61	0	5568.524	Gandinagar	5568.524	133.8163	
8	Polygon ZM	52	0	5189.992	Elamkulam	5189.992	10.6087	
9	Polygon ZM	56	0	3772.93	Konthuruthy	3772.93	11.95621	
10	Polygon ZM	58	0	4910.61	Perumanoor	4910.61	78.52284	
11	Polygon ZM	55	0	6747.489	Kadavanthra	6747.489	3.66432	
12	Polygon ZM	53	0	6558.105	Giri Nagar	6558.105	47.60589	
13	Polygon ZM	54	0	4883.969	Panampally Nagar	4883.969	78.22937	
	Total Catchment of Elamkulam Catchment from TP						623.5096	

Chilvanoor-Catchment								
FID	Shape *	ward_no	SHAPE_Len	Shape_Le_	ward_name	Shape_Le_	Shape_Area in Ha	
0	Polygon ZM	63	0	5755.793	kaloor South	5755.793	1.052447	
1	Polygon ZM	62	0	4961.405	Kathrukadavu	4961.405	68.63884	
2	Polygon ZM	43	0	5582.493	Karanakodam	5582.493	131.565	
3	Polygon ZM	42	0	5026.447	Palarivattom	5026.447	49.93302	
4	Polygon ZM	47	0	4766.989	Ponnurunny East	4766.989	14.40853	
5	Polygon ZM	44	0	6651.592	Thammanam	6651.592	113.4241	
6	Polygon ZM	61	0	5568.524	Gandinagar	5568.524	24.2263	
7	Polygon ZM	52	0	5189.992	Elamkulam	5189.992	119.6761	
8	Polygon ZM	51	0	4649.225	Ponnurnny	4649.225	107.6248	
9	Polygon ZM	48	0	13876.77	Vyttila	13876.77	1.559531	
10	Polygon ZM	49	0	9518.8	Poonithura	9518.8	2.516361	
11	Polygon ZM	50	0	5665.177	Vyttila Janatha	5665.177	116.6619	
12	Polygon ZM	55	0	6747.489	Kadavanthra	6747.489	38.71076	
13	Polygon ZM	53	0	6558.105	Giri Nagar	6558.105	27.57092	
14	Polygon ZM	63	0	0	Kaloor South	0	49.29918	
	Total Catchment of Elamkulam Catchment from Chilavanoor						866.8678	

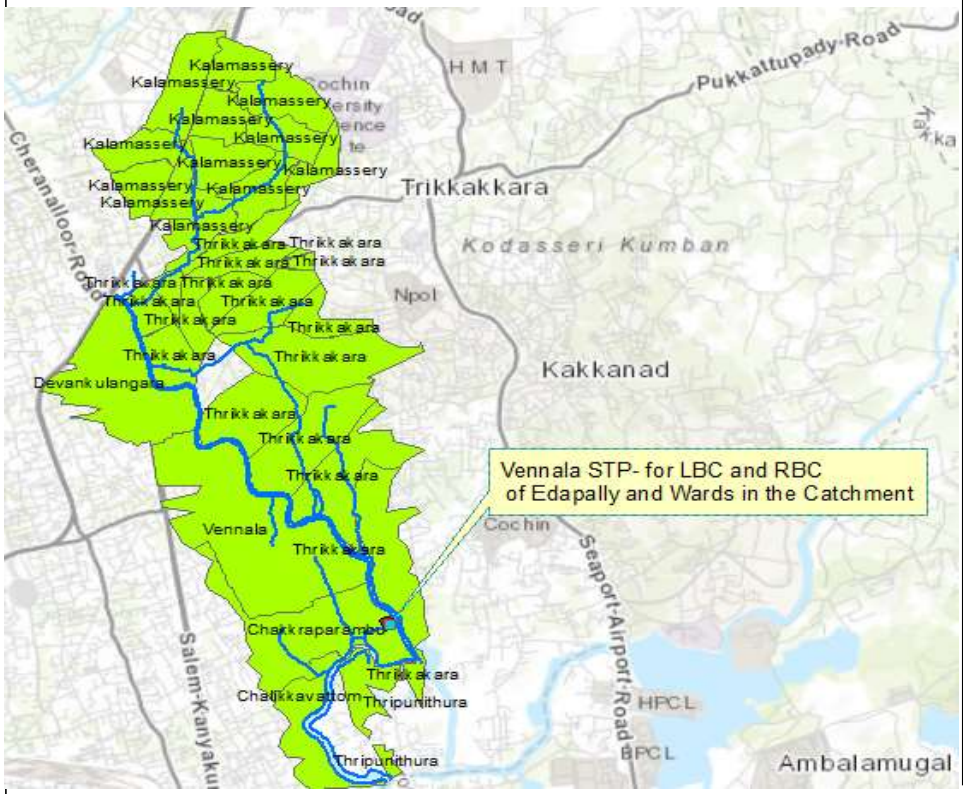
	Total catchment of Elamkulam Plant		1490.377	Ha

Summery of Sewerage Flow/Sewage			
Sewerage Flow			
Sewage (2021) in MLD	Sewage (2031) In MLD	Sewage (2041) in MLD	Sewage (2051) in MLD
13.48021	13.84349577	13.85943	13.68405

S.No.	Zone/Area in Ha	Average Population Density				Population Projection			
		Average Population Density (2021)	Average Population Density (2031)	Average Population Density (2041)	Average Population Density (2051)	Population Projection (2021)	Population Projection (2031)	Population Projection (2041)	Population Projection (2051)
1	623.5096	88.09032	90.46476	91.32854	89.42317	54925.16	56405.64496	56944.22	55756.21
2	866.8678	76.98682	79.06125	78.60584	78.15042	66737.39	68535.65264	68140.866	67746.08
	1490.377					121662.6	124941.2976	125085.09	123502.3

1	Per Capita Demand	135
2	Floating Population Per Capita Demand	35

Total Network Length 17.21 KM



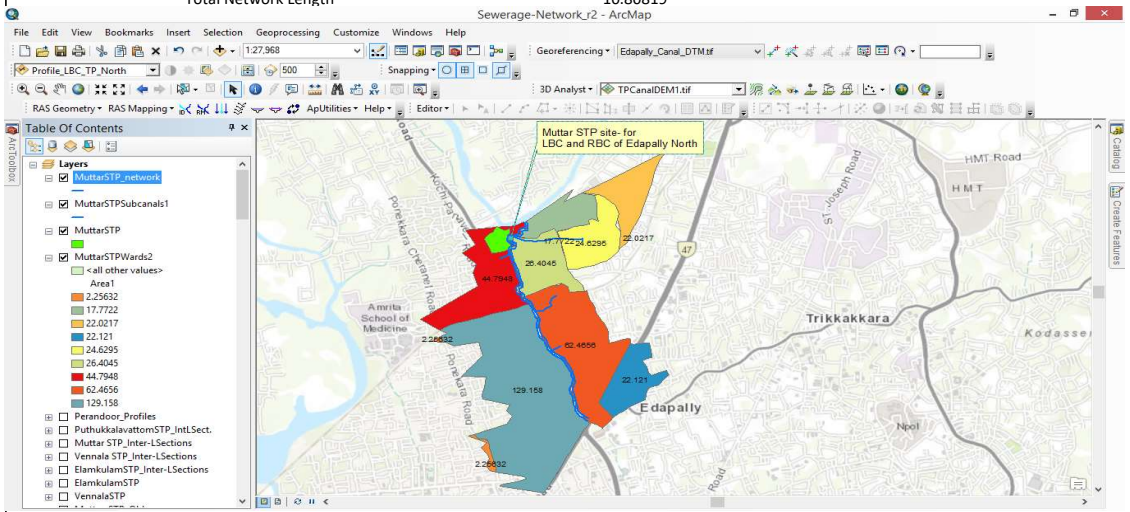
FID	Shape *	OBJECTID	FID_Thripu	Id	WardName	WardNo1	Area in Ha	
0	Polygon ZM	2	1	0	Thripunithura	2	31.6071	
1	Polygon ZM	7	-1	0	Kalamassery	32	29.7417	
2	Polygon ZM	8	-1	0	Kalamassery	31	19.5813	
3	Polygon ZM	9	-1	0	Kalamassery	35	21.9008	
4	Polygon ZM	10	-1	0	Kalamassery	36	23.6615	
5	Polygon ZM	12	-1	0	Kalamassery	37	41.2286	
6	Polygon ZM	13	-1	0	Kalamassery	25	23.6914	
7	Polygon ZM	14	-1	0	Kalamassery	24	24.5096	
8	Polygon ZM	15	-1	0	Kalamassery	26	35.2201	
9	Polygon ZM	16	-1	0	Kalamassery	28	23.5568	
10	Polygon ZM	17	-1	0	Kalamassery	29	27.676	
11	Polygon ZM	18	-1	0	Kalamassery	27	17.7191	
12	Polygon ZM	21	-1	0	Kalamassery	30	32.2396	
13	Polygon ZM	25	-1	0	Devankulangara	38	109.163	
14	Polygon ZM	27	-1	0	Vennala	41	190.832	
15	Polygon ZM	28	-1	0	Chakkraparambu	45	107.601	
16	Polygon ZM	29	-1	0	Chalikkavattom	46	46.6342	
17	Polygon ZM	30	-1	0	Thrikkakara	2	15.4892	
18	Polygon ZM	31	-1	0	Thrikkakara	3	9.55725	
19	Polygon ZM	32	-1	0	Thrikkakara	41	18.2365	
20	Polygon ZM	33	-1	0	Thrikkakara	1	25.9019	
21	Polygon ZM	35	-1	0	Thrikkakara	33	55.4606	
22	Polygon ZM	36	-1	0	Thrikkakara	31	67.0045	
23	Polygon ZM	37	-1	0	Thrikkakara	29	64.0103	
24	Polygon ZM	38	-1	0	Thrikkakara	30	67.8908	
25	Polygon ZM	39	-1	0	Thrikkakara	22	6.84117	
26	Polygon ZM	40	-1	0	Thrikkakara	4	21.014	
27	Polygon ZM	41	-1	0	Thrikkakara	40	19.1245	
28	Polygon ZM	42	-1	0	Thrikkakara	39	20.3401	
29	Polygon ZM	43	-1	0	Thrikkakara	36	4.62371	
30	Polygon ZM	44	-1	0	Thrikkakara	38	1.19944	
31	Polygon ZM	45	-1	0	Thrikkakara	34	35.6601	
32	Polygon ZM	46	-1	0	Thrikkakara	35	20.2516	
33	Polygon ZM	48	-1	0	Thrikkakara	32	79.0395	
					Total Catchment of Vennala Catchment from Edapally		1338.20897	In ha

Summery of Sewerage Flow/Sewage			
ewerage Flow			
Sewage (2021) in MLD	Sewage (2031) In MLD	Sewage (2041) in MLD	Sewage (2051) in MLD
9.13	9.38	9.33	9.27

1	Per Capita Demand	135
2	Floating Population Per Capita Demand	35

S.No.	Zone/Area in Ha	Average Population Density				Population Projection			
		Average Population Density (2021)	Average Population Density (2031)	Average Population Density (2041)	Average Population Density (2051)	Population Projection (2021)	Population Projection (2031)	Population Projection (2041)	Population Projection (2051)
1	1338.209	61.60598	63.26542	62.90272	62.54002	82441.67194	84662.35256	84176.98314	83691.61
	1338.209					82441.67194	84662.35256	84176.98314	83691.61

Total Network Length 10.80819



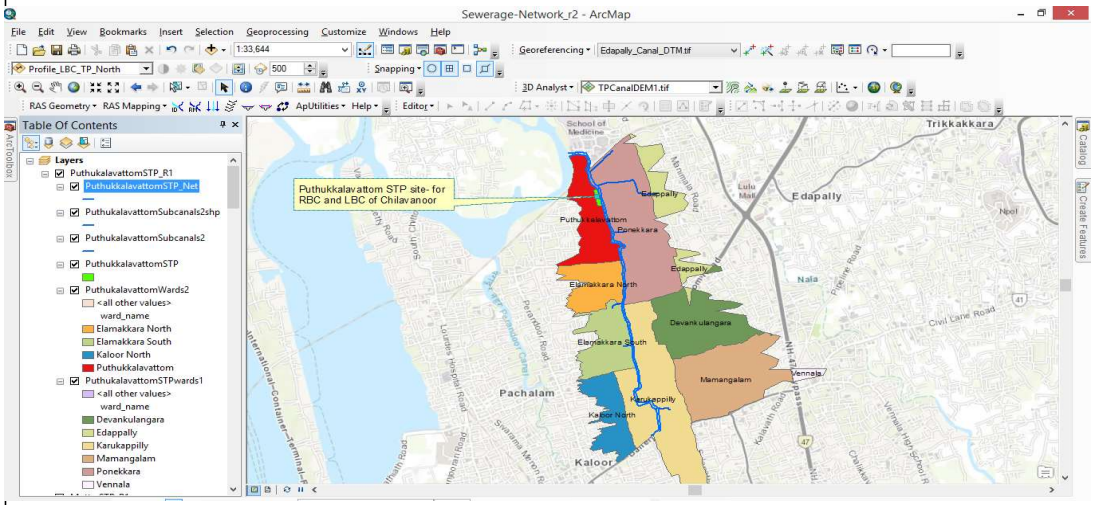
Edapally Catchment								
FID	Shape *	OBJECTID	FID_Thripu	Id	WardName	WardNo1	Area1	
0	Polygon ZM	3	-1	0	Kalamasser	39	26.4045	
1	Polygon ZM	4	-1	0	Kalamasser	38	24.6295	
2	Polygon ZM	5	-1	0	Kalamasser	34	62.4656	
3	Polygon ZM	6	-1	0	Kalamasser	33	22.121	
4	Polygon ZM	11	-1	0	Kalamasser	41	22.0217	
5	Polygon ZM	19	-1	0	Kalamasser	40	17.7722	
6	Polygon ZM	22	-1	0	Kunnumpu	36	44.7948	
7	Polygon ZM	23	-1	0	Ponekkara	35	2.25632	
8	Polygon ZM	24	-1	0	Edappally	37	129.158	
				Total Muttar Catchment from Edapally			351.6236	
	Total Muttar STP Catchment						351.6236	Ha

Summery of Sewerage Flow/Sewage			
Sewerage Flow			
Sewage (2021) in MLD	Sewage (2031) In MLD	Sewage (2041) in MLD	Sewage (2051) in MLD
2.40	2.46	2.45	2.44

1	Per Capita Demand	135
2	Floating Population Per Capita Demand	35

S.No.	Zone/Area in Ha	Average Population Density				Population Projection			
		Average Population Density (2021)	Average Population Density (2031)	Average Population Density (2041)	Average Population Density (2051)	Population Projection (2021)	Population Projection (2031)	Population Projection (2041)	Population Projection (2051)
1	351.62	61.61	63.27	62.90	62.54	21662	22246	22118	21991
	351.6236					21662	22246	22118	21991

Total Network Length 8.297647 Km



LBC Chilvanoor								
FID	Shape *	ward_no	SHAPE_Len	Shape_Le_	ward_name	Shape_Le_	Shape_Area	
0	Polygon ZM	68	0	4379.909	Kaloor North	4379.909	34.1954	
1	Polygon ZM	33	0	4632.247	Elamakkara North	4632.247	34.50817	
2	Polygon ZM	34	0	5277.59	Puthukkalavattom	5277.59	42.71036	
3	Polygon ZM	69	0	4461.547	Elamakkara South	4461.547	42.22518	
			Area of catchment in LBC Chilvanoor				153.6391	Ha
RBC Chilvanoor								
FID	Shape *	ward_no	SHAPE_Len	Shape_Le_	ward_name	Shape_Le_	Shape_Area	
0	Polygon ZM	35	0	5366.583	Ponekkara	5366.583	110.3288	
1	Polygon ZM	37	0	6105.55	Edappally	6105.55	31.83872	
2	Polygon ZM	39	0	6462.199	Karukappilly	6462.199	113.8762	
3	Polygon ZM	38	0	6926.441	Devankulangara	6926.441	68.11158	
4	Polygon ZM	40	0	4266.894	Mamangalam	4266.894	86.95332	
5	Polygon ZM	41	0	7257.01	Vennala	7257.01	4.407652	
			Area of catchment in RBC Chilvanoor				415.5163	Ha

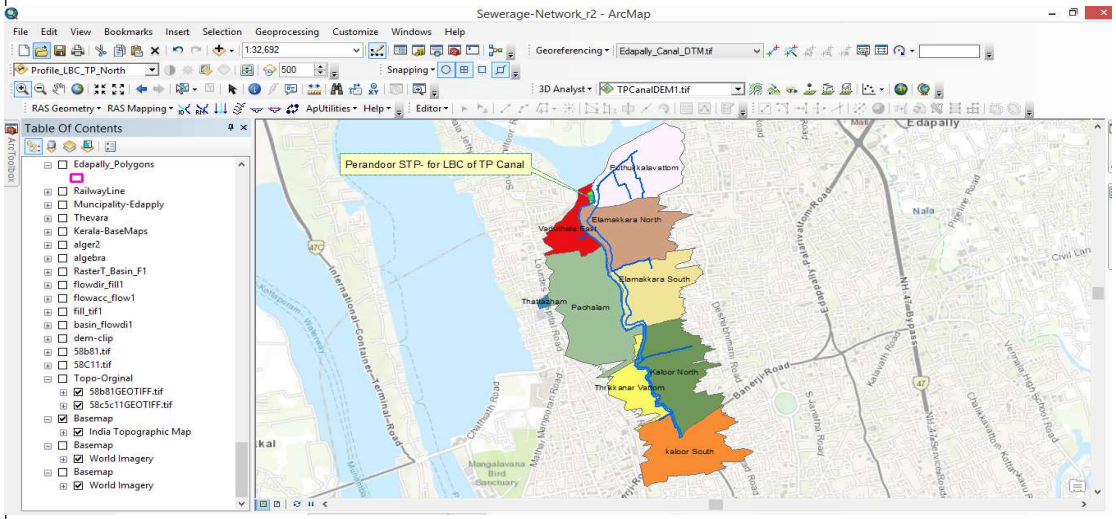
Total Puthukkalavattom Catchment	569.1554	Ha

Summery of Sewerage Flow/Sewage			
Sewerage Flow			
Sewage (2021) in MLD	Sewage (2031) In MLD	Sewage (2041) in MLD	Sewage (2051) in MLD
5.56	5.70	5.76	5.64

1	Per Capita Demand	135
2	Floating Population Per Capita Demand	35

S.No.	Zone/Area in Ha	Average Population Density				Population Projection			
		Average Population Density (2021)	Average Population Density (2031)	Average Population Density (2041)	Average Population Density (2051)	Population Projection (2021)	Population Projection (2031)	Population Projection (2041)	Population Projection (2051)
1	153.64	88.09	90.46	91.33	89.42	13534	13899	14032	13739
2	415.52	88.09	90.46	91.33	89.42	36603	37590	37948	37157
	569.155424					50137	51489	51980	50896

Total Network Length 3.810001 KM



RBC TP								
FID	Shape *	ward_no	SHAPE_Len	Shape_Le_	ward_name	Shape_Le_	Shape_Area	
0	Polygon ZM	68	0	4379.909	Kaloor North	4379.909	69.0779	
1	Polygon ZM	33	0	4632.247	Elamakkara North	4632.247	59.50027	
2	Polygon ZM	34	0	5277.59	Puthukkalavattom	5277.59	62.44868	
3	Polygon ZM	69	0	4461.547	Elamakkara South	4461.547	54.50706	
				RBC TP Area in Ha			245.5339	Ha

LBC TP								
FID	Shape *	ward_no	SHAPE_Len	Shape_Le_	ward_name	Shape_Le_	Shape_Area	
0	Polygon ZM	71	4958.349	9117.685	Thattazham	9117.685	1.32453	
1	Polygon ZM	32	0	4506.389	Vaduthala East	4506.389	22.47925	
2	Polygon ZM	70	0	5055.422	Pachalam	5055.422	91.31189	
3	Polygon ZM	67	0	4400.699	Thrikkanar Vattom	4400.699	24.44669	
4	Polygon ZM	63	0	5755.793	kaloor South	5755.793	60.30173	
				LBC TP Area in Ha			199.8641	Ha

		Total perandoor Catchment from TP	445.398	Ha

Summery of Sewerage Flow/Sewage			
Sewerage Flow			
Sewage (2021) in MLD	Sewage (2031) In MLD	Sewage (2041) in MLD	Sewage (2051) in MLD
4.35	4.46	4.51	4.41

1	Per Capita Demand	135
2	Floating Population Per Capita Demand	35

S.No.	Zone/Area in Ha	Average Population Density				Population Projection			
		Average Population Density (2021)	Average Population Density (2031)	Average Population Density (2041)	Average Population Density (2051)	Population Projection (2021)	Population Projection (2031)	Population Projection (2041)	Population Projection (2051)
1	245.53	88.09	90.46	91.33	89.42	21629	22212	22424	21956
2	199.86	88.09	90.46	91.33	89.42	17606	18081	18253	17872
	445.398					39235	40293	40678	39829

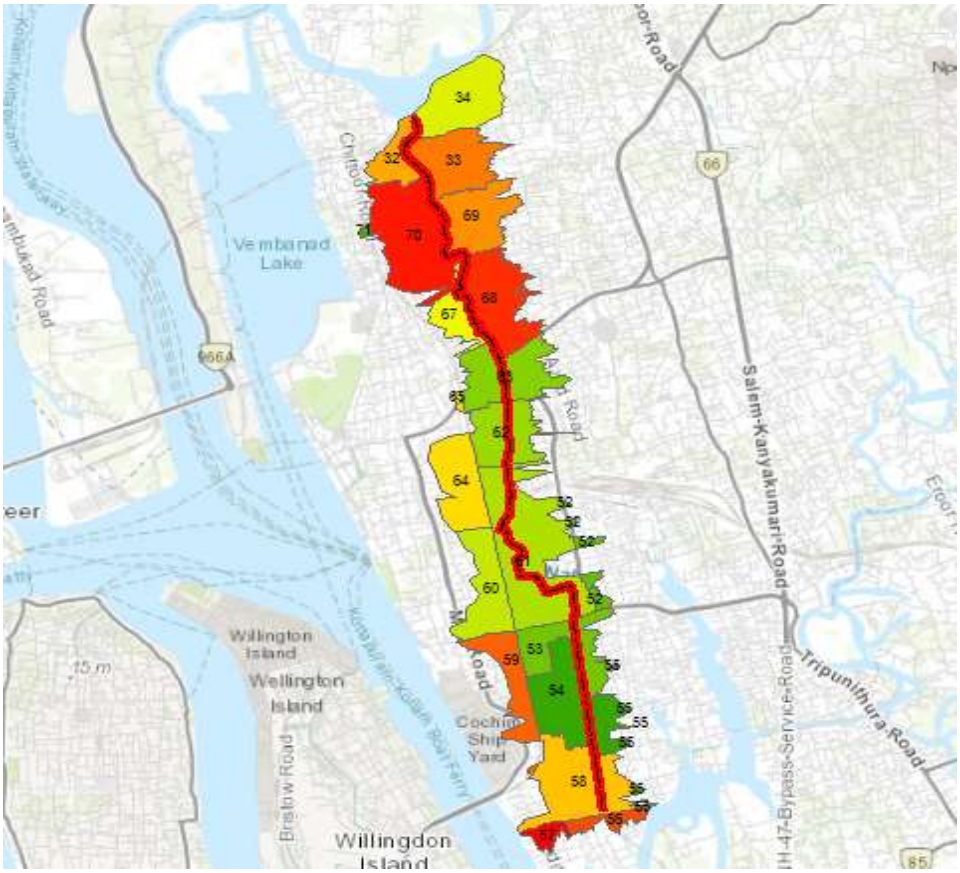
Ward wise Population Projection for Kochi Corporation

(Ward area provided in the table is excluding the major water bodies and restricted areas)

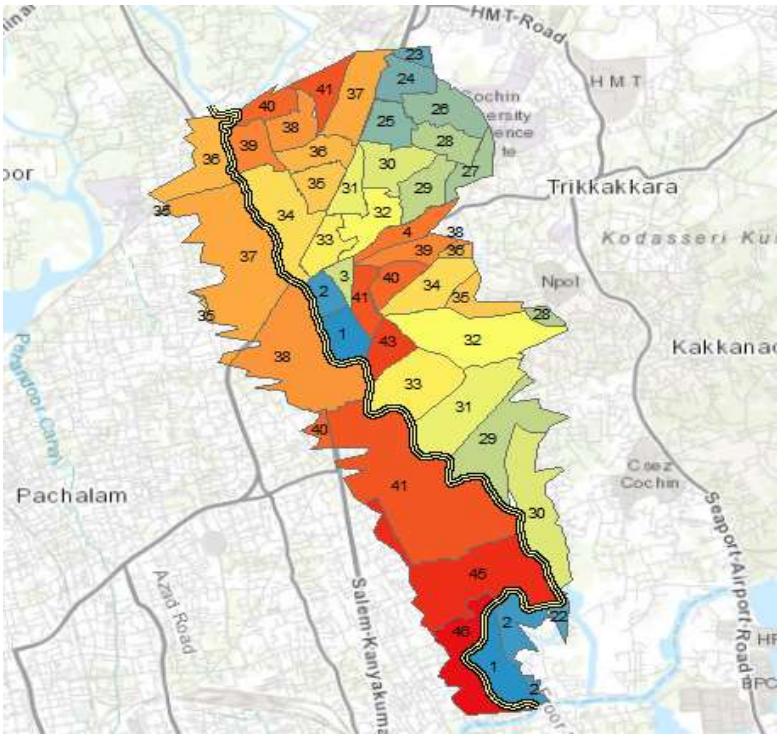
Ward No	Ward Name	Ward Area (hectare)	Population 2001	Population 2011	Population 2021	Population 2031	Population 2041	Population Density 2001	Population Density 2011	Population Density 2021	Population Density 2031	Population Density 2041	Avarge Increase in Denisty 2031-20041	Population Density 2051	Population 2051
1	Fort Kochi	143.58	12608	13742	14491	14882	14796	87.81	95.71	100.93	103.65	103.05	-0.60	102.45	14710
2	Kalvathi	38.23	8236	8977	9466	9721	9665	215.43	234.82	247.61	254.28	252.81	-1.46	251.35	9609
3	Iraveli	17.39	9074	9890	10429	10710	10649	521.79	568.72	599.71	615.87	612.36	-3.51	608.86	10588
4	Karippalam	39.62	10733	11698	12336	12668	12595	270.90	295.25	311.36	319.74	317.90	-1.84	316.05	12522
5	Mattanchery	62.11	12984	14152	14923	15325	15237	209.05	227.85	240.27	246.74	245.32	-1.42	243.91	15149
6	Kochangadi	31.71	8035	8758	9235	9484	9429	253.39	276.19	291.23	299.09	297.35	-1.73	295.62	9374
7	Cheralai	60.96	10186	11102	11707	12023	11954	167.09	182.12	192.04	197.23	196.10	-1.13	194.96	11885
8	Panayappilly	71.43	11385	12409	13085	13438	13361	159.39	173.72	183.19	188.13	187.05	-1.08	185.97	13284
9	Chakkamadam	29.84	5382	5866	6186	6353	6316	180.36	196.58	207.31	212.90	211.66	-1.24	210.42	6279
10	Karuvelippady	59.01	8307	9054	9548	9805	9749	140.77	153.43	161.80	166.16	165.21	-0.95	164.26	9693
11	Thoppumpadi	98.71	9757	10635	11214	11516	11450	98.85	107.74	113.61	116.66	116.00	-0.67	115.33	11384
12	Tharebhagam	83.81	8526	9293	9799	10063	10006	101.73	110.88	116.92	120.07	119.39	-0.68	118.71	9949
13	Kadebhagam	61.75	9705	10578	11154	11455	11389	157.17	171.30	180.63	185.51	184.44	-1.07	183.37	11323
14	Thazhuppu	90.09	10285	11210	11821	12140	12070	114.16	124.43	131.21	134.75	133.98	-0.78	133.20	12000
15	Edakochi	104.4	7915	8627	9097	9342	9288	75.81	82.63	87.14	89.48	88.97	-0.52	88.45	9234
16	Edakochi South	148.13	8532	9300	9806	10071	10013	57.60	62.78	66.20	67.99	67.60	-0.39	67.20	9955
17	Perumpadappu	70.81	9074	9890	10429	10710	10649	128.15	139.67	147.28	151.25	150.39	-0.86	149.53	10588
18	Konam	87.57	9176	10001	10546	10831	10768	104.78	114.21	120.43	123.68	122.96	-0.72	122.25	10705
19	Palluruthy - Kacherippady	70.6	10114	11024	11624	11938	11869	143.26	156.15	164.65	169.09	168.12	-0.98	167.14	11800
20	Nambyapuram	56.58	8122	8853	9335	9587	9531	143.55	156.47	164.99	169.44	168.45	-0.99	167.46	9475
21	Pullardesham	76.22	10563	11513	12141	12468	12396	138.59	151.05	159.29	163.58	162.63	-0.94	161.69	12324
22	Mundamveli	118.91	7808	8510	8974	9216	9163	65.66	71.57	75.47	77.50	77.06	-0.45	76.61	9110
23	Manassery	62.01	8076	8802	9282	9532	9477	130.24	141.94	149.69	153.72	152.83	-0.89	151.94	9422
24	Moolamkuzhi	59	7688	8380	8836	9074	9022	130.31	142.03	149.76	153.80	152.92	-0.88	152.03	8970
25	Chullikkal	43.28	8017	8738	9214	9463	9408	185.24	201.89	212.89	218.65	217.38	-1.27	216.10	9353
26	Nazarath	32.88	7140	7782	8206	8428	8379	217.15	236.68	249.57	256.33	254.84	-1.49	253.35	8330
27	Fort Cochin Veli	57.36	6788	7399	7802	8012	7966	118.34	128.99	136.02	139.68	138.88	-0.80	138.08	7920
28	Amaravathy	47.64	11240	12251	12919	13267	13190	235.94	257.16	271.18	278.48	276.87	-1.62	275.25	13113
29	Wellinton Island South	244.95	2729	2974	3137	3221	3203	11.14	12.14	12.81	13.15	13.08	-0.07	13.00	3185
30	Wellinton Island North	595.68	3060	3335	3517	3612	3591	5.14	5.60	5.90	6.06	6.03	-0.04	5.99	3570
31	Vaduthala West	109.9	10290	11216	11827	12146	12076	93.63	102.06	107.62	110.52	109.88	-0.64	109.24	12006
32	Vaduthala East	83.02	7229	7879	8309	8533	8483	87.08	94.90	100.08	102.78	102.18	-0.60	101.58	8433
33	Elamakkara North	94	8939	9743	10274	10551	10490	95.10	103.65	109.30	112.24	111.60	-0.65	110.95	10429
34	Puthukkalavattom	116.43	7880	8589	9057	9301	9247	67.68	73.77	77.79	79.88	79.42	-0.46	78.96	9193
35	Ponekkara	112.59	8060	8785	9264	9513	9459	71.59	78.03	82.28	84.49	84.01	-0.48	83.53	9405
36	Kunnumpuarm	206.58	8040	8763	9241	9490	9435	38.92	42.42	44.73	45.94	45.67	-0.27	45.41	9380
37	Edappally	161.08	8185	8921	9407	9661	9605	50.81	55.38	58.40	59.98	59.63	-0.35	59.28	9549
38	Devankulangara	177.59	9323	10162	10715	11004	10941	52.50	57.22	60.34	61.96	61.61	-0.35	61.25	10878
39	Karukappilly	113.88	8185	8921	9407	9661	9605	71.87	78.34	82.60	84.83	84.34	-0.49	83.85	9549
40	Mamangalam	98.31	6003	6543	6899	7085	7045	61.06	66.55	70.18	72.07	71.66	-0.41	71.25	7005
41	Vennala	201.59	10465	11406	12028	12352	12281	51.91	56.58	59.67	61.27	60.92	-0.35	60.57	12210
42	Palarivattom	123.02	12087	13174	13892	14267	14184	98.25	107.09	112.92	115.97	115.30	-0.67	114.62	14101
43	Karanakodam	131.56	9672	10542	11116	11416	11350	73.52	80.13	84.49	86.77	86.27	-0.50	85.77	11284
44	Thammanam	129.53	7821	8524	8989	9231	9178	60.38	65.81	69.40	71.27	70.86	-0.41	70.45	9125
45	Chakkraparambu	200.4	7991	8710	9184	9432	9378	39.88	43.46	45.83	47.07	46.80	-0.27	46.53	9324
46	Chalikkavattom	82.39	5120	5581	5885	6043	6008	62.14	67.74	71.43	73.35	72.92	-0.42	72.50	5973
47	Ponnurunny East	111.14	5407	5893	6215	6382	6345	48.65	53.02	55.92	57.42	57.09	-0.33	56.76	6308
48	Vyttila	174.98	7855	8562	9028	9271	9218	44.89	48.93	51.59	52.98	52.68	-0.30	52.38	9165
49	Poonithura	127.75	7122	7763	8186	8406	8358	55.75	60.77	64.08	65.80	65.42	-0.38	65.05	8310
50	Vyttila Janatha	136.7	7913	8625	9095	9340	9286	57.89	63.09	66.53	68.32	67.93	-0.40	67.53	9232
51	Ponnurnny	117.91	8376	9129	9627	9886	9829	71.04	77.42	81.65	83.84	83.36	-0.48	82.88	9772
52	Elamkulam	130.33	8841	9636	10161	10435	10375	67.84	73.94	77.96	80.07	79.61	-0.46	79.15	10315
53	Giri Nagar	93.49	7398	8063	8503	8732	8682	79.13	86.24	90.95	93.40	92.87	-0.53	92.33	8632
54	Panampally Nagar	81.83	5885	6414	6764	6946	6906	71.92	78.38	82.66	84.88	84.39	-0.49	83.91	6866
55	Kadavanthra	185.82	9268	10102	10652	10939	10876	49.88	54.36	57.32	58.87	58.53	-0.34	58.19	10813
56	Konthuruthy	73.05	7321	7980	8414	8641	8591	100.22	109.24	115.18	118.29	117.60	-0.68	116.92	8541
57	Thevara	92.54	4737	5163	5445	5591	5559	51.19	55.79	58.84	60.42	60.07	-0.35	59.73	5527
58	Perumanoor	103.5	8526	9293	9799	10063	10006	82.38	89.79	94.68	97.23	96.68	-0.55	96.13	9949

59	Ravipuram	147.55	6093	6641	7003	7192	7150	41.29	45.01	47.46	48.74	48.46	-0.28	48.17	7108
60	Ernakulam South	155.92	7821	8524	8989	9231	9178	50.16	54.67	57.65	59.20	58.86	-0.34	58.52	9125
61	Gandinagar	158.08	9915	10807	11396	11703	11636	62.72	68.36	72.09	74.03	73.61	-0.42	73.18	11569
62	Kathrukadavu	118.92	9076	9892	10432	10713	10651	76.32	83.18	87.72	90.09	89.56	-0.52	89.04	10589
63	kaloor South	113.44	7625	8311	8764	9000	8948	67.22	73.26	77.26	79.34	78.88	-0.46	78.42	8896
64	Ernakulam Central	159.71	12002	13082	13794	14166	14085	75.15	81.91	86.37	88.70	88.19	-0.51	87.68	14004
65	Ernakulam North	82.41	5017	5468	5766	5922	5888	60.88	66.35	69.97	71.86	71.45	-0.41	71.04	5854
66	Ayyappankavu	163.21	6718	7322	7721	7929	7884	41.16	44.86	47.31	48.58	48.31	-0.28	48.03	7839
67	Thrikkanar Vattom	68.4	9345	10186	10741	11030	10967	136.62	148.92	157.03	161.26	160.34	-0.92	159.42	10904
68	Kaloor North	103.29	8424	9182	9682	9943	9886	81.56	88.90	93.74	96.26	95.71	-0.55	95.16	9829
69	Elamakkara South	96.72	13057	14231	15007	15412	15323	135.00	147.14	155.16	159.35	158.43	-0.92	157.51	15234
70	Pachalam	109.07	8044	8768	9245	9495	9440	73.75	80.39	84.76	87.05	86.55	-0.50	86.05	9385
71	Thattazham	111.52	8152	8885	9369	9622	9567	73.10	79.67	84.01	86.28	85.79	-0.49	85.29	9512
			598474	652135	687572	706062	702019	104.24	113.61	119.80	123.03	122.32		121.62	697976

TP- Catchment Area and Ward Area in Ha and Population in 2041 and 2051													
Sl No	Ward Number	Ward Name	Shape Area in Ha in TP Catchment	Total Area in Ha	%Area in Tn TP Catchment	Population Density in 2021	Population Density in 2031	Population Density in 2041	Population Density in 2051	Population in 2021	Population in 2031	Population in 2041	Population in 2051
1	32	Vaduthala East	22.5	83.02	27.1	100.1	102.8	109.9	101.58	2250	2310	2470	2283
2	33	Elamakkara North	59.5	94.00	63.3	109.3	112.2	102.2	110.95	6503	6679	6080	6601
3	34	Puthukkalavattom	62.4	116.43	53.6	77.8	79.9	111.6	78.96	4858	4989	6969	4931
4	52	Elamkulam	10.6	130.33	8.1	78.0	80.1	79.6	79.15	827	849	845	840
5	53	Giri Nagar	47.6	93.49	50.9	91.0	93.4	92.9	92.33	4330	4446	4421	4395
6	54	Panampally Nagar	78.2	81.83	95.6	82.7	84.9	84.4	83.91	6466	6640	6602	6564
7	55	Kadavanthra	3.7	185.82	2.0	57.3	58.9	58.5	58.19	210	216	214	213
8	56	Konthuruthy	12.0	73.05	16.4	115.2	118.3	117.6	116.92	1377	1414	1406	1398
9	57	Thevara	9.7	92.54	10.5	58.8	60.4	60.1	59.73	572	587	584	581
10	58	Perumanoor	78.5	103.50	75.9	94.7	97.2	96.7	96.13	7434	7635	7591	7548
11	59	Ravipuram	38.5	147.55	26.1	47.5	48.7	48.5	48.17	1828	1878	1867	1856
12	60	Ernakulam South	48.1	155.92	30.8	57.7	59.2	58.9	58.52	2773	2847	2831	2815
13	61	Gandinagar	133.8	158.08	84.6	72.1	74.0	73.6	73.18	9647	9907	9850	9793
14	62	Kathrukadavu	49.3	118.92	41.4	87.7	90.1	89.6	89.04	4321	4438	4412	4386
15	63	kaloor South	60.3	113.44	53.2	77.3	79.3	78.9	78.42	4659	4784	4757	4729
16	64	Ernakulam Central	52.0	159.71	32.6	86.4	88.7	88.2	87.68	4493	4614	4588	4562
17	65	Ernakulam North	1.2	82.41	1.4	70.0	71.9	71.4	71.04	82	85	84	84
18	67	Thrikkanar Vattom	24.4	68.40	35.7	157.0	161.3	160.3	159.42	3839	3942	3920	3897
19	68	Kaloor North	69.1	103.29	66.9	93.7	96.3	95.7	95.16	6475	6650	6612	6573
20	69	Elamakkara South	54.5	96.72	56.4	155.2	159.3	158.4	157.51	8457	8686	8635	8585
21	70	Pachalam	91.3	109.07	83.7	84.8	87.1	86.5	86.05	7740	7949	7903	7857
22	71	Thattazham	1.3	111.52	1.2	84.0	86.3	85.8	85.29	111	114	114	113
						88.1	90.5	91.3	89.4	89254	91659	92754	90605

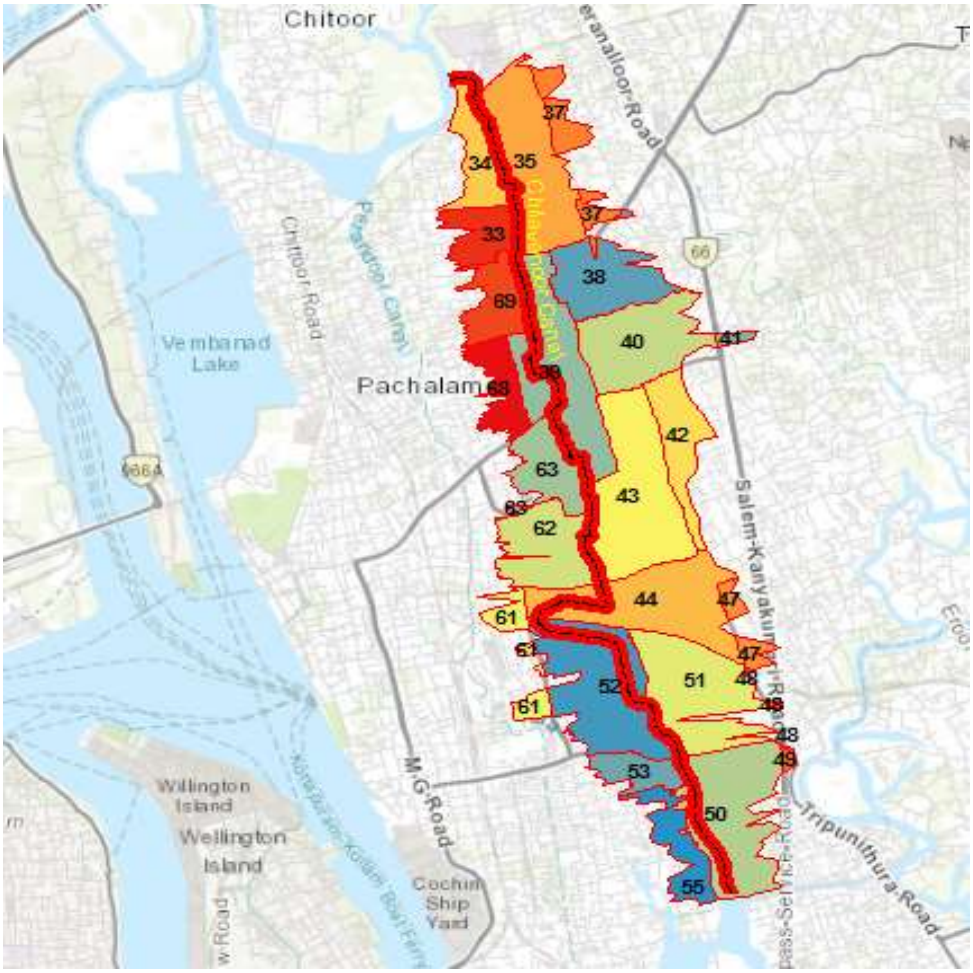


Edapally- Catchment Area and Ward Area in Ha and Population in 2041 and 2051															
Sl No	Ward Number	Ward Name	Shape Area in Ha in Chilvanoor Catchment	Total Area in Ha	%Area in Tn TP Catchment	Population Density in 2011	Population Density in 2021	Population Density in 2031	Population Density in 2041	Population Density in 2051	Population in 2011	Population in 2021	Population in 2031	Population in 2041	Population in 2051
Corporation- Boundary - Left Bank Canal															
1	35	Ponekkara	2.3	112.59	2.0	78.0	82.3	84.5	84.0	83.5	176	186	191	190	188
2	36	Kunnumpuarm	45.0	206.58	21.8	42.4	44.7	45.9	45.7	45.4	1910	2015	2069	2057	2045
3	37	Edappally	129.2	161.08	80.2	55.4	58.4	60.0	59.6	59.3	7155	7545	7749	7704	7659
4	38	Devankulangara	109.5	177.59	61.6	57.2	60.3	62.0	61.6	61.3	6264	6605	6783	6744	6705
5	40	Mamangalam	7.5	98.31	7.6	66.6	70.2	72.1	71.7	71.3	498	525	539	536	533
6	41	Vennala	191.4	201.59	94.9	56.6	59.7	61.3	60.9	60.6	10829	11420	11727	11660	11592
7	45	Chakkraparambu	108.6	200.40	54.2	43.5	45.8	47.1	46.8	46.5	4719	4976	5110	5081	5051
8	46	Chalikkavattom	46.6	82.39	56.6	67.7	71.4	73.3	72.9	72.5	3159	3331	3420	3401	3381
					Avg Density	58.4	61.6	63.3	62.9	62.5	34710	36601	37588	37372	37155
Muncipality- Boundary - Right Bank Canal															
Kalamassery Ward															
											Real Data				
9	23	NA	6.96	NA	NA	NA	61.6	63.3	62.9	62.5	1546	429	441	438	436
10	24	NA	24.58	NA	NA	NA	61.6	63.3	62.9	62.5	1334	1515	1555	1546	1538
11	25	NA	24.15	NA	NA	NA	61.6	63.3	62.9	62.5	1420	1488	1528	1519	1510
12	26	NA	35.25	NA	NA	NA	61.6	63.3	62.9	62.5	1599	2171	2230	2217	2204
13	27	NA	17.81	NA	NA	NA	61.6	63.3	62.9	62.5	789	1097	1127	1120	1114
14	28	NA	23.58	NA	NA	NA	61.6	63.3	62.9	62.5	1558	1453	1492	1483	1475
15	29	NA	27.90	NA	NA	NA	61.6	63.3	62.9	62.5	1606	1719	1765	1755	1745
16	30	NA	32.29	NA	NA	NA	61.6	63.3	62.9	62.5	2199	1989	2043	2031	2019
17	31	NA	19.68	NA	NA	NA	61.6	63.3	62.9	62.5	1899	1213	1245	1238	1231
18	32	NA	29.87	NA	NA	NA	61.6	63.3	62.9	62.5	1695	1840	1890	1879	1868
19	33	NA	22.27	NA	NA	NA	61.6	63.3	62.9	62.5	2200	1372	1409	1401	1393
20	34	NA	62.66	NA	NA	NA	61.6	63.3	62.9	62.5	1948	3860	3964	3941	3919
21	35	NA	22.06	NA	NA	NA	61.6	63.3	62.9	62.5	1708	1359	1396	1388	1380
22	36	NA	23.84	NA	NA	NA	61.6	63.3	62.9	62.5	2073	1469	1508	1500	1491
23	37	NA	41.79	NA	NA	NA	61.6	63.3	62.9	62.5	1666	2575	2644	2629	2614
24	38	NA	24.68	NA	NA	NA	61.6	63.3	62.9	62.5	2136	1521	1561	1553	1544
25	39	NA	26.71	NA	NA	NA	61.6	63.3	62.9	62.5	1731	1646	1690	1680	1671
26	40	NA	17.92	NA	NA	NA	61.6	63.3	62.9	62.5	1049	1104	1134	1127	1121
27	41	NA	22.05	NA	NA	NA	61.6	63.3	62.9	62.5	1291	1358	1395	1387	1379
											31446	31177	32016	31833	31649
Thrikkakara Ward											Real Data				
28	1	NA	26.36	NA	NA	NA	61.6	63.3	62.9	62.5	1965	1624	1668	1658	1649
29	2	NA	15.76	NA	NA	NA	61.6	63.3	62.9	62.5	1877	971	997	991	986
30	3	NA	9.71	NA	NA	NA	61.6	63.3	62.9	62.5	1729	598	614	611	607
31	4	NA	21.26	NA	NA	NA	61.6	63.3	62.9	62.5	430	1310	1345	1338	1330
32	22	NA	7.02	NA	NA	NA	61.6	63.3	62.9	62.5	76	433	444	442	439
33	28	NA	6.47	NA	NA	NA	61.6	63.3	62.9	62.5	1669	399	410	407	405
34	29	NA	65.74	NA	NA	NA	61.6	63.3	62.9	62.5	2220	4050	4159	4135	4112
35	30	NA	70.05	NA	NA	NA	61.6	63.3	62.9	62.5	1994	4316	4432	4407	4381
36	31	NA	67.02	NA	NA	NA	61.6	63.3	62.9	62.5	1487	4129	4240	4216	4192
37	32	NA	79.13	NA	NA	NA	61.6	63.3	62.9	62.5	2118	4875	5006	4977	4949
38	33	NA	55.75	NA	NA	NA	61.6	63.3	62.9	62.5	207	3435	3527	3507	3487
39	34	NA	35.81	NA	NA	NA	61.6	63.3	62.9	62.5	2032	2206	2265	2252	2239
40	35	NA	20.28	NA	NA	NA	61.6	63.3	62.9	62.5	2189	1249	1283	1276	1268
41	36	NA	4.64	NA	NA	NA	61.6	63.3	62.9	62.5	2659	286	293	292	290
42	38	NA	1.20	NA	NA	NA	61.6	63.3	62.9	62.5	2085	74	76	76	75
43	39	NA	20.47	NA	NA	NA	61.6	63.3	62.9	62.5	1198	1261	1295	1287	1280
44	40	NA	19.20	NA	NA	NA	61.6	63.3	62.9	62.5	1124	1183	1215	1208	1201
45	41	NA	18.35	NA	NA	NA	61.6	63.3	62.9	62.5	1074	1131	1161	1154	1148
46	43	NA	21.93	NA	NA	NA	61.6	63.3	62.9	62.5	1284	1351	1388	1380	1372
Thripunithura Ward											29416	34880	35819	35614	35409
28	1	NA	36.21	NA	NA		61.6	63.3	62.9	62.5	2119	2230.6	2290.6	2277.5	2264.4
29	2	NA	31.70	NA	NA		61.6	63.3	62.9	62.5	1855	1952.9	2005.5	1994.0	1982.5
											3974	4183	4296	4271	4247
														Total MLD	



Chilvanoor- Catchment Area and Ward Area in Ha and Population in 2041 and 2051

Sl No	Ward Number	Ward Name	Shape Area in Ha in Chilvanoor Catchment	Total Area in Ha	%Area in Tn TP Catchment	Population Density in 2021	Population Density in 2031	Population Density in 2041	Population Density in 2051	Population in 2021	Population in 2031	Population in 2041	Population in 2051
1	33	Elamakkara North	34.5	94.00	36.7	109.3	112.2	111.6	110.9	3771.7	3873.4	3851.0	3828.6
2	34	Puthukkalavattom	42.7	116.43	36.7	77.8	79.9	79.4	79.0	3322.4	3411.9	3392.1	3372.3
3	35	Ponekkara	110.3	112.59	98.0	82.3	84.5	84.0	83.5	9078.0	9321.9	9269.0	9216.1
4	37	Edappally	31.8	161.08	19.8	58.4	60.0	59.6	59.3	1859.4	1909.6	1898.5	1887.4
5	38	Devankulangara	68.1	177.59	38.4	60.3	62.0	61.6	61.3	4109.6	4220.4	4196.2	4172.1
6	39	Karukappilly	113.9	113.88	100.0	82.6	84.8	84.3	83.9	9406.7	9660.7	9604.7	9548.7
7	40	Mamangalam	87.0	98.31	88.4	70.2	72.1	71.7	71.3	6102.0	6266.5	6231.2	6195.8
8	41	Vennala	4.4	201.59	2.2	59.7	61.3	60.9	60.6	263.0	270.1	268.5	267.0
9	42	Palarivattom	49.9	123.02	40.6	112.9	116.0	115.3	114.6	5638.7	5790.9	5757.2	5723.5
10	43	Karanakodam	131.6	131.56	100.0	84.5	86.8	86.3	85.8	11116.4	11416.4	11350.4	11284.4
11	44	Thammanam	113.4	129.53	87.6	69.4	71.3	70.9	70.4	7871.3	8083.2	8036.8	7990.4
12	47	Ponnurunny East	14.4	200.4	7.2	45.8	47.1	46.8	46.5	660.3	678.2	674.3	670.4
13	48	Vyttila	1.6	82.39	1.9	71.4	73.3	72.9	72.5	111.4	114.4	113.7	113.1
14	49	Poonithura	2.5	111.14	2.3	55.9	57.4	57.1	56.8	140.7	144.5	143.7	142.8
15	50	Vyttila Janatha	116.7	174.98	66.7	51.6	53.0	52.7	52.4	6019.1	6181.1	6145.8	6110.4
16	51	Ponnurnny	107.6	127.75	84.2	64.1	65.8	65.4	65.0	6896.4	7081.8	7041.3	7000.9
17	52	Elamkulam	119.7	136.7	87.5	66.5	68.3	67.9	67.5	7962.4	8176.8	8129.6	8082.3
18	53	Giri Nagar	27.6	117.91	23.4	81.6	83.8	83.4	82.9	2251.1	2311.6	2298.3	2285.0
19	55	Kadavanthra	38.7	185.82	20.8	57.3	58.9	58.5	58.2	2219.1	2278.9	2265.7	2252.6
20	61	Gandinagar	24.2	158.08	15.3	72.1	74.0	73.6	73.2	1746.5	1793.5	1783.3	1773.0
21	62	Kathrukadavu	68.6	118.92	57.7	87.7	90.1	89.6	89.0	6021.2	6183.4	6147.6	6111.8
22	63	kaloor South	1.1	113.44	0.9	77.3	79.3	78.9	78.4	81.3	83.5	83.0	82.5
23	68	Kaloor North	34.2	103.29	33.1	93.7	96.3	95.7	95.2	3205.3	3291.7	3272.9	3254.0
24	69	Elamakkara South	42.2	96.72	43.7	155.2	159.3	158.4	157.5	6551.6	6728.4	6689.6	6650.7
						77.0	79.1	78.6	78.2	106405	109273	108644	108016



Abstract Cost for Sewerage Network of Edapally Canals				
	(Interceptor - Main)			
		Amount in (Rs.)	Amount in Lakhs	
I	TOTAL COST OF INTERCEPTOR MAIN LBC	6,52,98,903	652.99	
II	TOTAL COST OF INTERCEPTOR MAIN RBC	6,18,92,328	618.92	
III	SUB MAINS		-	
1	Vattekunnam Near Muttar	1313814	13.14	
2	Vattekunnam near highway	615877	6.16	
3	Vattekunnam Near Muttar	2321064	23.21	
4	Thammanam-pulleppady Road	858294	8.58	
5	Puravankara	6266253	62.66	
6	Paruthelil Road 3	2249428	22.49	
7	Paruthelil Road 2	7234323	72.34	
8	Paruthelil road 1	5561525	55.62	
9	Palachuvadu road	5501864	55.02	
10	Near Vennala HS	3435040	34.35	
11	Near Thrikovil road	4492195	44.92	
12	Near Railway line	1688374	16.88	
13	Near Kallikuzhy	1970125	19.70	
14	Near Flyover	1961954	19.62	
15	Mulepadam thodu	10413642	104.14	
16	Koonamthai Road	11812458	118.12	
17	Thammanam-pulleppady Road	858294	8.58	
18	Thammanam-pulleppady Road	858294	8.58	
19	Chembumukku 2	4901603	49.02	
20	Chembumukku 1	12037938	120.38	
	Sub Main Total	86894198	868.94	
III	Pumping Stations at Sub Drains	13,59,56,401	1,359.56	
IV	12 Imtermideiate Pumping Station for Edapally	149160707.5	1,491.61	
	Total	49,92,02,537	4,992.03	
	In lakhs	**4992.02537**	**4,992.03**	

Abstract Cost for Sewerage Network of T-P Canals				
	(Interceptor - Main)			
		Amount in (Rs.)	Amount in Lakhs	
I	TOTAL COST OF INTERCEPTOR MAIN LBC	5,56,16,652	556.17	
II	TOTAL COST OF INTERCEPTOR MAIN RBC	5,43,79,880	543.80	
III	SUB MAINS		-	
1	Perandoor Temple	2062904	20.63	
2	Vivekanada nagar	2676167	26.76	
3	Swami vivekanada Road 2	2091544	20.92	
4	Swami vivekanada Road 1	1504034	15.04	
5	Sastha Temple Road	769803	7.70	
6	Railway line parallel	3046304	30.46	
7	Pourasamithy Road	499848	5.00	
8	Perandoor Road	2662644	26.63	
9	Perandoor Road	2662644	26.63	
10	Parambithara Road	697608	6.98	
11	Panambilly Nagar	2767096	27.67	
12	Mullassery Canal	7281538	72.82	
13	Kottaikanal	2101826	21.02	
14	Koithara Canal LS	7453448	74.53	
15	Kathoorba Nagar	1881444	18.81	
16	Karshaka Road	1023251	10.23	
17	K C Abraham master Road	3519991	35.20	
18	Gandhi nagar Road	4303521	43.04	
19	Chinmaya Vidyalaya	669291	6.69	
20	Aryapadam thodu	2725932	27.26	
	Sub Main Total	52400840	524.01	
III	Pumping Stations at Sub Drains	12,88,00,801	1,288.01	
IV	10 Imtermideiate Pumping Station for TP	124300589.5	1,243.01	
	Total	41,54,98,761	4,154.99	
	In lakhs	4154.987613	4,154.99	

Abstract Cost for Sewerage Network of Chilavanoor Canals				
	Chilavanoor Canals			
	(Interceptor - Main)			
		Amount in (Rs.)	Amount in Lakhs	
I	TOTAL COST OF INTERCEPTOR MAIN LBC	10,64,92,749	1,064.93	
II	TOTAL COST OF INTERCEPTOR MAIN RBC	101168111	1,011.68	
III	SUB MAINS FOR BOTH THE INTERCEPTOR MAINS		-	
1	Thammanam-pulleppady Road	1399747	14.00	
2	Water land road 2	2274898	22.75	
3	Water land road 1	1631631	16.32	
4	Vylassery Road	2450359	24.50	
5	Vasanth Nagar	1614263	16.14	
6	Subash Nagar	1283605	12.84	
7	Stadium Link Road	9395487	93.95	
8	Sakavu Abu road	5723757	57.24	
9	Railyard 1	10357556	103.58	
10	Rail Yard 2	1787820	17.88	
11	Rail Nagar 2	1311857	13.12	
12	Rail Nagar 1	8617723	86.18	
13	Ponnurunni junction	4307779	43.08	
14	Parallel to Railway line	3418357	34.18	
15	Paradise Road	6940782	69.41	
16	Near Fathima Church Road	5885480	58.85	
17	Near DLF Apartment	3933785	39.34	
18	Meenchira Road	7563365	75.63	
19	Kumaranashan Road	1279796	12.80	
20	Kumaranashan nagar	17588745	175.89	
21	Kousalya Nagar	932988	9.33	
22	Freinds avenue road	1429088	14.29	
23	BTS Road	1405950	14.06	
24	Adimury Road	5986034	59.86	
	Sub Main Total	108520854	1,085.21	
III	Pumping Stations at Sub Drains	17,17,34,401	1,717.34	
IV	11 Imtermideiate Pumping Station for Chilvanoor	13,67,30,649	1,367.31	
	Total	62,46,46,764	6,246.47	
	In lakhs	6246.467638	6,246.47	

Transitional Sanitation Facilities in Chilavanoor Canal Catchment

Biotoilets facilitis during the transitional stage			
Chilavanoor Canal Stretch	Population in 2021	Population in 2031	Remarks
Facilty at Household level			
Population	94138	96675	
Households	23535	24169	4 Persons per Households
Design Population Left Bank	58037		
Design Population at Right Bank	37110		
Households			
Households Left Bank	11607		5 persons per Hhs
Households at Right Bank	7422		
Biotoilets facilities per HHs			
Biotoilets facilities Left Bank	1161		0.5% Canal stretch Hhs may use the facilites
Biotoilets facilities at Right Bank	742		
Total Number of Bio Toilet Units	1903		
Facilty at Canal Front			
One Toilet Facility at each 500 m			
Number of Units Left Bank Canal	23		Canal length 11.5 Km
Number of Units Right Bank Canal	22		Canal length 10.95 Km
Total Number of Units	Units	Unit Cost	Total Cost
Left Bank Canal	1184	30000	35512180
Right Bank	764	30000	22922809
			58434988.9
Sewegae Transportation cost and disposal cost 30%			
Left Bank Canal			10653653.97
Right Bank			6876842.703
Sub Total Cost			
Left Bank Canal			46165834
Right Bank			29799652
		Total	7,59,65,486
Total Forecasted Population		Unit Cost	
Chilavanoor	94138	807.0	
TP	70470		5,68,66,710
Edapally	118786		9,58,55,701
Total Cost - Sanitation Facilities			**22,86,87,897**

Annexure 6.2.4					
Cost Estimate Solid waste management					
S. No.	**Description**	**Unit**	**Quantity**	**Rate**	**Amount**
1	240 l capacity standalone HDPE bins with lid mounted on metal frame anchored to ground, including installation and foundation cost.	No.	104	₹ 5,000	₹ 5,20,000.00
2	40 l twin bin with lid.	No.	15000	₹ 1,000	₹ 1,50,00,000.00
3	120 l capacity free standing wheel mounted HDPE bins with lid.	No.	228	₹ 3,000	₹ 6,84,000.00
4	80 l x 2 standalone HDPE twin bin set with fixed/openable lid mounted on metal frame anchored to ground.	No.	829	₹ 5,000	₹ 41,45,000.00
5	60 l x 3 free standing FRP tri-bin set with openable lid.	No.	34	₹ 20,000	₹ 6,80,000.00
6	100 l to 120 l all weather smart bins including onboard garbage level sensor, garbage compactor, weight sensor with scale, with mobile internet communication capability along with requisite hardware and software.	No.	129	₹ 90,000	₹ 1,16,10,000.00
	Sub-total		**2119**		**₹ 3,26,39,000.00**
7	Replacement cost				₹ 56,77,800.00
	Total				**₹ 3,83,16,800.00**

Annexure 6.3

Abstract Cost : Land acquisition : Canal oriented development

Annexure 6.3.i

S. No.	Description	Canal	Unit	Area	Rate (INR)	Amount (INR)
1	Land Acquisition Charges along canal banks	Edappally Canal	ha	16.6417	₹ 11,90,00,000.00	₹ 1,98,03,62,300.00
		Thevara-Perandoor Canal	ha	7.50223	₹ 11,47,50,000.00	₹ 86,08,80,892.50
		Thevara Canal	ha	2.0017	₹ 11,47,50,000.00	₹ 22,96,95,075.00
		Chilavanoor Canal	ha	8.2677	₹ 11,47,50,000.00	₹ 94,87,18,575.00
		Market Canal	ha	0.264	₹ 11,47,50,000.00	₹ 3,02,94,000.00
	Total					**₹ 4,04,99,50,842.50**

Annexure 6.3.ii

S. No.	Description	Canal	Unit	Area	Rate (INR)	Amount (INR)
2	Land Acquisition: Access road for bridges	Edappally Canal	ha	0.1	₹ 11,47,50,000.00	₹ 1,14,75,000.00
		Thevara-Perandoor Canal	ha	0.196	₹ 11,47,50,000.00	₹ 2,24,91,000.00
		Thevara Canal	ha	0.028	₹ 11,47,50,000.00	₹ 32,13,000.00
		Chilavanoor Canal	ha	0.172	₹ 11,47,50,000.00	₹ 1,97,37,000.00
3	Land acqusition - Additional STPs	Edappally Canal	ha	1.01125	₹ 11,47,50,000.00	₹ 11,60,40,937.50
		Thevara-Perandoor Canal	ha	0.4045	₹ 11,47,50,000.00	₹ 4,64,16,375.00
		Chilavanoor Canal	ha	0.303375	₹ 11,47,50,000.00	₹ 3,48,12,281.25
	Total					**₹ 25,41,85,593.75**

Annexure 6.3.iii

S. No.	Description	Canal	Unit	Area	Rate (INR)	Amount (INR)
4	Land Acquisition: Access road for jetty terminals	Edappally Canal	ha	0.18	₹ 11,47,50,000.00	₹ 2,06,55,000.00
		Thevara-Perandoor Canal	ha	0.20	₹ 11,47,50,000.00	₹ 2,29,00,000.00
		Thevara Canal	ha	0.04	₹ 11,47,50,000.00	₹ 45,90,000.00
		Chilavanoor Canal	ha	0.18	₹ 11,47,50,000.00	₹ 2,05,00,000.00
	Total					**₹ 6,86,45,000.00**
	Grand Total					**₹ 4,37,27,81,436.25**

DETAILED ESTIMATE

Description			area in sqm	area in ha	Rate/ha	Amount
EDAPPALLY CANAL	Canal bank	11230m x 4m	44920	4.492	₹ 11,90,00,000.00	₹ 53,45,48,000.00
	Beautification area	7000m x 15m	105000	10.5	₹ 11,90,00,000.00	₹ 1,24,95,00,000.00
	Jetties 8nos		16497	1.6497	₹ 11,90,00,000.00	₹ 19,63,14,300.00
	STP	(2*0.4045)+(.5*.4045)	10112.5	1.01125	₹ 11,47,50,000.00	₹ 11,60,40,937.50
	acces road to jetty teminal		1800	0.18	₹ 11,47,50,000.00	₹ 2,06,55,000.00
	access road to bridges		1000	0.1	₹ 11,47,50,000.00	₹ 1,14,75,000.00
	sub total		179329.5	17.93295		**₹ 2,12,85,33,237.50**
	Revenue streams	15.19		15.19		**₹ 1,19,30,45,874.67**
	Total			33.12295		**₹ 3,32,15,79,112.17**
Description			**area in sqm**	**area in ha**	**Rate/ha**	**Amount**
CHILAVANOOR CANAL	Canal bank	11150m x 4m	44600	4.46	₹ 11,47,50,000.00	₹ 51,17,85,000.00
	Additional acquisition >16.5		25840	2.584	₹ 11,47,50,000.00	₹ 29,65,14,000.00
	Jetties 9nos		12237	1.2237	₹ 11,47,50,000.00	₹ 14,04,19,575.00
	STP	(.75*.4045)	3033.75	0.303375	₹ 11,47,50,000.00	₹ 3,48,12,281.25
	acces road to jetty teminal		1786	0.18	₹ 11,47,50,000.00	₹ 2,05,00,000.00
	access road to bridges		1720	0.172	₹ 11,47,50,000.00	₹ 1,97,37,000.00
	sub total		89217.24237	8.921724		
	Total			8.921724		**₹ 1,02,37,67,856.25**
Description			**area in sqm**	**area in ha**	**Rate/ha**	**Amount**
THEVARA PERANDOOR CANAL	Canal bank	9880m x 4m	39520	3.952	₹ 11,47,50,000.00	₹ 45,34,92,000.00
	Additional acquisition >16.5		14820	1.482	₹ 11,47,50,000.00	₹ 17,00,59,500.00
	Jetties 10nos		8682.3	0.86823	₹ 11,47,50,000.00	₹ 9,96,29,392.50
	STP	(1*.4045)	4045	0.4045	₹ 11,47,50,000.00	₹ 4,64,16,375.00
	acces road to jetty teminal		1995.64	0.199564	₹ 11,47,50,000.00	₹ 2,29,00,000.00
	access road to bridges		1960	0.196	₹ 11,47,50,000.00	₹ 2,24,91,000.00
	access road along canal		12000	1.2	₹ 11,47,50,000.00	₹ 13,77,00,000.00
	sub total		71022.9427	7.102294		**₹ 95,26,88,267.50**
	Revenue streams	2.67		2.67		**₹ 12,13,06,434.00**
	Total			9.772294		**₹ 1,07,39,94,701.50**
Description			**area in sqm**	**area in ha**	**Rate/ha**	**Amount**
THEVARA CANAL	Canal bank	1410m x 4m	14100	1.41	₹ 11,47,50,000.00	₹ 16,17,97,500.00
	Jetties 2nos		517	0.0517	₹ 11,47,50,000.00	₹ 59,32,575.00
	acces road to jetty teminal		400	0.04	₹ 11,47,50,000.00	₹ 45,90,000.00
	access road to bridges		280	0.028	₹ 11,47,50,000.00	₹ 32,13,000.00
	acces road along canal		5400	0.54	₹ 11,47,50,000.00	₹ 6,19,65,000.00
	sub total		20697	2.0697		
	Total					**₹ 23,74,98,075.00**
Description			**area in sqm**	**area in ha**	**Rate/ha**	**Amount**
MARKET CANAL	Canal bank	660m x 4m	2640	0.264	₹ 11,47,50,000.00	₹ 3,02,94,000.00
	sub total		2640	0.264		
						₹ 3,02,94,000.00
Revenue stream land acquisition					**₹ 1,31,43,52,308.67**	
Canal oriented development Land acquisition					**₹ 4,37,27,81,436.25**	
Rehabilitation & Resettlement Land acquisition					**₹ 29,16,00,000.00**	
Grand total					**₹ 5,97,87,33,744.92**	

Annexure 6.4

Project mangement+ Environmental Monitoring& Specific Additional Contracts etc.

Description	Amount (Rs)
Specific additional contracts	₹ 2,50,00,000.00
Environmental monitoring	₹ 2,00,00,000.00
Project management cost + specialised work like LIDAR survey+public campaign/social awareness management	₹ 30,00,00,000.00
Total	**₹ 34,50,00,000.00**

Abstract cost estimates of development of residential colony (in Kakkanad, Kochi) with 7 blocks of stilt + 10 storeyed buildings under the IURWTS Project		
Summary		
S.No.	**Description/Item**	**Amount (Rs.)**
1	Block-1	₹ 10,35,07,404
2	Block-2	₹ 10,35,07,404
3	Block-3	₹ 10,35,07,404
4	Block-4	₹ 10,35,07,404
5	Block-5	₹ 10,35,07,404
6	Block-6	₹ 10,35,07,404
7	Block-7	₹ 10,35,07,404
8	Development of site	₹ 96,19,419
9	Specialised E&M Works	₹ 5,33,85,308
	TOTAL	**₹ 78,75,56,556**

Cost estimates of development of residential colony (in Kakkanad, Kochi) under the IURWTS Project							
Estimate of one block (out of total 7 blocks)							
	CPWD PAR 2019						
Sl. No.	Ann-exure	Sl. No.	Description/Item	Unit	Quantity	Rate (INR)	Amount (INR)
		1.0	**BUILDING COST**				
1	I	1.1	RCC framed structure (upto 6	sqm	2116.571	₹ 19,500.00	₹ 4,12,73,134.50
		1.1.1	Floor height 3.60m				
		1.1.2	Floor height 2.90m				
			SUB-TOTAL-A				**₹ 4,12,73,134.50**
		1.3	**EXTRA FOR**				
2	I	1.3.1	Every additional storey over six storeys upto twelve storeys (For RCC Framed Structure only)(till 10th	sqm	330.421	₹ 20,080.00	₹ 66,34,853.68
	I	1.3.1		sqm	330.421	₹ 20,660.00	₹ 68,26,497.86
	I	1.3.1		sqm	330.421	₹ 21,240.00	₹ 70,18,142.04
	I	1.3.1		sqm	330.421	₹ 21,820.00	₹ 72,09,786.22
3	I	1.3.3	Every 0.30m higher plinth over normal plinth height of 0.45m (on G.F. area only)	sqm	134.045	₹ 335.00	₹ 44,905.08
4	I	1.3.5	Making stronger foundations to take load of one additional floor at a a later date (on area of additional one floor only)	sqm	330.421	₹ 1,470.00	₹ 4,85,718.87
5	I	1.3.6	Resisting earthquake forces (for RCC famed structures only)	sqm	3638.858	₹ 1,200.00	₹ 43,66,629.60
6	I	1.3.7	R.C.C. Pile foundation	sqm	334.648	₹ 16,600.00	₹ 55,55,156.80
		1.4	**BASEMENT FLOOR**				
		1.4.1	Floor ht. upto 3.35 m. with Kota Stones/HDPE membrance i/c integral crystalline water proofing.	sqm	88.694	₹ 30,000.00	₹ 26,60,820.00
	I	1.6	**FIRE ALARM SYSTEM**				
7	I	1.6.1	Manual fire alarm system	sqm	3683.205	₹ 250.00	₹ 9,20,801.25
			STILT PORTION				
8	I	1.8.1	Stilt portion of multistorey RCC framed structure (up to ht. of 3.60m). Applicable area only.	sqm	200.603	₹ 8,000.00	₹ 16,04,824.00
			SUB-TOTAL-B				**₹ 4,33,28,135.40**
		2.0	**SERVICES**				
9	I	2.1	Internal water supply and sanitary installations			9%	₹ 37,14,582.11

Cost estimates of development of residential colony (in Kakkanad, Kochi) under the IURWTS Project							
Estimate of one block (out of total 7 blocks)							
	CPWD PAR 2019						
Sl. No.	Ann-exure	Sl. No.	Description/Item	Unit	Quantity	Rate (INR)	Amount (INR)
10	I	2.2	External service connections				
11	I	2.2.1	Electrical external service connections			3.75%	₹ 15,47,742.54
12	I	2.2.2	Civil external service connections			1.25%	₹ 5,15,914.18
13	I	2.3	Internal electrical installations			12.5%	₹ 51,59,141.81
			EXTRA FOR				
14	I	2.6.1	Power wiring and plugs			4%	₹ 16,50,925.38
15	I	2.6.3	Lightning conductors			0.25%	₹ 1,03,182.84
16	I	2.6.4	Telephone conduits			0.25%	₹ 1,03,182.84
17	I	2.6.5	Centralized intercom system			1%	₹ 4,12,731.35
18	I	2.6.6	Third party quality assurance			1%	₹ 4,12,731.35
			SUB-TOTAL-C				**₹ 1,36,20,134.39**
19	I	3.0	**LIFTS**				
20	I	3.1.1	Passenger lift (ACVVVF, 16 Pax)	1	NA	2600000	₹ 32,60,000.00
			SUB-TOTAL-D				**₹ 32,60,000.00**
		4.0	**WATER TANK (RCC ONLY)**				
21		4.5	Overhead tank with staging height between 30.0m and 40.0m	L	38500	₹40/litre	₹ 15,40,000.00
22		4.6	Underground sump	L	27000	₹18/litre	₹ 4,86,000.00
			SUB-TOTAL-E				**₹ 20,26,000.00**
			TOTAL				**₹ 10,35,07,404.28**

Cost estimates of development of Stilt+10 storey residential complex (in Kakkanad, Kochi) under the IURWTS Project							
Estimate of Site Development							
	CPWD PAR 2019						
Sl. No.	Ann-exure	Sl. No.	Description/Item	Unit	Quantity	Rate (INR)	Amount (INR)
P			**DEVELOPMENT OF SITE**				
1	I	5.1	Levelling (area of plot)	sqm	6554.30	₹ 160.00	₹ 10,48,688.00
2	I	5.2	**Internal roads & paths**				
3	I	5.2.3	CC pavement with vacuum dewatered concrete	sqm	2009.87	₹ 85.00	₹ 1,70,839.10
4	I	5.2.4	Footpath with kerb stone	sqm	2449.09	₹ 85.00	₹ 2,08,172.44
5	I	5.3	Sewer	sqm	4242.35	₹ 165.00	₹ 6,99,987.85
6	I	5.4.	Filter water supply				
7	I	5.4.1	Distribution lines 100mm dia and below	sqm	4242.35	₹ 100.00	₹ 4,24,235.06
8	I	5.4.2	Peripheral grid 150mm to 300mm dia pipes	sqm	4242.35	₹ 100.00	₹ 4,24,235.06
9	I	5.4.3	Unfiltered water supply distribution lines (area of plot)	sqm	4242.35	₹ 65.00	₹ 2,75,752.79
10	I	5.5	Storm water drains (area of plot)	sqm	4242.35	₹ 130.00	₹ 5,51,505.58
11	I	5.6	Rain water harvesting (RWH)	sqm	2312.95	₹ 90.00	₹ 2,08,165.23
12	I	5.7	Trenches for services	m	850.00	₹ 585.00	₹ 4,97,250.00
13	I	5.8.1	Boundary wall with 1.50m normal height from G.L. & 0.60m high MS grill, and required no. of steel gates/wicket gates etc.	m	450.00	₹ 9,000.00	₹ 40,50,000.00
14	I	5.9.1	Horticulture operations including 30cm earth filling, grassing, tree plantation/shrubs and potted plants etc.	sqm	4242.35	₹ 250.00	₹ 10,60,587.65
			SUB-TOTAL-F				**₹ 96,19,418.75**

Cost estimates of development of residential colony (in Kakkanad, Kochi) under the IURWTS Project							
Plinth area rates for the common specialised E&M services for IURWTS R&R Housing							
	CPWD PAR 2019						
Sl. No.	Ann-exure	Sl. No.	Description/Item	Unit	Rate	Quantity	Amount
1	V	1	Supplying, installation, testing and commissioning of 33kV/0.433kV or 11kV/0.433 kV, substation equipments comprising HT panel, Dry type transformers, Bus trunking from transformer to LT panel, Automatic Power factor control (APFC), Active Harmonic Filters, TVSS (Transient Voltage suppression system, SPD (Surge protection system/device), Essential panel, Earthing, required inter-connections, sub-station safety equipments including LT cabling from sub station to the buildings fed by the sub station	KVA	₹ 9,000.00	2800	₹ 2,52,00,000.00
			DIESEL GENERATOR SET				

Plinth area rates for the common specialised E&M services for IURWTS R&R Housing							
	CPWD PAR 2019						
Sl. No.	Ann-exure	Sl. No.	Description/Item	Unit	Rate	Quantity	Amount
2	V	2	Supplying Installation testing and commissioning of Silent type DG Sets, AMF Panel, Bus Ducting/Cables from DG Sets to Essential panel, Synchronizing panel where required, DG Set enclosure room sound insulation/ventilation/smoke exhaust as required, Earthing of DG set system, control cabling, Fuel tank/piping, DG set Exhaust piping/Exhaust Chimney as per CPCB norms, Civil works connected with DG Sets including foundation as required.	per KVA	₹ 11,000.00	140	₹ 15,40,000.00
3			**SOLAR PHOTO VOLTAIC POWER GENERATION SYSTEM**				
	V	8	Supplying Installation testing and commissioning of GRID interactive roof top solar photo voltaic power genration system i/c space frame but without battery.	per KWp	₹ 65,000.00	280	₹ 1,82,00,000.00
4			**SOLAR WATER HEATING SYSTEM**				
	V	9	Supplying, Installation testing and commissioning of solar water heating system with heat exchanger type including electrical heater backup, make up water tank but without piping				

Plinth area rates for the common specialised E&M services for IURWTS R&R Housing							
	CPWD PAR 2019						
Sl. No.	Ann-exure	Sl. No.	Description/Item	Unit	Rate	Quantity	Amount
4.1			100 liter per day	100 litres per day	₹ 22,500.00	70	₹ 15,75,000.00
5	V	15	**BASIC HOME SECURITY FOR RESIDENTIAL COLONY** Supplying and installation testing and commissioning of basic security system in the residential colony to include control room at the gate and intercom connection to each dwelling unit, and basic CC TV system to be installed at the entry and exit points, Parking areas , entry point of each dwelling unit and other common areas as required. To include CCTV control room, required UG cabling, recording system and monitor/ monitors in the control room				
5.1	V	15.2	CCTV System	per Sqm. Of residential Area	₹ 300.00	4242.35	₹ 12,72,705.18
6	V	20	**STREET LIGHTING WITH LED**				
6.1			Supplying and installation testing and commissioning of LED Street/ Compound/ High mast/ Pathway/ Landscape Lighting for the entire Campus	per sqm.(Plot Area)	₹ 150.00	4242.35	₹ 6,36,352.59
7		21	**STP**				

Plinth area rates for the common specialised E&M services for IURWTS R&R Housing							
	CPWD PAR 2019						
Sl. No.	Ann-exure	Sl. No.	Description/Item	Unit	Rate	Quantity	Amount
	V	21.3	Supplying, installation, testing and commissioning of STP of appropriate technology including Civil Works (except plant room), Tertiary Treatment etc., for the campus. Per day for plant size above 100000 LPD	per 1000 Ltr.	₹ 50,000.00	99.23	₹ 49,61,250.00
Total							**₹ 5,33,85,307.77**

Sub-division	Description	Occupancy	Area (acres)
Part-1	IURWTS	Multi-family units	1.62
Part-2	Other agency	Multi-family units	3.47
Part-3	Paddyland part		2.64
Total			**7.73**

Annexure 6.5

Annexure 6.5.ii

S. No.	Description	Units	Quantity	Rate (INR)	Amount (INR)
	Land Acquisition cost - 7.73 acres (already acquired)	LS	1	₹ 29,61,00,000.00	**₹ 29,61,00,000.00**

Annexure 6.5.iii

S. No.	Description	Units	Quantity	Rate (INR)	Amount (INR)
	Buildings Compenation cost for PAP@104 Nos. building @ Rs. 18.08 Lakh	no	104	₹ 18,07,692.31	**₹ 18,80,00,000.00**

Annexure 6.5.iv

S. No.	Description	Units	Quantity	Rate (INR)	Amount (INR)
	Buildings Compenation cost for PAF @791 building @Rs 5 Lakh	no	791	₹ 5,00,000.00	**₹ 39,55,00,000.00**

Annexure 6.5.5

Removal of utilities including railway bridges/culverts (to be handled by respective department) and cross structure demolition

Description	Amount (Rs)
Removal of utilities including railway bridges/culverts (to be handled by respective department)	₹ 25,00,00,000.00
Demolition of existing structure	₹ 5,00,00,000.00
Total	**₹ 30,00,00,000.00**

Detailed Estimate: Demolision of existing structure							
S. No.	**Code**	**Description**	**Unit**	**Qty**	**Rate (INR)**	**Amount (INR)**	**Remarks**
1	**15.18**	Dismantling steel work in built up sections in angles, tees, flats and channels including all gusset plates, bolts, nuts, cutting rivets, welding etc. including dismembering and stacking within 50 metres lead	Kg	186000.00	₹ 5.83	₹ 10,83,957.51	DSR
2	**15.58**	Demolishing R.C.C. work by mechanical means and stockpiling at designated locations and disposal of dismantled materials up to a lead of 1 kilometre, stacking serviceable and unserviceable material separately including cutting reinforcement bars.	cum	14505.60	₹ 2,980.00	₹ 4,32,26,688.00	DSR
3	**15.9.2**	Demolishing stone rubble masonry manually/ by mechanical means including stacking of serviceable material and disposal of unserviceable material within 50 metres lead as per direction of Engineer-in-charge : In cement mortar	cum	1920.00	₹ 2,454.00	₹ 47,11,680.00	DSR
4		Unforseen	LS			₹ 9,77,674.49	
						₹ 5,00,00,000.00	

Annexure 6.6

Abstract Cost - Development of Konthuruthy canal

Description	Amount (Rs)
Development of konthuruthy canal	₹ 34,00,00,000.00
Total	**₹ 34,00,00,000.00**

ADDITIONAL ESTIMATE FOR KONTHURUTHY CANAL									
Sl.No	Description	Unit	No	L	B	H	Qty	Rate	Amount
1	Shore protection	sqm	2	650		8.5	11050	₹ 11,395.00	₹ 12,59,14,750.00
2	Deepening and widening	cum	1	47588.75			47588.8	₹ 630.00	₹ 2,99,80,912.50
3	40 m road bridge and access road	No	1				1	₹ 15,00,00,000.00	₹ 15,00,00,000.00
4	foot over bridge	No	2	1			2	₹ 84,84,848.00	₹ 1,69,69,696.00
5	Demolition of existing structure	LS	1				1	₹ 1,00,00,000.00	₹ 1,00,00,000.00
6	Fencing	LS	1				1	₹ 71,34,641.50	₹ 71,34,641.50
	Total								**₹ 34,00,00,000.00**

Deepening and Widening Calculation

chainage	required width	width	depth of deepening	interval	cutting width	deepening qty	cutting depth	cutting qty	remarks
0	40	8	1	10	32	80	2.25	720	
10	40	8.3	1	10	31.7	83	2.25	713.25	
20	40	8.65	1	10	31.35	86.5	2.25	705.375	
30	40	8.83	1	10	31.17	88.3	2.25	701.325	
40	40	9.53	1	10	30.47	95.3	2.25	685.575	
50	40	10.57	1	10	29.43	105.7	2.25	662.175	
60	40	6.53	1	10	33.47	65.3	2.25	753.075	
70	40	6.56	1	10	33.44	65.6	2.25	752.4	
80	40	6.89	1	10	33.11	68.9	2.25	744.975	
90	40	7.64	1	10	32.36	76.4	2.25	728.1	
100	40	6.79	1	10	33.21	67.9	2.25	747.225	
107	40	5	1	7	35	35	2.25	551.25	
115	40	0	1	8	40	0	2.25	720	Road
120	40	5.15	1	10	34.85	51.5	2.25	784.125	
130	40	4.72	1	10	35.28	47.2	2.25	793.8	
140	40	4.82	1	10	35.18	48.2	2.25	791.55	
150	40	5.22	1	10	34.78	52.2	2.25	782.55	
160	40	5	1	10	35	50	2.25	787.5	
170	40	18	1	10	22	180	2.25	495	
180	40	18	1	10	22	180	2.25	495	
190	40	18	1	10	22	180	2.25	495	
200	40	18	1	10	22	180	2.25	495	
210	40	18	1	10	22	180	2.25	495	
220	40	18	1	10	22	180	2.25	495	
230	40	18	1	10	22	180	2.25	495	
240	40	18	1	10	22	180	2.25	495	
250	40	18	1	10	22	180	2.25	495	
260	40	18	1	10	22	180	2.25	495	
270	40	18	1	10	22	180	2.25	495	
280	40	18	1	10	22	180	2.25	495	
290	40	18	1	10	22	180	2.25	495	
300	40	18	1	10	22	180	2.25	495	
310	40	18	1	10	22	180	2.25	495	
320	40	18	1	10	22	180	2.25	495	

chainage	required width	width	depth of deepening	interval	cutting width	deepening qty	cutting depth	cutting qty	remarks
330	40	18	1	10	22	180	2.25	495	
340	40	18	1	10	22	180	2.25	495	
350	40	18	1	10	22	180	2.25	495	
360	40	18	1	10	22	180	2.25	495	
370	40	18	1	10	22	180	2.25	495	
380	40	18	1	10	22	180	2.25	495	
390	40	18	1	10	22	180	2.25	495	
400	40	18	1	10	22	180	2.25	495	
410	40	18	1	10	22	180	2.25	495	
420	40	18	1	10	22	180	2.25	495	
430	40	18	1	10	22	180	2.25	495	
440	40	18	1	10	22	180	2.25	495	
450	40	9.8	1	10	22	98	2.25	495	
460	40	9.8	1	10	22	98	2.25	495	
470	40	9.8	1	10	22	98	2.25	495	
480	40	9.8	1	10	22	98	2.25	495	
490	40	23	1	10	22	230	2.25	495	
500	40	23	1	10	22	230	2.25	495	
510	40	23	1	10	22	230	2.25	495	
520	40	23	1	10	22	230	2.25	495	
530	40	23	1	10	22	230	2.25	495	
540	40	23	1	10	30.2	230	2.25	679.5	
550	40	23	1	10	30.2	230	2.25	679.5	
560	40	23	1	10	30.2	230	2.25	679.5	
570	40	23	1	10	30.2	230	2.25	679.5	
580	40	23	1	10	17	230	2.25	382.5	
590	40	23	1	10	17	230	2.25	382.5	
600	40	23	1	10	17	230	2.25	382.5	
610	40	23	1	10	17	230	2.25	382.5	
620	40	23	1	10	17	230	2.25	382.5	
width larger than 40m	1700		1			1700			
					deepening total	**11519**	**Widening total**	**36069.75**	
					Total quantity	**47588.75**	**₹ 630.00**	**₹ 2,99,80,912.50**	

Detailed Project Report - Annexures: Drawings

Integrated Urban Regeneration and Water Transport System (IURWTS) in Kochi

Project #: WT/2024

Revision #: R0

June 08, 2020

General Consultant - IURWTS:

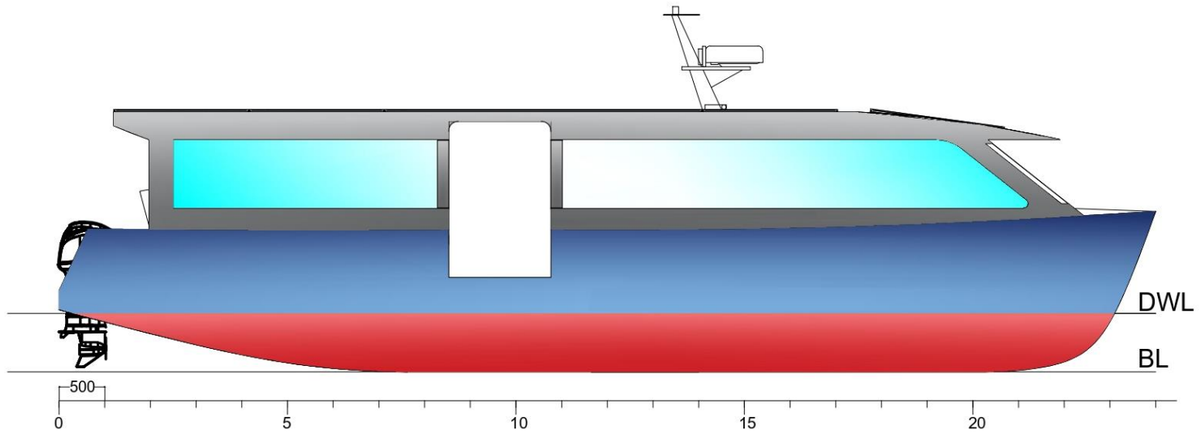
Antea Nederland B.V. and Antea India Pvt. Ltd.

Client:

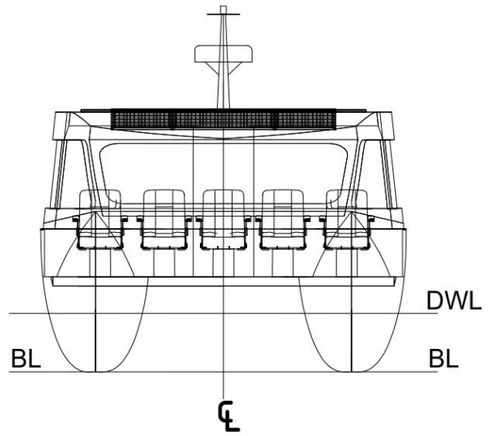
Kochi Metro Rail Limited, (A Joint Venture of Govt. of Kerala and Govt. of India)

D.1 Preliminary arrangement of design vessels

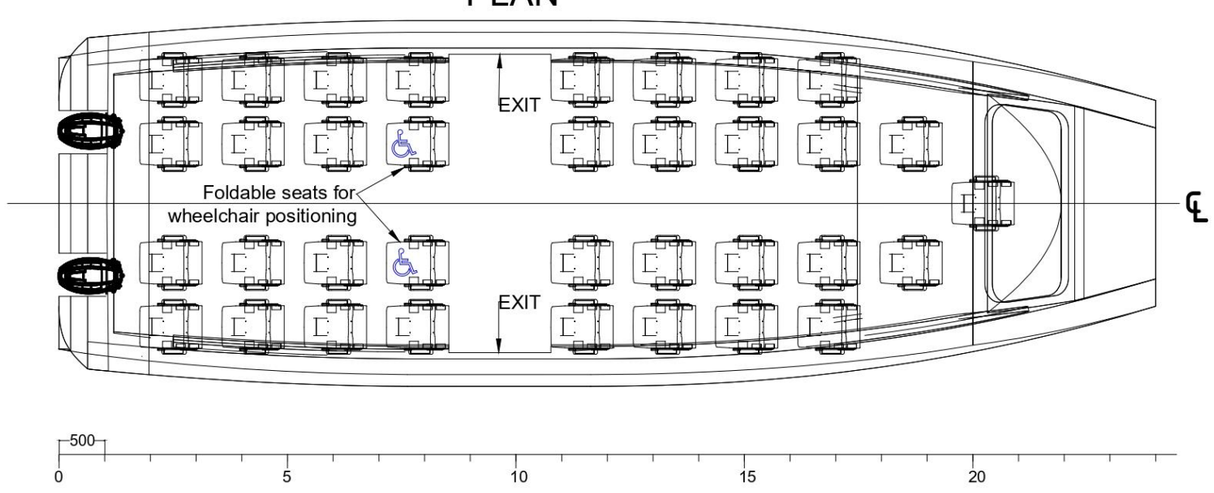
PROFILE



AFT VIEW



PLAN



MAIN PARTICULARS	
LENGTH OA	12.000 m
WIDTH CAT	4.000 m
BREADTH DEMIHULL	1.200 m
DEPTH MLD.	0.900m
DRAFT DESIGN MLD.	0.600 m
PASSENGER CAPACITY	35 PAX
SERVICE SPEED	5.5 knots
MAX. SPEED	7 knots
ROUTE	Thevara-Perandoor/Chilavannur/Edapally/ Market Canals

CLIENT:
KOCHI METRO RAIL LIMITED
4th Floor, JLN Stadium Metro Station, Banerji Road, Kaloor,Kochi, Kerala - 682017
Ph: 0484-2846700 , 2846770
Fax: 0484-2970810

GENERAL CONSULTANT:
Antea Nederland B.V and Antea India(JV)
40/157, Kudiyirikkal Building, First Floor Palarivattam, Kochi - 682025,Kerala

PROJECT:
GENERAL COUNSULTANCY SERVICES INTEGRATED URBAN REGENERATION AND WATER TRANSPORT SYSTEM, KOCHI

Antea Nederland B.V and Antea India(JV)

	NAME	SIGN	DATE
DRAWN			
DESIGNED			
CHECKED			
APPROVED			

KEY PLAN:

NO OBJECTION BY KMRL

CIVIL | MEP

REVISIONS

NO.	DESCRIPTION	DATE	BY
R0	TENDER DRAWING		

INTEGRATED URBAN REGENARATION & WATER TRANSPORT SYSTEM

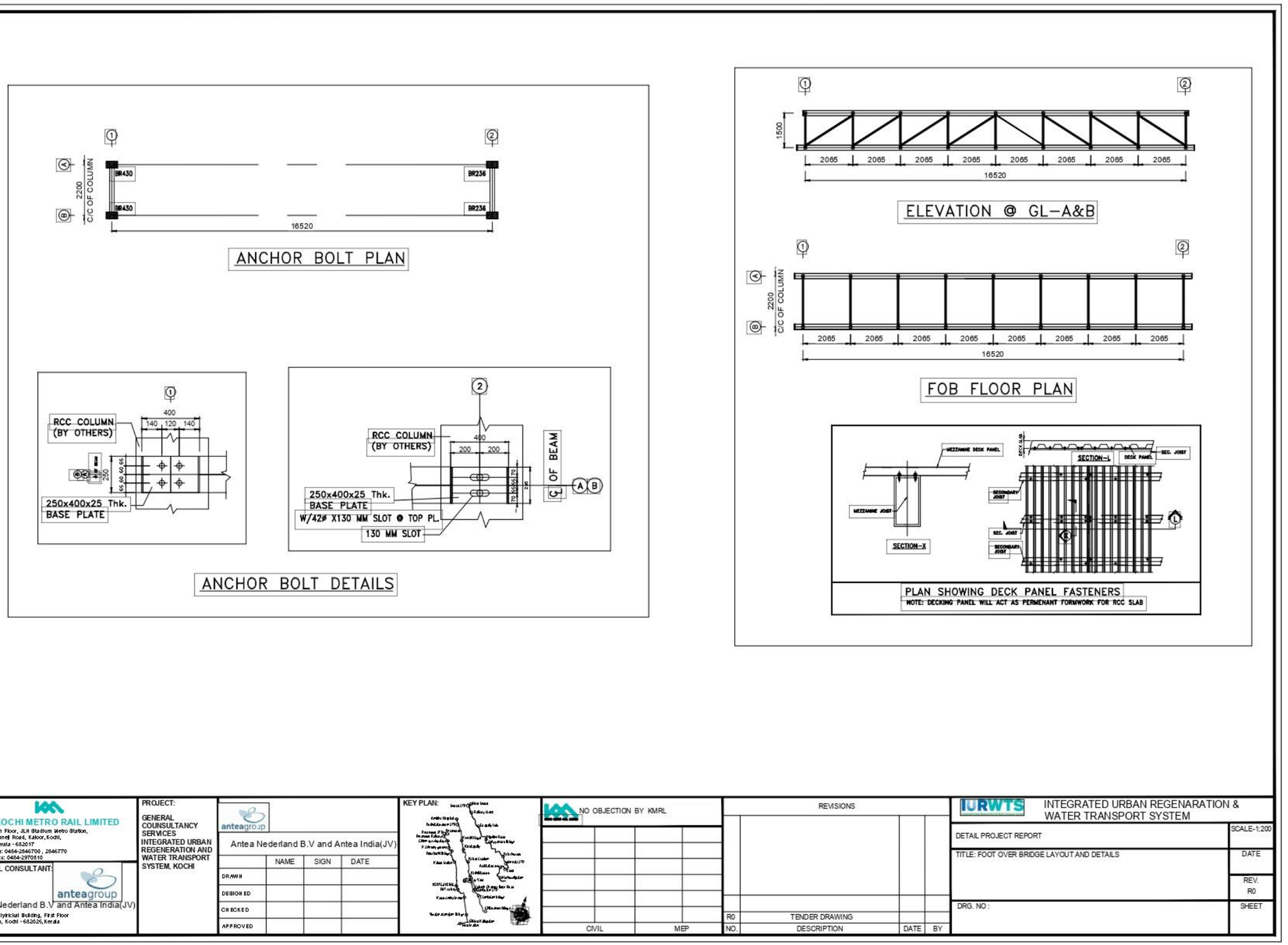
DEATAILED PROJECT REPORT — SCALE-1:50

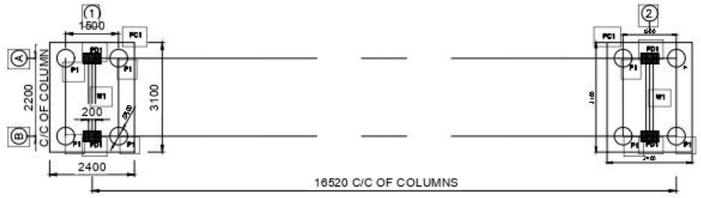
TITLE:BOAT DRAWING — DATE

REV. R0

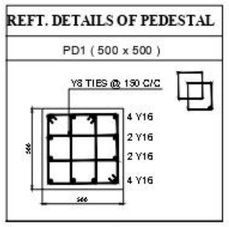
DRG. NO : — SHEET

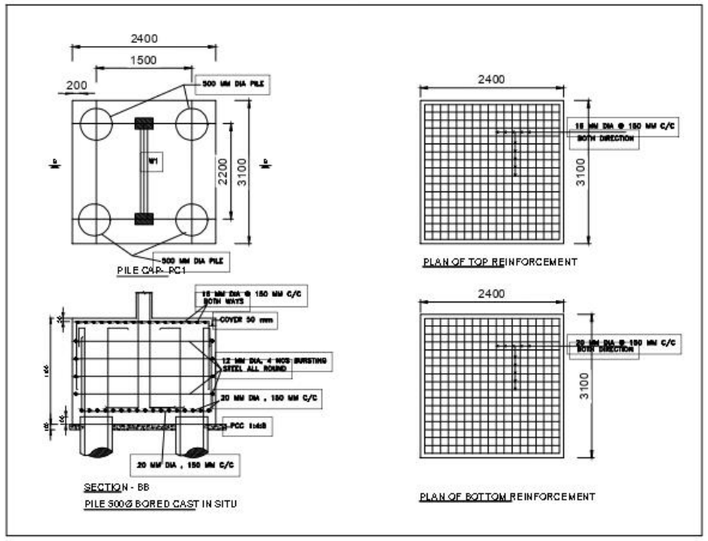
D.2 Foot over bridge layout and details

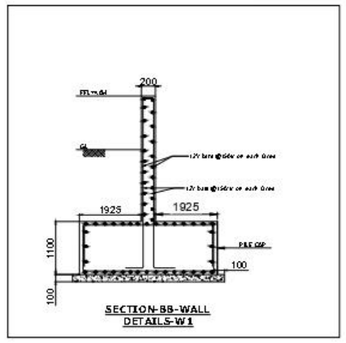


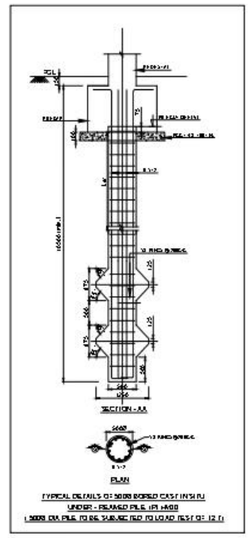


PILE/PILE CAP LAYOUT









SHUTTERING OF ANY PART OF THE STRUCTURE SHALL NOT BE RE
THE CONCRETE ATTAINS 70% OF THE SPECIFIED STRENGTH OF CO
HOWEVER THE FOLLOWING MINIMUM PERIOD (AFTER FINAL POUR)

A) VERTICAL SIDE SHUTTERING OF COLUMNS,WALLS & BEAMS	- 24HOUR
B) BOTTOM SHUTTERING OF SLABS (KEEPING THE PROPS)	- 3 DAYS
C) BOTTOM SHUTTERING OF BEAMS (KEEPING THE PROPS)	- 7 DAYS
d) PROPS TO SLABS :	
i. SPANNING UPTO 4.5 M	- 7 DAYS
ii. SPANNING OVER 4.5 M	- 14 DAYS
E) PROPS TO BEAMS & ARCHES :	
i. SPANNING UPTO 6 M	- 14 DAYS
ii. SPANNING OVER 6 M	- 21 DAYS

LAP JOINTS FOR REINFORCEMENT BARS :

i) AT ANY CROSS SECTION OF THE MEMBER,NOT MORE THAN 50% BARS SHALL BE LAPPED.

iii) LAP LENGTH SHALL BE AS PER (SP:34-1999)

iv) LAPS IN COLUMNS SHALL BE PROVIDED AT MID HEIGHT OF FLOO SLAB LEVEL .

v) LAPS IN BEAMS AND SLABS SHALL BE PROVIDED AT SPAN/3 DIST THE SUPPORT.

vi) WELDING OF BARS SHALL BE DONE AS A STITCH WELD FOR 5 TI BAR AND A GAP OF 5TIMES OF BAR AND AGAIN WELDING FOR A TIMES DIAMETER OF BAR USING ARC WELDING AND SPECIAL EL AFTER OBTAINING PRIOR WRITTEN APPROVAL FROM THE STRUC DESIGNER WELDING PROCEDURE AND DETAILS SHOULD COMFI APPENDIX-A OF SP:34.

NOTES:-

1. ALL DIMENSIONS ARE IN MM.
2. ONLY WRITTEN DIMENSION TO BE FOLLOWED.
3. ANY DISCREPENCIES NOTICED IN THE DRG. SHALL BE BROUGHT TO OUR NOTICE IMMEDIATELY.
5. GRADE OF CONCRETE SHALL CONFIRM TO IS 456 : 2000
   M25 UNO.
6. "Y" DENOTES HIGH STRENGTH DEFORMED BARS OF GRADE FE500 CONFORMING TO IS 1786 : 1985
7. CLEAR COVER TO REINFORCEMENT.
   A. COLUMNS = 40MM
   B. FOOTINGS = 50MM @side & 75MM @ Bottom
   C. PLINTH BEAM = 30MM

LEGEND

CLIENT:
KOCHI METRO RAIL LIMITED
4th Floor, JLN Stadium Metro Station, Banerji Road, Kaloor, Kochi, Kerala - 682017
Ph: 0484-2846700 , 2846770
Fax: 0484-2970810

GENERAL CONSULTANT:
Antea Nederland B.V and Antea India(JV)
401/57, Nadiyirickal Building, First Floor Palarivattam, Kochi - 682025, Kerala

PROJECT:
GENERAL COUNSULTANCY SERVICES INTEGRATED URBAN REGENERATION AND WATER TRANSPORT SYSTEM, KOCHI

Antea Nederland B.V and Antea India(JV)

	NAME	SIGN	DATE
DRAWN			
DESIGNED			
CHECKED			
APPROVED			

KEY PLAN:

NO OBJECTION BY KMRL

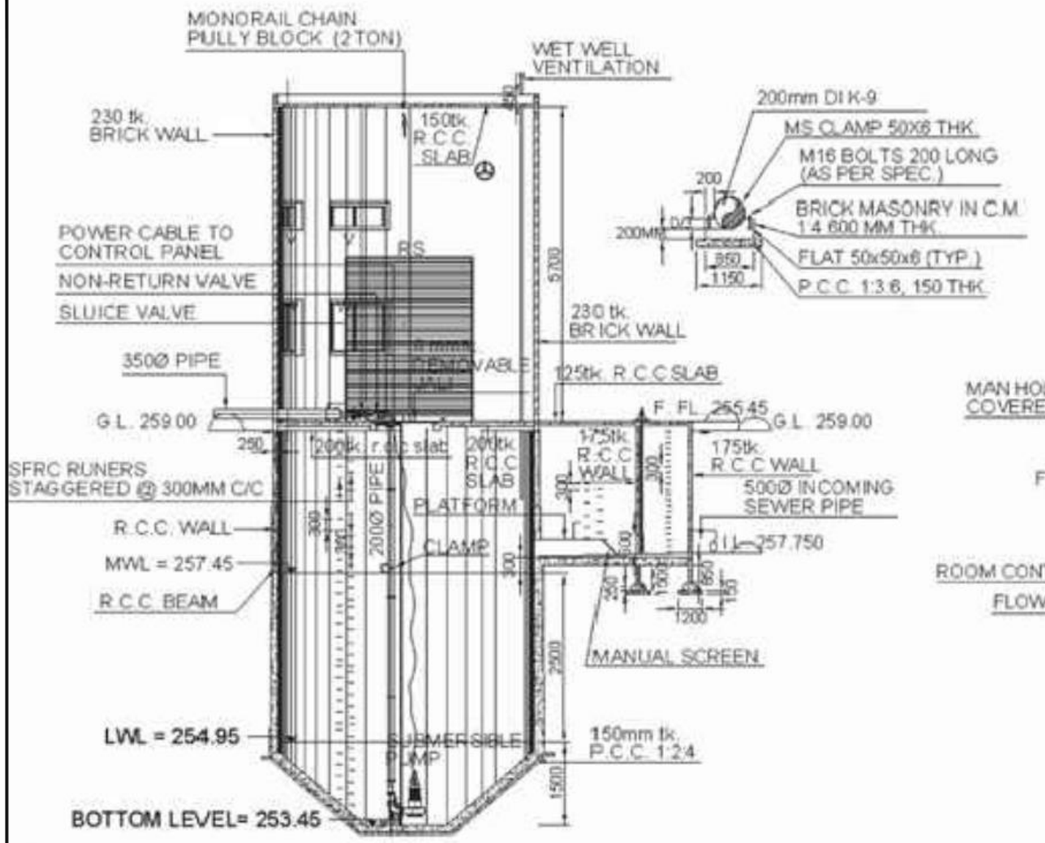
CIVIL	MEP

REVISIONS

NO.	DESCRIPTION	DATE	BY
R0.	TENDER DRAWING		

IURWTS INTEGRATED URBAN REGENARATION & WATER TRANSPORT SYSTEM

LOCATION:
SCALE-1:200
TITLE:
DATE
REV. R0
DRG. NO :
SHEET



NAME	SIZE	NOS.
RS	2400 X 3000	01
D	1200 X 2100	01
W	1500 X 1200	04
V	1500 X 600	04
	EXHAUST FAN	01

CIVIL WORK IS DESIGNED FOR YEAR 2041

PUMP IS DESIGNED FOR YEAR 2026. IN FUTURE IT IS BEING REPLACED BY HIGHER CAPICITY PUMP

CLIENT: KOCHI METRO RAIL LIMITED
4th Floor, JLN Stadium Metro Station, Baneji Road, Kaloor, Kochi, Kerala - 682017
Ph: 0484-2846700 , 2846770
Fax: 0484-2370510

GENERAL CONSULTANT: anteagroup
Antea Nederland B.V and Antea India(JV)
40/157, Nadhikkal Building, First Floor, Palarivattam, Kochi - 682025, Kerala

PROJECT: GENERAL COUNSULTANCY SERVICES INTEGRATED URBAN REGENERATION AND WATER TRANSPORT SYSTEM, KOCHI

anteagroup
Antea Nederland B.V and Antea India(JV)

	NAME	SIGN	DATE
DRAWN			
DESIGNED			
CHECKED			
APPROVED			

KEY PLAN:

NO OBJECTION BY KMRL

CIVIL		MEP	

REVISIONS

NO.	DESCRIPTION	DATE	BY
R0	TENDER DRAWING		

IURWTS INTEGRATED URBAN REGENARATION & WATER TRANSPORT SYSTEM

DETAIL PROJECT REPORT — SCALE

TITLE: DRAWING OF LIFT STATION — DATE

REV. R0

DRG. NO : — SHEET

About Antea Group

From city to countryside, from air to water: Antea Group's engineers and consultants have been contributing to our living environment in the Netherlands for years now. We design bridges and roadways, and create residential neighborhoods and water structures. But we are also involved in areas such as the environment, safety, asset management and energy. Under the name Oranjewoud, we expanded into an all-round, independent partner for companies and government bodies. As the Antea Group, we also apply this knowledge at a global level. By combining valuable knowledge, including on technical matters, with a pragmatic approach, we make solutions attainable and workable. Goal-oriented, with an eye for sustainability. In this way, we anticipate today's questions and tomorrow's answers. Just as we have been for over 60 years now.

Contact information
29, Monitorweg
1322 BK ALMERE
P.O. Box 10044
1301 AA ALMEREThe Netherlands

www.anteagroup.nl

Detailed Project Report-

Rehabilitation & Resettlement component

Integrated Urban Regeneration & Water Transport System, Kochi, India

project number WT/2024

revision # 2

June 08, 2020

Appendix Volume I

Antea Group

Antea Nederland. Antea India

Understanding today.
Improving tomorrow.

DETAILED PROJECT REPORT

REHABILITATION & RESETTLEMENT COMPONENT

General Consultancy for

Integrated Urban Regeneration & Water Transport System (IURWTS), Kochi, Kerala, India

project number: WT/2024

revision: #2

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Authors

Antea Group Team

Client

Kochi Metro Rail Limited

daterelease	description	approval	release
29 May 2020	revision #02	K.K. Gupta	W. Kloezen

Acronyms

BOQ	Bill of Quantities
CRZ	Coastal Regulation Zone
CSML	Cochin Smart Mission Ltd
DoTP	Department of Town planning
DPR	Detailed project Report
EIA	Environmental impact Assessment
ESMP	Environment and Social Management Plan
GC	General Consultant
GCC	General Conditions of Contract
GCDA	Greater Cochin Development Authority
IURWTS	Integrated Urban Regeneration and Water Transport System
IWT	Inland Water Transport
JV	Joint Venture
KIIFB	Kerala Infrastructure Investment Fund Board
KLUB	Kerala Land Use Board
KMRL	Kochi Metro Rail Ltd.
KSEB	Kerala state Electricity Board
KSINC	Kerala Shipping and Inland Navigation Corporation
KSPC	Kerala State Pollution Control Board
KWA	Kerala Water Authority
NATPAC	National Transportation Planning and Research Centre
OPEX	Operating Expenditure
R & R	Rehabilitation & Resettlement
SCADA	Supervisory Control and data Acquisition
SCC	Special Conditions of Contract
SEIAA	State Environment Impact Assessment Authority
SOR	Schedule of rates
STP	Sewage treatment plant

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CHAPTER - 1

SALIENT FEATURES/EXECUTIVE SUMMARY

1 SALIENT FEATURES/EXECUTIVE SUMMARY

1.1 Salient Features

Sl.No.	Title of the Project	Integrated Urban Regeneration & Water Transport System, Kochi, India
1.	Department	Kochi Metro Rail Limited
2.	District	Ernakulam
3.	Taluk	Kanayannur
4.	Legislative Assembly Constituency	Ernakulam
5.	Implementing Agency/SPV	Bhavanam Foundation Kerala/Kochi Metro Rail Limited
6.	DPR prepared by	Antea Group, Nederland
7.	R&R Component Outlay	Rs.81.26 crores
8.	Budget provision from KIIFB	Rs 566.52 Crores (Only Land Acquisition and Building Compensation cost)
9.	Budget speech reference	GO (Rt) No. 2010/2019/RD dated 23rd July 2019
10.	Administrative sanction	Separate AS to be finalized
11.	Nature of the Project (New/Renovation/Upgradation	New residential buildings on a new site.
12.	Present status	7.73 acres of land at Re-survey no 528/8 (part), 528/11, 528/12, 499/1 of Kakkanad village, Kanayannur Taluk, Ernakulam District identified by Government of Kerala for R&R settlement of P&T, Udaya and Kudumbi colonies, in which 1.73 acres of land at Re-survey no 499/1 is paddy land.
13.	Need for the project	Along certain stretches of the canals, the

Sl.No.	Title of the Project	Integrated Urban Regeneration & Water Transport System, Kochi, India
		required width is unavailable due to people living on the floodplain banks, who are required to be resettled or compensated for freeing up land along the banks to obtain the required width.
14.	Details of investigation/surveys conducted	DPR has been prepared based on available topographic survey. Upon award of execution work detailed survey and geotechnical investigations will be carried out by contractor.
15.	Whether Land Acquisition involved?	yes
16.	If yes, furnish details	Cost of land: Rs 29.61crores
17.	Total estimated cost and item wise cost breakup and details of Schedule of rates.	Cost of 7 no. Stilt + 10 storeyed residential buildings including land cost is ₹ **786,606,422/** Site Development cost is ₹ **9,619,419/** Cost of E&M works is₹ **53,385,308/** Total cost of project development excluding land cost is₹ **787,556,556/** Total estimate (building cost including land cost): ₹ **1083,656,556/** Plinth Area Rates 2019 of the CPWD has been followed in determining the project cost.
18.	Details of revenue streams if any	Resettlement and rehabilitation will not generate any revenue stream.

Sl.No.	Title of the Project	Integrated Urban Regeneration & Water Transport System, Kochi, India
		The recovery of O&M cost is however possible by accruals to the RWA of these resettled families.
19.	Requirement/Demand analysis	The number of families that are required to be resettled, constitutes the demand of the project. It is 280.
20.	Details of Cost Benefit Analysis (CBR Value)	Detailed in Chapter:9 (ERR:2.57%)
21.	Details of project risks	Identified as ▪ adverse weather condition ▪ dispute with the re-settlers ▪ unforeseeable shortage of labour or materials ▪ strikes ▪ damage due to fire, flood, earthquake, and thunder.
22.	Details of project management organisation strategy	KMRL appointed vide G.O. (Ms) No 07/2018/CSIND dated 12 Nov. 2018, as the SPV of the IURWTS Project; of which the said R&R project is a **critical activity**. KMRL will register on the Direct Benefit Transfer (DBT) Portal of KIIFB. Hereafter, finalization of tender, contracts, and concession agreement, as required, will be initiated by the BFK, for implementation of the project. SPV will create the milestones for release of payment to the contractor in the Project Management Software provided by KIIFB. SPV shall enter a contract with BFK for achievement of the set milestones. SPV will

Sl.No.	Title of the Project	Integrated Urban Regeneration & Water Transport System, Kochi, India
		scrutinize the bills raised by the contractor. SPV shall furnish monthly progress report and half yearly project report to KIIFB through the online project management platform prescribed by KIIFB.
23.	Details of Contract Management strategy	Item rate contract or EPC contract, as deemed fit. BFK will be managing on ground and KMRL will be supervising the contract management. GC supports KMRL as per contract.
24.	Details of statutory Clearances & Environmental aspects & Sustainability	• Municipal building permit • Fire NOC • Clearance from SLEIA Authority (Category B project) • Tree cutting permission through Department of Forests All impacts will be mitigated through the EMP section of the construction contract. Construction phase impacts are to be mitigated while operational phase has positive impacts (10% of power demand to be replaced with solar power instead of 5% as per KMBR-2019). Water reuse. Zero harmful liquid effluent discharge. Accruals to RWA contributing majorly towards O&M costs of sub-project identified and internal revenue stream suggested (parking

Sl.No.	Title of the Project	Integrated Urban Regeneration & Water Transport System, Kochi, India
		charges).
25.	Details of Project Implementation Schedule (PIS) & work break down Schedule (WBS) proposed, Duration to complete the project	Preconstruction activities are scheduled over 122 days and construction start to finish period is 609 days. Considering the start date as 30.08.2020, the project is expected to be completed on 30.04.2022. WBS (Chapter 14) will be further synchronized during work award negotiations.
26.	Quality control Infrastructure and mechanism	Detailed work methodology of any work will be approved prior to commencement. Quality Assurance Team comprising of inspection & testing unit and site engineers headed by the Quality Manager will be deployed, to ensure adherence to the QM manuals of the CPWD/PWD, as deemed fit, as the QMS of the project.
27.	Operation and Maintenance (O&M) arrangement of the project after completion	O&M committee created under the RWA, will steer the O&M-staff by developing routine systems for maintenance and upkeep of all building services, including lifts, for which, collection of monthly rent from vehicle parking spaces provided by design under KMBR-2019; which will provide the majority of the O&M funds, will be astutely followed by the said O&M committee.

Sl.No.	Title of the Project	Integrated Urban Regeneration & Water Transport System, Kochi, India
28.	Details of attached drawings	Annexure 1
29.	Other attachments	n/a

1.2 Executive Summary

Kochi City, which also represents a major port of India, underwent the degeneration phases; due to intense urbanization and industrialization; resulting in total neglect and widespread abuse of its inland canals over the years.

Recently, there is a renewed interest and will, both political and administrate, in moving to the regeneration phase.

Kochi corporation and surrounding municipalities are struggling to balance the demands of the growing population with commensurate sanitation facilities, that has led to the dilapidation of the canal system.

Issues such as “unchecked” development, “encroachment by slum dwellers”, congestion on roads, pollution of air and water and tremendous gaps in city services are rampant, straining the limited capacity and resources of the local government.

The canals that were navigable in the past, are not so anymore.

Since degradation of the canals have rendered them non-navigable, that their rejuvenation should return navigability in them has been a logical conclusion.

It is in this context, that preparation of a preliminary DPR was thought of, by Kerala State Inland Navigation Corporation, (KSINC), towards an *“Integrated Urban Regeneration and*

Inland Water Transport System" (IURWTS) for Kochi; along its 5 major canals (passing through Kochi City, within the municipal corporation area of Cochin), as listed below:

- Thevara
- Thevara Perandoor
- Chilavanoor
- Edappally and
- Market canal, and their catchments.

Task was assigned to NATPAC. The DPR was prepared and submitted in July 2018, by NATPAC identifying methods of reviving navigability in them along with requirements for rejuvenation of the urban area in and around these 5 canals. The urban area referred, is the "core-area" of the City of Cochin. The cost of the interventions required, was estimated at Rs 1418.62 crores which includes canal development, regeneration, and fleet charges.

The actions envisaged are, the cleaning of the canals (by preventing sewage inflows and sloid waste dumping on one hand and by desilting on the other), widening of the canals to a minimum navigable width in those stretches where navigation would be possible, making passenger jetties for commuter use, developing vacant lands along the canals into public spaces and increase the overall area under public recreational areas in Kochi City. Additionally, few public property development projects which would boost tourism and be capable of revenue generation in the long run, are also envisaged.

The said DPR, identified the inevitable relocation of three slums along two of the canals, namely, Thevara-Perandoor and Chilavanoor canal.

It provisioned Rs.81.26 Cr. against this component; including the cost of the land, for resettlement. The three slums identified are:

1. P&T Colony in Ward No. 61 (of the municipal corporation)
2. Udaya Nagar in Ward No. 61, and
3. Old Kudumbi colony in Ward No. 52

To move forward, the Government of Kerala (GoK) ordered selecting KMRL as the SPV to validate the preliminary DPR, and for undertaking the tender process and execution works along with, as a project.

The General Consultant (GC) selected for the planning, detailing, execution, and supervision based on global tender invited by KMRL, is Antea Group, Nederland having exposure to similar urban regeneration and canal front development works for International projects.

One of the prime tasks of the GC at the onset of the IURWTS Project of the KMRL was to prepare the resettlement spatial plan on a part of a site already identified. The slum dwellers must be urgently resettled to a new location for the main project to take off, is the requirement in nutshell.

This DPR is prepared in compliance of the same.

- It deals with the resettlement housing to be provided to the slum dwellers of the three colonies.
- It provides for the requirement of 280 independent dwelling units to be used for resettling and rehabilitating the affected families with a total population of 559 members.
- It can accommodate up to 1400 persons in terms of total population.

The land identified for Rehabilitation & Resettlement is located at Kakkanad, Thrikkakkara municipality, Kochi. The is suitable for the development of residential units. The area of the said land is 7.73 acres.

The land requirement under the IURWTS Project for resettlement and rehabilitation is only 1.62 acres. Remaining area will be utilized for resettling project affected people (PAP) from other areas of Kochi, under the Life Mission, Kerala. A common ring road has been provided, which consume about 1.27 acres of the land serving both the IURWTS and the Life Mission components.

Based on the requirement/demand of 280 DU, 7 building blocks with stilt+10 floors configuration have been considered, with each block having 40 units, and each unit built up area of 63.10sqm. (or 678.96sft) and corresponding carpet area of 56.603 sqm (or 609sft.). Each DU has been conceived as a 2 bedroom, 1 and ½ toilets, 1 living room, separate dining hall, kitchen with separate work-area and 2 balconies, as a high upgrade from the present accommodation under enjoyment by the population of the three colonies to be resettled under the IURWTS Project. Adequate provision of organized central open space has been included in the layout plan or site plan of the new colony in Kakkanad, as is the case regarding parking spaces, as per the KMBR revised in 2019.

The cost estimated for the 280 resettlement dwelling units (DU) in seven Stilt+10 storeyed buildings with 4 DU per floor and total 40 DU in each block configuration, has been worked out as Rs.**87.32** crores (as compared to Rs. 81.25 crores outlay) including the land cost, site development works, special electrical and mechanical works, provision of rooftop solar power plants, solar water heating, LED lights, emergency generator for stretcher size lifts and the common areas, roads, parking, landscaping, water harvesting, sewage treatment plant, dual plumbing etc. complete.

The project is a net expenditure scheme. O&M is self-sustaining though, considering that parking spaces (77 numbers) will be perpetually charged on monthly basis, whether in open or covered (20 out of the 76) formats, which would accrue to the RWA of the new colony.

Areas freed in the Wards 61 and 52 should be reverted to the public domain. Land use change of such land parcels (in the heart/core of the city) to parks and open spaces is foreseen, which can fetch a small revenue to the IURWTS Project from the gate-fee collections envisaged at such public spaces. Development cost of the vacated land parcels into parks are however not under the scope of this DPR.

Statutory clearances required for the development of the residential buildings have been identified. Fire NOC and tree cutting permissions will be necessary. The KMBR-2019 provisions have been adhered.

The project once approved can be completed in an aggressive schedule of 24 months. The project will enhance socio-economic status of the relocated families. The project should be implemented early to bring about socio-economic benefits to a larger population living in the city core by opening up accessible land and bringing them under public use in the form of recreational spaces along the waterfront of the cleaned-up canals.

CHAPTER - 2

INTRODUCTION

2 INTRODUCTION

The IURWTS Project is conceived for the development of 5 major canals in cochin city. The development involves widening the canals to a sufficient width in order tackle the flooding in Cochin city and to make the canals navigable. There are stretches along the canals where the required width is unavailable or where the development is difficult due to people inhabiting on the banks of the canal. For the development to happen along these stretches the people need to be resettled or compensated. The five canals are:

1. Thevara canal (Length: 1.41 km)
2. Thevara Perandoor canal (Length: 9.88 km)
3. Chilavanoor canal (Length: 11.15 km)
4. Edappally canal (Length: 11.23 km), and
5. Market canal (Length: 0.66 km)

This DPR is specific to the R&R component of the IURWTS Project. It reviews the cost estimates prepared earlier in 2018. It contains the concept designs developed based on the demand analysis and all the functional aspects with reference to the recent revisions in the municipal building rules. It contains suggestions of collecting charges from the parking spaces for covering a major part of the O&M costs of the project post execution and during occupancy by the families resettled in the new housing colony/estate. A cost benefit analysis is included. It also brings out the strategies for project management and contract management, environmental and sustainability aspects, risks assessment and mitigative measures, along with the quality management plan, operations and maintenance plan, the roles and responsibilities of the various stakeholders during and after the construction period, and the implementation schedule of 24 months.

The three colonies identified along the banks of 2 canals, as stated in **Table-1** below, are required to be resettled on a part of the site identified in Kakkanad in order to free up land on the canal bank for the required widening of the canal/waterway.

Table 1: Details of the 3 settlements: DPR

Sl. No.	Colony name	Canal	No. of families	Chainage	Location
1	P and T colony	Thevara Perandoor	152	6600	Near IOCL (left bank)
2	Udaya colony	-do-	81	6100	Near KSINC (left bank)
3	Old Kudumbi colony	Chilavanoor	47	8600	Subhash Chandra Bose road (right bank)
		Total	**280**	3	4

Brief description of the colonies is given below.

2.1.1 P and T colony

1. **Location:** On left bank of Thevara Perandoor canal, opposite IOCL. (**Fig1**) (Near warehouse, Market Road, Kadavanthara).
2. **Inhabitant profile:** Daily wage earners (auto rickshaw drivers, housemaids and head load workers).
3. **Special attention:** Many have occupants of this area for more than 25 years.
4. Number of buildings: 86

Figure 1: P and T colony

2.12 Udaya colony

1. **Location:** On left bank of Thevara Perandoor canal (**Fig2**) (Near KSINC).
2. **Special attention**:
    - Developed under GCDA about 40 years ago.
    - As per the original plan, the colony has three income-group based zones
    - Four housing layout formats are to be encountered.

Figure 2: Udaya colony

3. **Number of buildings**: 67

2.13 Old Kudumbi colony

1. **Location:** On right bank of Chilavanoor canal (**Fig3**).
    - Near Subhash Chandra Bose Road.
2. **Special attention**:
    - Boundary is not delineated
3. **No of buildings:** 28 buildings.

Figure 3: Old Kudumbi Colony

CHAPTER - 3

STATUS FEASIBILITY STUDIES

3 STATUS FEASIBILITY STUDIES

3.1 Investigation / Surveys conducted

The land identified for relocation of the people of the three slums is located in Kakkanad, Thrikkakkara municipality, Kochi. The plot measures 31282.2sqm i.e., 7.73 acres in area. The topographic survey was already undertaken by the implementing agency and the survey report and drawings were provided by SPV to GC. The IURWTS-R&R component is considered as a phase-I development in an area of1.62 acres and in the later phase(s) the project affected people from other areas in Kochi is proposed to be resettled in the balance area of the site, as informed by the implementing agency. Previously done topographic survey report is shown in figure (**Fig4**) below.

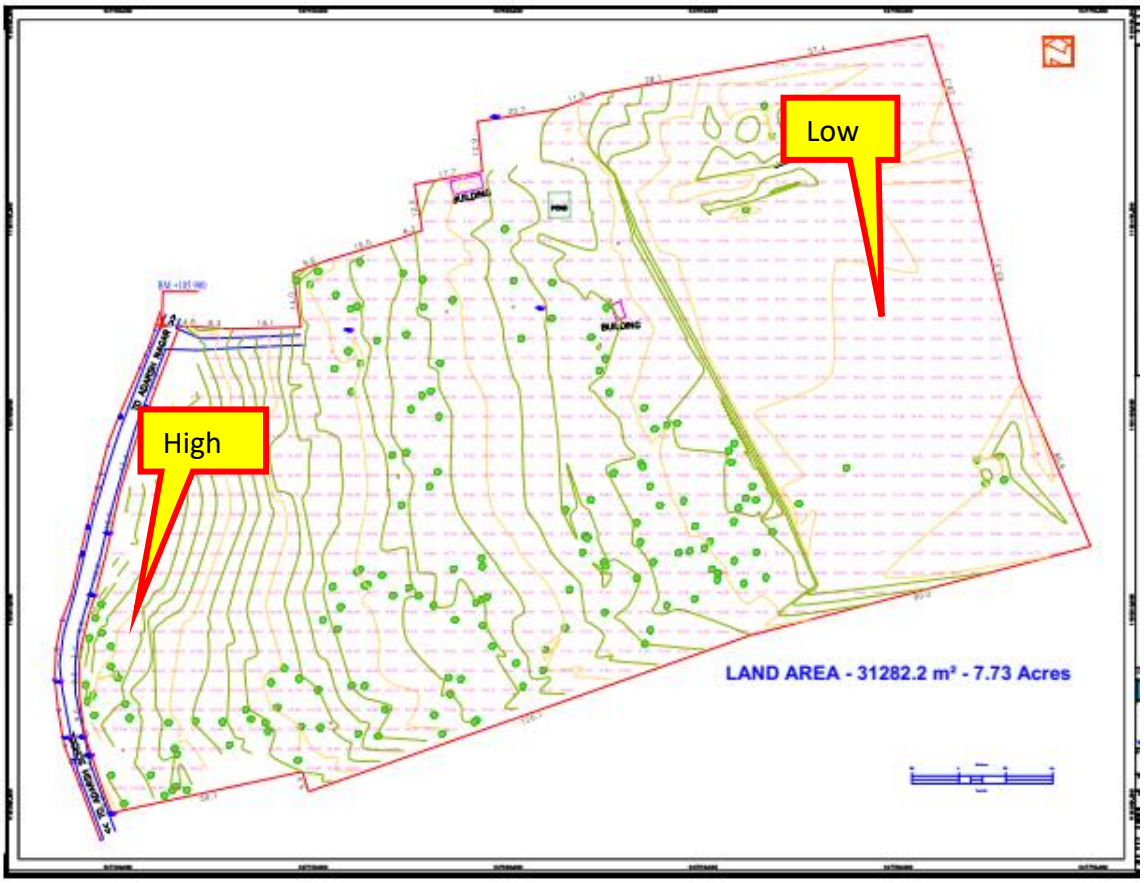


Figure 4: Topographic Survey Report

3.1.1 Description of site

- Area of site 7.73 acres.
- Elevation difference is about 14 to 15 m (between the approach road and the eastern end).
- Site is approached from west through the Adarsha Nagar Road.
- The site has good frontage length of about 130.0m.
- Site possesses good development potential.
- Red soil, considered good for construction, has been noted on the surface.
- The site has a large no. of trees.
- The Bhavan's Adarsh School is located close to the site
- The site is constituted of RS plot numbers 528/8 (Part), 528/11, 528/12 and 499/1. RS plot 499/1 measuring about 1.73 acres is under paddy land classification. Permission for construction (Annexure-3), is under consideration by the authority.
- Paddy land area is located on the eastern end (also the lower end) of the site.
- Site is approximately 6.0km from present location of the three colonies.

Existing site conditions is shown in the photos below.

Pic 1: General view of the site

Pic 2: Level and clear part within the site, looking west

Pic 3: Existing kutcha access way leading into the site, from its western boundary

Pic 4: A view from within the site, looking east

3.1.2 Resettlement proposal under Phase-1

The Re-settlement proposed site under phase -1 by the implementing agency is for an area of 1.62 acres as marked in the master plan drawings given as Annexure-1. The concept design for the resettlement proposal is based on the preliminary topography undertaken by the implementing agency. Before the detailed design drawings are prepared by the selected contractor the topographic survey will be undertaken at closer interval to extract the exact quantities ground levelling and foundation works.

3.2 Implementing agency

Bhavanam Foundation Kerala (BFK), KMRL and KIIFB, through the standard tripartite agreement will be creating the Special Purpose Vehicle (SPV) for project implementation. KMRL would be assigning the responsibility of implementing the IURWTS-R&R Project to BFK who would enter into contract with the contractor selected for executing the residential building construction project on the Kakkanad site for the R&R component of the IURWTS Project.

CHAPTER - 4

REQUIREMENT / DEMAND ANALYSIS

4 REQUIREMENT / DEMAND ANALYSIS

4.1 Background

The IURWTS Kochi project is being funded by Government of Kerala through Kerala Infrastructure Investment Fund Board (KIIFB). Projects are funded by the KIIFB through tripartite agreement between a public agency (in this case, BFK), a department under the Government of Kerala (in this case, KMRL), and the KIIFB.

Bhavanam Foundation Kerala (BFK) is a public sector, non-profit company registered under section 8 of the Companies Act, 2013 and fully owned by the Government of Kerala under the Department of Labour and Skills. The Honourable Minister for Labour, Skills and Excise is the Chairman of the company. BFK's objectives is to provide, promote, develop, and establish residential accommodation, education, healthcare, other associated infrastructure and services to laborers, workers, and low-waged employees in Kerala. The project will be implemented as per KIIFB guidelines.

BFK will be entrusted with the execution of the R&R component under the IURWTS Project of KMRL by entering into a contract with a competitively selected contractor, based on the assignment of the responsibility of implementing the project by KMRL on BFK, under the said tripartite agreement.

The requirement for R&R was identified earlier during the preparation of the DPR by NATPAC in 2017-18. That DPR had been got prepared by KSINC. Thereafter, the follow-up activities for implementation of the findings and recommendations of that DPR has been entrusted to KMRL. The KMRL selected a Netherlands based company named Antea Group through competitive bidding process to carry out the activities under the IURWTS Project, framed under a specific Terms of Reference (ToR).

The (GC) of the IURWTS Project, Antea Group Netherlands B.V. has prepared a conceptual designs of the R&R housing unit and a layout for 280 dwelling units as per the assessed requirement/demand of the project supporting the attainment the goal of the IURWTS Project along with working out the cost estimates of the whole project based on the Plinth Area Rates (PAR)-2019 published by the Central Public Works Department (CPWD), Government of India (GoI). Such role of the GC is established vide the said ToR of the IURWTS Project. This DPR is prepared in compliance of the same, with an estimated project cost of **Rs. 87.32 crores** including the cost of1.62 acres of land out of total 7.72 acres, which is required for the R&R housing under the IURWTS Project.

4.2 Requirement

As a part of the urban regeneration programme for Kochi city a detailed Project report for Integrated Urban **Regeneration** and Water Transport System (IURWTS) in Kochi was prepared in July 2018. One of the envisaged goals of the project conceived is the rehabilitation and resettlement of the slum dwellers along 2canals in the Project area as explained in chapter:2 of this report.

A site was identified in Kakkanad in 2018, by a government agency, for accommodating the PAP of the IURWTS Project as well as other affected people in an around Kochi. Under the IURWTS Kochi project three colonies requiring relocation were identified. As an incentivization measure towards acceptance by the PAP to shift to the new location, two bedroom DU were envisaged to be given to all relocatees. It was also envisaged that the R&R component of the IURWTS would be one of the foremost activities that required to be accomplished, to allow the whole conceived project to achieve momentum.

The criteria used for fixing the sizes of each dwelling unit is given in the subdivisions below.

4.2.1 Dwelling unit (DU) size

4.2.1.1 DPR

The size of DU suggested earlier was 900sq. ft. Initial discussions indicated an approximate size of 600sft for two bedrooms configuration, as acceptable to most. The GC referred information from various sources as given below for a comparative analysis of the appropriate size for the R&R DU under the IURWTS contextual to the present times and general aspirations. The important referrals are described in the sections below.

4.2.1.2 Minimum sizes

Dimensions of the designed spaces had to be comfortable, yet the minimal required. The size of the bedroom and its shape (l x b) required to accommodate a standard double bed. Dimensions of mattress of reputed manufacturers were referred for deriving the bedroom dimensions.

4.2.1.3 Standard double bed size

The bed size considered is 1685mm x 1900mm (5'-06" x 6'-03", approximately).

4.2.1.4 Minimum width of habitable room

Single occupant hostel rooms can be less than 2.4m (wall-face to wall-face). The dimension can be up to 2.1m, but no less, to accommodate the full length of a single bed.

4.2.2 Provided sizes

4.2.2.1 HFA: PMAY

The smallest size considered under the GoI scheme, for a dwelling unit is 32.0sqm. The configuration considered is • 1 bedroom • 1 multipurpose hall • 1 toilet and •1 kitchen. Balcony is optional, but generally in a multi-storeyed building, balconies are being provided.

4.2.2.2 Life Mission, Kerala

Samples of few dwelling unit designs on individual plots, as available in the website of Bhavanam Foundation Kerala, the agency running the mission have been referred. The configuration is • 2 bedrooms • 1 living – dining room • 1 toilet and • kitchen. Typology, being single-storied buildings on individual plots, has allowed a second entrance, generally through the kitchen. The unit areas vary from 399sft to 404sft (37.0sqm to 38.0sqm).

To accommodate a double bed, the Bhavanam Foundation Kerala (BFK) proto-type designs do not have a bedroom width less than 2.4m.

When a standard double bed length is considered as 6 feet, 2.4m or 8 feet is the considered minimum, in the said prototypes.

4.3 Demand Analysis

Currently, based on the demand for resettlement of the slum dwellers of the 3 colonies,280 rehabilitation units is being planned at the proposed site on an area of1.62 acres only. The master plan of the site with the buildings are given in Annexure 1 at the end of the report. The buildings proposed is in 7 blocks of G+10 with 40 units totalling to 280 units. The DPR for R&R is an outcome of the requirement/demand for the resettling the slum dwellers

CHAPTER - 5

FUNCTIONAL DESIGN

5 FUNCTIONAL DESIGN

It is proposed to construct seven multi-storeyed high-rise residential buildings over an area of 1.62 acres. The multi-storeyed residential complex will resettle of slum dwellers from three slum areas in the IURWTS-KOCHI project command. The complex comprises of 7 blocks with G+10 floors with 4 dwelling units per floor totalling to 280 units. Each unit has a total built up area of 63.1 sqm. The design and layout have been prepared satisfying all the proviso of the rules of the KMBR-2019, including provision of manual firefighting system with dedicated 25000L overhead tank and required parking spaces including visitor parking and two-wheeler parking etc.

5.1 Facilities provided as contemplated in KMBR-2019

Above the minimum requirements the following facilities are also provided in/against/for each block

5.1.1 Parking (requirements)

Parking has been provided as per rule 29 under the KMBR 2019 for Group-A1 building. All the DU are of the size smaller than 75sqm, requiring one car parking space for every three DU. Required number of parking spaces is 93. Additional parking for visitors has been provided. Parking for two wheelers has been additionally provided. Provision has been given for 20 covered car parks in the stilt. Revenue from car parking is envisaged for supporting a part of the O&M expenditure.

5.1.2 Approval of layout

The competent authority for approval is District Town Planner[1].

[1] Rule 30, Table 11, KMBR-2019.

5.1.3 Access

- 5m clear motorable width facilitating fire-fighting vehicles is provided at two adjacent sides of a building, of which one is contiguous to the access street[2].
- To facilitate entrance of fire-fighting vehicles, the width of entrance provided is 5.0m[3] wide as per requirement of KMBR.

5.1.4 Distance between buildings

As the project proposed is a group of building comprising of 7 blocks the provision in KMBR to provide a minimum distance between the various blocks of 5.0m[4] has been adhered.

5.1.5 Solar assisted heating and lighting

Provision for rooftop solar energy installation, to generate 5% of the connected load5as contemplated in KMBR has been provided as the proposed units come under the category of Group A1 buildings or apartment houses or residential flats, exceeding 500sqm of total built up area and comes under the purview of the Chapter XV of the building byelaws[6]

The provision includes hot water supply which will be solar heater assisted for all new buildings with total built up area exceeding 500sqm. Minimum 25 litres capacity per

[2] Rule 81(6)(i), KMBR-2019.

[3] Rule 81(6)(iii), KMBR-2019.

[4] Rule 81(6)(ii), KMBR-2019.

[5] Rule 2(1)(v), KMBR-2019: maximum amount of wattage allocated to all applicants/owners of a building.

[6] Rule 77, KMBR-2019.

day[7]for each bathroom and kitchen, or to each DU is to be provided, subject to the condition that maximum 50% of the roof area is provided with the solar system. Continuous supply of water to the solar heater system as well as from it to the hot water distribution system to supply hot water to various points of use through insulated pipelines, is provided.

5.1.6 Rainwater harvesting

Workable ground water recharging arrangements have been provided as integral part, as per the KMBR-20198, of the R&R buildings, through collection of roof top rainwater. At the lower reaches of the site, on the eastern end, the existing water body will also be used to as the recharge pond using the collected roof top rainwater. Recharge will also be done using the principles enshrined by the CPWD publication on harvesting rainwater named “Rain Water Harvesting and Conservation Manual,” using modular RWH, soak way, recharge pit with bore, lateral shaft with borewells etc. as suited to the ground water level, of the site.

5.1.7 Water re-use and recycling

Provisions has been given in the buildings with in-situ liquid waste management treatment plants with provision for recycling and reuse of the use water[9]. Wastewater collection system are double stack system. Water supply system are dual pipe system separating the KWA supply from the recycled water. Overhead storage tanks are with dual arrangements. Ground tanks are also be dual. Package STP plant are provided catering for the recycled water quality requirements. Each building block are conceived with two sets of tanks for ease of maintenance and cleaning operations.

[7] Rule 78(2) & (3), KMBR-2019.

[8] Rule 76(1)(i) &(ii), KMBR-2019.

[9] Rule 79(6), KMBR-2019.

5.1.8 Fire escape staircase

The requirements of fire escape staircase, as per the KMBR-201910 have been conceived in the proposal with connection to public access and/or common areas on all floors and leads directly to exterior open space at the ground, with at least one side abutting external wall. This side being has been provided with openable glass or break open glass or fully open and has landing areas accessible from external side to facilitate rescue operations during emergency. The other provisions include

- Minimum width of fire escape should not be less than 1.0m.
- Tread should not be more than 250mm.
- Riser should not exceed 190mm and number of risers should not exceed 16 per flight of stairs.
- Height of handrail should not be less than 1.0m and not more than 1.2m.
- Balustrades spacing should not be more than 150mm.
- Entrance to fire escape staircase shall be separated and as far as possible remote from other staircases.
- 1.2m width has been provided for the fire staircase in this DPR. Riser height provided is 187.5mm. 250mm tread has been provided. Handrails of 1.0m height will be provided. Balustrade spacing will be maintained at 150mm or will be lessened to 120mm.

5.1.9 Occupant load

- Occupant load[11] criteria as per KMBR has been adhered to determine the pax handling capacity of a lift or a lifts bank installed in relation to the number of floors in the building and the occupants per floor.

[10] Rule 35(2), KMBR-2019.

[11] KMBR-2019 & NBC-2016

- Exit widths of staircases and doors considered for emergency situations have been determined from the number of persons on a floor, which the occupant load criterion determines.

5.1.10Desirable Services provided

1. Two ground water storage tanks for KWA water and reused water
2. Three overhead water supply tanks including one 25000 litre fire storage tank
3. Roof top solar PV generator catering to 10 percent of total demand
4. Roof top Solar water heater supplying 25 litres hot water to each dwelling unit.
5. Dry type 11/0.415 KVA dedicated transformer
6. CC TV surveillance
7. Common STPs for all the 7 blocks one for black and one for grey effluent
8. Roof top rainwater harvesting for ground recharge through nearby paddy land water body
9. Automated street lighting system
10. Manual fire-fighting system.
11. Community hall
12. Enough covered car parks are also provided.
13. DG supply for lift
14. Consolidated centralised open space
15. Fire tank of 25000L capacity provided on terrace floor

CHAPTER - 6

CONCEPT DESIGN

6 CONCEPT DESIGN

The basic concept space design with conceptual structural framing has been undertaken for estimating the costs involved in the project. The PAR 2019 of the CPWD has been used for working out the cost. The concept plan and drawings are as given in chapter as **Annexure:1.**

In the detailed design it will be ensured to embody all the special amenities and facilities given under the Chapter:5 functional design, in the construction and development programme of this R&R sub project.

CHAPTER - 7

FINANCIAL ESTIMATES & COST PROJECTIONS

7 FINANCIAL ESTIMATES & COST PROJECTIONS

7.1 Cost estimates

The project cost estimates have been prepared considering various construction and infrastructural works. The estimates for quantities (based on the concept designs and estimation of materials) for the civil works are worked out based on CPWD Rates.

7.2 Estimation of Quantities and Components

The quantities of major items of work have been estimated based on the concept Architectural designs, Structural designs, Electrical, Fire and Safety design requirements. The abstract of the cost estimate is as given below in **Tables 2, 3, 4&5**.

Table 2: Summary of Cost Estimate

Abstract cost estimates of development of residential colony (in Kakkanad, Kochi) with 7 blocks of stilt + 10 storeyed buildings under the IURWTS Project		
Summary		
Sl. No.	**Description/Item**	**Amount (Rs.)**
1	Block-1	₹ 103,507,404
2	Block-2	₹ 103,507,404
3	Block-3	₹ 103,507,404
4	Block-4	₹ 103,507,404
5	Block-5	₹ 103,507,404
6	Block-6	₹ 103,507,404
7	Block-7	₹ 103,507,404
8	Development of site	₹ 9,619,419
9	Specialised E&M Works	₹ 53,385,308
	Sub-total A	**₹ 787,556,556**
10	Land cost (7.73 acres)	**₹ 296,100,000**
	Grand total	**₹ 1,083,656,556**

Table 3: Estimate for a Typical Block

Cost estimates of development of residential colony (in Kakkanad, Kochi) under the IURWTS Project							
Estimate of one block (out of total 7 blocks)							
	CPWD PAR 2019						
Sl. No.	Annexure	Sl. No.	Description/Item	Unit	Quantity	Rate (INR)	Amount (INR)
		1.0	**BUILDING COST**				
1	I	1.1	RCC framed structure (up to 6 storeys)	sqm	2116.571	₹ 19,500.00	₹ 41,273,134.50
		1.1.1	Floor height 3.60m				
		1.1.2	Floor height 2.90m				
			SUB-TOTAL-A				**₹ 41,273,134.50**
		1.3	**EXTRA FOR**				
2	I	1.3.1	Every additional storey over six storeys up to twelve storeys (For RCC Framed Structure only)(till 10th floor)	sqm	330.421	₹ 20,080.00	₹ 6,634,853.68
	I	1.3.1		sqm	330.421	₹ 20,660.00	₹ 6,826,497.86
	I	1.3.1		sqm	330.421	₹ 21,240.00	₹ 7,018,142.04
	I	1.3.1		sqm	330.421	₹ 21,820.00	₹ 7,209,786.22
3	I	1.3.3	Every 0.30m higher plinth over normal plinth height of 0.45m (on G.F. area only)	sqm	134.045	₹ 335.00	₹ 44,905.08
4	I	1.3.5	Making stronger foundations to take load of one additional floor at a later date (on area of additional one floor only)	sqm	330.421	₹ 1,470.00	₹ 485,718.87
5	I	1.3.6	Resisting earthquake forces (for RCC famed structures only)	sqm	3638.858	₹ 1,200.00	₹ 4,366,629.60
6	I	1.3.7	R.C.C. Pile foundation	sqm	334.648	₹ 16,600.00	₹ 5,555,156.80
		1.4	**BASEMENT FLOOR**				
		1.4.1	Floor ht. up to 3.35 m. with Kota Stones/HDPE membrane i/c	sqm	88.694	₹ 30,000.00	₹ 2,660,820.00

Cost estimates of development of residential colony (in Kakkanad, Kochi) under the IURWTS Project							
Estimate of one block (out of total 7 blocks)							
	CPWD PAR 2019						
			integral crystalline water proofing.				
	I	1.6	**FIRE ALARM SYSTEM**				
7	I	1.6.1	Manual fire alarm system	sqm	3683.205	₹ 250.00	₹ 920,801.25
			STILT PORTION				
8	I	1.8.1	Stilt portion of multistorey RCC framed structure (up to ht. of 3.60m). Applicable area only.	sqm	200.603	₹ 8,000.00	₹ 1,604,824.00
			SUB-TOTAL-B				**₹ 43,328,135.40**
		2.0	**SERVICES**				
9	I	2.1	Internal water supply and sanitary installations			9%	₹ 3,714,582.11
10	I	2.2	External service connections				
11	I	2.2.1	Electrical external service connections			3.75%	₹ 1,547,742.54
12	I	2.2.2	Civil external service connections			1.25%	₹ 515,914.18
13	I	2.3	Internal electrical installations			12.5%	₹ 5,159,141.81
			EXTRA FOR				
14	I	2.6.1	Power wiring and plugs			4%	₹ 1,650,925.38
15	I	2.6.3	Lightning conductors			0.25%	₹ 103,182.84
16	I	2.6.4	Telephone conduits			0.25%	₹ 103,182.84
17	I	2.6.5	Centralized intercom system			1%	₹ 412,731.35
18	I	2.6.6	Third party quality assurance			1%	₹ 412,731.35
			SUB-TOTAL-C				**₹ 13,620,134.39**
19	I	3.0	**LIFTS**				
20	I	3.1.1	Passenger lift (ACVVVF, 16 Pax)	1	NA	2600000	₹ 3,260,000.00
			SUB-TOTAL-D				**₹ 3,260,000.00**
		4.0	**WATER TANK (RCC ONLY)**				
21		4.5	Overhead tank with staging height between 30.0m and 40.0m	L	38500	₹40/litre	₹ 1,540,000.00
22		4.6	Underground sump	L	27000	₹18/litre	₹ 486,000.00
			SUB-TOTAL-E				**₹ 2,026,000.00**

Cost estimates of development of residential colony (in Kakkanad, Kochi) under the IURWTS Project							
Estimate of one block (out of total 7 blocks)							
	CPWD PAR 2019						
			TOTAL				₹ 103,507,404.28

Table 4: Estimate for Site development for 7 blocks

Cost estimates of development of Stilt+10 storey residential complex (in Kakkanad, Kochi) under the IURWTS Project							
Estimate of Site Development							
	CPWD PAR 2019						
Sl. No.	Annexure	Sl. No.	Description/Item	Unit	Quantity	Rate (INR)	Amount (INR)
			DEVELOPMENT OF SITE				
1	I	5.1	Levelling (area of plot)	sqm	6554.30	₹ 160.00	₹ 1,048,688.00
2	I	5.2	**Internal roads & paths**				
3	I	5.2.3	CC pavement with vacuum dewatered concrete	sqm	2009.87	₹ 85.00	₹ 170,839.10
4	I	5.2.4	Footpath with kerb stone	sqm	2449.09	₹ 85.00	₹ 208,172.44
5	I	5.3	Sewer	sqm	4242.35	₹ 165.00	₹ 699,987.85
6	I	5.4.	Filter water supply				
7	I	5.4.1	Distribution lines 100mm dia and below	sqm	4242.35	₹ 100.00	₹ 424,235.06
8	I	5.4.2	Peripheral grid 150mm to 300mm dia pipes	sqm	4242.35	₹ 100.00	₹ 424,235.06
9	I	5.4.3	Unfiltered water supply distribution lines (area of plot)	sqm	4242.35	₹ 65.00	₹ 275,752.79
10	I	5.5	Storm water drains (area of plot)	sqm	4242.35	₹ 130.00	₹ 551,505.58
11	I	5.6	Rainwater harvesting (RWH)	sqm	2312.95	₹ 90.00	₹ 208,165.23
12	I	5.7	Trenches for services	m	850.00	₹ 585.00	₹ 497,250.00
13	I	5.8.1	Boundary wall with 1.50m normal height from G.L. & 0.60m high MS grill, and required no. of steel gates/wicket gates etc.	m	450.00	₹ 9,000.00	₹ 4,050,000.00

14	I	5.9.1	Horticulture operations including 30cm earth filling, grassing, tree plantation/shrubs and potted plants etc.	sqm	4242.35	₹ 250.00	₹ 1,060,587.65
			SUB-TOTAL-F				**₹ 9,619,418.75**

Table 5: Plinth area rates for the specialized E&M services for IURWTS R&R housing

Cost estimates of development of residential colony (in Kakkanad, Kochi) under the IURWTS Project							
Plinth area rates for the common specialized E&M services for IURWTS R&R Housing							
	CPWD PAR 2019						
Sl. No.	**Annexure**	**Sl. No.**	**Description/Item**	**Unit**	**Rate**	**Quantity**	**Amount**
1	V	1	Supplying, installation, testing and commissioning of 33kV/0.433kV or 11kV/0.433 kV, substation equipment comprising HT panel, Dry type transformers, Bus trunking from transformer to LT panel, Automatic Power factor control (APFC), Active Harmonic Filters, TVSS (Transient Voltage suppression system, SPD (Surge protection system/device), Essential panel, Earthing, required inter-connections, sub-station safety equipment including LT cabling from substation to the buildings fed by the sub station	KVA	₹ 9,000.00	2800	₹ 25,200,000.00
2			**DIESEL GENERATOR SET**				

Cost estimates of development of residential colony (in Kakkanad, Kochi) under the IURWTS Project							
Plinth area rates for the common specialized E&M services for IURWTS R&R Housing							
	CPWD PAR 2019						
Sl. No.	Annexure	Sl. No.	Description/Item	Unit	Rate	Quantity	Amount
	V	2	Supplying Installation testing and commissioning of Silent type DG Sets, AMF Panel, Bus Ducting/Cables from DG Sets to Essential panel, Synchronizing panel where required, DG Set enclosure room sound insulation/ventilation/smoke exhaust as required, Earthing of DG set system, control cabling, Fuel tank/piping, DG set Exhaust piping/Exhaust Chimney as per CPCB norms, Civil works connected with DG Sets including foundation as required.	per KVA	₹ 11,000.00	140	₹ 1,540,000.00
3			**SOLAR PHOTO VOLTAIC POWER GENERATION SYSTEM**				
	V	8	Supplying Installation testing and commissioning of GRID interactive roof top solar photo voltaic power generation system i/c space frame but without battery.	per KWp	₹ 65,000.00	280	₹ 18,200,000.00
4			**SOLAR WATER HEATING SYSTEM**				
	V	9	Supplying, Installation testing and commissioning of solar water heating system with heat exchanger type including electrical heater backup, make up water tank but without piping				

Cost estimates of development of residential colony (in Kakkanad, Kochi) under the IURWTS Project							
Plinth area rates for the common specialized E&M services for IURWTS R&R Housing							
	CPWD PAR 2019						
Sl. No.	Annexure	Sl. No.	Description/Item	Unit	Rate	Quantity	Amount
4.1			100 liter per day	100 litres per day	₹ 22,500.00	70	₹ 1,575,000.00
5	V	15	**BASIC HOME SECURITY FOR RESIDENTIAL COLONY** Supplying and installation testing and commissioning of basic security system in the residential colony to include control room at the gate and intercom connection to each dwelling unit, and basic CCTV system to be installed at the entry and exit points, Parking areas , entry point of each dwelling unit and other common areas as required. To include CCTV control room, required UG cabling, recording system and monitor/ monitors in the control room				
5.1	V	15.2	CCTV System	per Sqm. of residential Area	₹ 300.00	4242.35	₹ 1,272,705.18
6			**STREET LIGHTING WITH LED**				

Cost estimates of development of residential colony (in Kakkanad, Kochi) under the IURWTS Project							
Plinth area rates for the common specialized E&M services for IURWTS R&R Housing							
	CPWD PAR 2019						
Sl. No.	**Annexure**	**Sl. No.**	**Description/Item**	**Unit**	**Rate**	**Quantity**	**Amount**
6.1	V	20	Supplying and installation testing and commissioning of LED Street/ Compound/ High mast/ Pathway/ Landscape Lighting for the entire Campus	per sqm. (Plot Area)	₹ 150.00	4242.35	₹ 636,352.59
7		21	**STP**				
	V	21.3	Supplying, installation, testing and commissioning of STP of appropriate technology including Civil Works (except plant room), Tertiary Treatment etc., for the campus. Per day for plant size above 100000 LPD	per 1000 Ltr.	₹ 50,000.00	99.23	₹ 4,961,250.00
Total							**₹ 53,385,307.77**

Note: Centage/Project Management charges are not included in the estimate.

CHAPTER - 8

REVENUE STREAMS

8 REVENUE STREAMS

The project proposed is mainly for resettlement of slum dwellers of P&T colony, Udaya colony and Kudumbi colony and for the project affected people. This is mainly a socially committed project for the welfare of the slum dwellers. Resettlement schemes cannot generate revenues. These area net expenditure projects with high positive of socio-economic benefits,

By way of moving the slum dwellers to alternate location with better facilities it is proposed to develop the vacated canal bank as a public open space with parks and other amenities like cycle track, walkway, advertisement space and vendor space along the park etc. for general enjoyment of the public and tourists.

The task of sourcing the advertising space will be given to advertising business companies though bidding. The O&M committee constituted for the park will decide on the amount to be collected for all the activities. The revenue stream thus generated will be towards the IURWTS Project. This important component of revenue generation is outside the scope of this DPR. It will be addressed in the main DPR of the IURWTS Project, based on the decided use of the vacated land and assigning activities and function to the same.

Within the R&R component of the IURWTS Project, as an internal accrual of the sub-project, the analysed revenue generation possibilities are explained in Chapter 9.

CHAPTER - 9

COST BENEFIT ANALYSIS & INVESTMENT CRITERIA

9 COST BENEFIT ANALYSIS & INVESTMENT CRITERIA

Economic and Financial analysis for the Resettlement and Rehabilitation component is undertaken to assess the impact on the families that will be rehabilitated, the ensuing economic benefits to them and the benefits arising from the alternate use of the acquired land. The economic analysis is conducted to quantify the economic benefits and costs as a basis for assessing the Component's economic viability and sustainability in the long term. Project social benefits are excluded but are expected to be substantial.

9.1 Financial Analysis

9.1.1 Methodology

The financial analysis used current market price of the land, construction cost and economic benefits. The financial analysis is based on the survey of the number of families that will have to be relocated and resettled. The survey concluded that that 280 families will have to be rehabilitated into seven blocks of apartments to be constructed for the purpose. The land required for the construction has been acquired at Kakkanad measuring 7.73 acres.

The cost for the project consists of two main components:

- Land acquisition & Construction cost
- Operation and Maintenance cost

9.1.2 Construction Costs

Construction of development works are assumed to start in August 2020 and will be completed in 24 months. Total estimated cost excluding land acquisition amounts to **Rs 78.76crores**, including area development works, construction, overheads, and social development. The detailed cost estimate is given in **Chapter 07.**

9.1.3 Operation and Maintenance Costs

It is estimated that the operation and management (O&M) costs will be 0.005 % of the project cost every 5 years. The expected O&M cost is as shown in **Table 6** below:

Table 6: Increase in O & M Cost

Years	Percentage to Project Cost	Amount
1-5	0.005	25.52
6-10	0.01	25.77
11-15	0.015	76.55
15-20	0.02	102.06
20-30	0.025	127.58

9.1.4 Benefits and Future Situation (With Project)

Revenue and Profit from the Operations

It is expected that the completion of the Rehabilitation component will result in the following benefits:

- **Parking fee collection**

The new buildings will have a total of 90 parking slots, out of which 40 will be allocated for the residents and 50 (40 open parking and 10 covered parking) will be offered to the residents of the adjacent flats. Currently, the residents of the nearby apartments are facing severe parking bottlenecks. It is expected that the open parking slots can be charged at Rs.1,000/month (Yearly Rs.12,000) and Rs.2,000/month for the covered slots, in the first year which will be increased by 5% after every 5 year. It is assumed that this will fetch a revenue of Rs.7.20 lakhs in the first year.

- **Benefit from new job creation**

In order to maintain the buildings, the new blocks of apartments will require the following permanent staff on monthly salary basis. The operation cost for staff salary given **Table:7**

Table 7: Operational cost for staff salary

Title	No of staff	Monthly salary (INR)	Annual (INR)
Managers	1	30,000	30,000
Block supervisors	3	20,000	60,000
Civil supervisor	1	20,000	20,000
Electrician	2	18,000	36,000
Plumbers	3	18,000	54,000
Gardeners	5	12,000	60,000
Cleaners (2x7)	14	10,000	1,40,000
Total	**58**		**4,00,000**

It is assumed that the salary will be increased by 5% annually.

- **Benefit due to Higher Productivity**

For the purpose of calculating the higher productivity, it is assumed that on an average, there are 3 working adults, earning average Rs800/day with 70% of working days a year. It is expected that with improved living conditions, their productivity will be improve by 15% in the first year and marginally by 3% per year, thereafter.

- **Benefit from savings in Healthcare**

It is assumed that each family consists of average 4 members (total 1120 people) and the improved living conditions could save Rs5,000 per person on account of cost of medicine, hospitalization and flood related assistance etc. in the first year and this will be increased by 2.5% every year.

- **Benefit of new public park**

The evacuated land will be utilized to develop public park with entrance fee of Rs50/Pax in the first year of operation. It is expected that the park will have average 350

visitors/day and the revenue will be increased by 3% per year, due to increase in the number of visitors and periodic revision in the entrance fee.

9.2 Economic Analysis

9.2.1 Methodology and Assumptions

The economic internal rate of return (EIRR) and benefit–cost ratio is estimated over 30 years.

9.2.2 Results of the Economic Analysis

The analysis has considered only the direct economic benefit ensuing from the rehabilitation of the people to a location with better living conditions. The indirect benefits such as indirect jobs created, benefits resulting from improved social conditions (e.g. improved sanitation, reduced crime rate), change in educational standards and better higher employment opportunities etc. are not considered at this stage. The details given in **Table:8**

Table 8: Economic Returns – Summary (Rs in Lakhs)

Cost of project	O & M Cost	Total Cost	Project Benefits	Net Project Benefits	ERR
10,837	4,056	14,893	16,487	1,594	2.90%

The ERR of the project needs to be compared with cost of capital for investment decision. Although, the ERR of the component is only 2.57%, this should be considered holistically for the project. Some of the commercially viable components will significantly improve the project ERR as a whole and the project cannot be conceived without the Resettlement and Rehabilitation component. Project cost and benefits analysis has been given **Table 9**. Sensitivity analysis will be done for the project as whole, not for the Rehabilitation and Resettlement component in isolation.

Table 9: Economic Analysis

	Project Costs			Project Benefits						
Year	Cost of Development	O&M Cost	Total Cost	Parking fee collected	Additonal Employment	Benefit due to Higher Productivity	Benefit from savings in Healthcare	Benefit of new public park	Total	Net Project Benefits
2020										
Land Acquisitio	(2,962)		(2,962)							(2,962)
Construction	(7,875)		(7,875)							(7,875)
2022		(39.38)	(39.38)	19.20	4.00	211.68	56.00	63.88	354.76	315.38
2023		(39.38)	(39.38)	19.20	4.20	218.03	57.40	65.79	364.62	325.25
2024		(39.38)	(39.38)	19.20	4.41	224.57	58.84	67.76	374.78	335.41
2025		(39.38)	(39.38)	19.20	4.63	231.31	60.31	69.80	385.24	345.87
2026		(39.38)	(39.38)	19.20	4.86	238.25	61.81	71.89	396.02	356.64
2027		(78.75)	(78.75)	20.16	5.11	245.40	63.36	74.05	408.07	329.32
2028		(78.75)	(78.75)	20.16	5.36	252.76	64.94	76.27	419.49	340.74
2029		(78.75)	(78.75)	20.16	5.63	260.34	66.57	78.56	431.25	352.50
2030		(78.75)	(78.75)	20.16	5.91	268.15	68.23	80.91	443.37	364.62
2031		(118.13)	(118.13)	20.16	6.21	276.19	69.94	83.34	455.84	337.71
2032		(118.13)	(118.13)	21.17	6.52	284.48	71.68	85.84	469.69	351.57
2033		(118.13)	(118.13)	21.17	6.84	293.01	73.48	88.42	482.92	364.79
2034		(118.13)	(118.13)	21.17	7.18	301.81	75.31	91.07	496.54	378.42
2035		(118.13)	(118.13)	21.17	7.54	310.86	77.20	93.80	510.57	392.44
2036		(157.50)	(157.50)	21.17	7.92	320.18	79.13	96.62	525.02	367.52
2037		(157.50)	(157.50)	22.23	8.32	329.79	81.10	99.52	540.95	383.45
2038		(157.50)	(157.50)	22.23	8.73	339.68	83.13	102.50	556.28	398.78
2039		(157.50)	(157.50)	22.23	9.17	349.87	85.21	105.58	572.06	414.56
2040		(157.50)	(157.50)	22.23	9.63	360.37	87.34	108.74	588.31	430.81
2041		(196.88)	(196.88)	22.23	10.11	371.18	89.52	112.01	605.05	408.17
2042		(196.88)	(196.88)	23.34	10.61	382.32	91.76	115.37	623.40	426.52
2043		(196.88)	(196.88)	23.34	11.14	393.79	94.06	118.83	641.15	444.28
2044		(196.88)	(196.88)	23.34	11.70	405.60	96.41	122.39	659.44	462.56
2045		(196.88)	(196.88)	23.34	12.29	417.77	98.82	126.06	678.27	481.40
2046		(196.88)	(196.88)	23.34	12.90	430.30	101.29	129.84	697.67	500.80
2047		(196.88)	(196.88)	24.50	13.55	443.21	103.82	133.74	718.82	521.95
2048		(196.88)	(196.88)	24.50	14.22	456.51	106.42	137.75	739.40	542.53
2049		(196.88)	(196.88)	24.50	14.93	470.20	109.08	141.88	760.60	563.73
2050		(196.88)	(196.88)	24.50	15.68	484.31	111.80	146.14	782.44	585.56
2051		(196.88)	(196.88)	24.50	16.46	498.84	114.60	150.53	804.93	608.06
Total	**(10,837)**	**(4,056)**	**(14,893)**	**653**	**266**	**10,071**	**2,459**	**3,039**	**16,487**	**1,594**
									ERR	**2.90%**

CHAPTER - 10

ENVIRONMENTAL AND SUSTAINABILITY ASPECTS

10 ENVIRONMENTAL AND SUSTAINABILITY ASPECTS

To achieve good development in a city like Kochi which is stressed by climate change and diminishing natural resources, infrastructure needs to be sustainable. Sustainable infrastructure not only enables sound economic development, job creation and the purchase of local goods and services, it also enhances quality of life for citizens, increases positive impacts, helps protect our vital natural resources and environment, and promotes a more effective and efficient use of financial resources. This section of DPR gives an overview of the Environmental and suitability aspects of the project.

10.1 Impact Assessment

Apart from all the positive aspects of the project, they are associated with some negative impacts on nearby communities as well as the natural environment. Some of the major environmental impacts of this project include impact on green cover, change in land use, accelerated urbanization etc.

Keeping in view of the above impacts, Environmental Assessment is carried out for the project in order to identify the base-line environmental profile for the project's area of influence due to the proposed project activities and also to prepare an Environmental Management Plan (EMP) to mitigate the identified adverse impacts on the environmental components during the design, construction and operation of the project components.

Some of the major environmental impacts of this project include loss of some number of trees, resettlement of people, disruption of local economic activities, demographic change and accelerated urbanization. Based on the project details and the baseline environmental status, potential impacts that are expected to accrue as a result of the proposed project have been identified.

10.1.1 Impacts due to Project Location

Project Affected People (PAPs): The estimated PAPs of the R&R project is approximately 1000. Engagement with affected communities in the course of projects, activities could be highlighted more to emphasise the key nature of such activities and the priority they hold.

Change of Land use: Project activities include the Clearing, stripping and levelling the sites, earth filling, excavation for foundations and construction activities would result some minor changes in the land use.

Loss of Ecology: The proposed location for building construction is a vacant land with some trees and bushes. Some trees need to be cut for construction. However, no major impacts are anticipated on the ecology due to construction and operation of the proposed apartments.

10.1.2 Impacts during Construction Phase

The impacts during construction phase will be localized and short-term and primarily related to civil works and erection of equipment. The duration of impact will be limited to the construction phase only. The following activities may cause environmental impacts during construction of the proposed project:

- Site preparation
- Excavation and backfilling
- Hauling of earth materials
- Piling, cutting, and drilling
- Erection of concrete and steel structures
- Noise from heavy equipment operation
- Painting and finishing
- Clean up operations
- Landscaping and Green belt development

The activities and probable impacts during construction phase is detailed in **Table 10** below:

Table 10: Activities & Probable Impacts during Construction Phase

Activities	Sector	Anticipated Impacts
Site clearing and levelling (cutting, stripping excavation, earth movement, compaction)	Air	Fugitive dust emission
		Air emission from construction equipment and machinery
	Water	Run off from grass stripped area.
	Land	Loss of fertile topsoil
		Change in drainage pattern
	Ecology	Loss of vegetation
Transportation and storage of construction material/ equipment	Air	Air emission from vehicles
		Fugitive dust emission due to traffic movement
	Water	Spilling of construction material and flow into streams.
		Run off from storage areas of construction material
	Soil	Deposition of spilled construction material and flow into streams
	Public utilities	Increased flow of traffic and congestion
Civil construction activities	Air	Fugitive dust emission
	Water	Run off from erection areas containing oils, paints
	Socio-economic	Increase in employment
Influx of labors	Socio-economic	Stress on infrastructure
		Stress on social relation

Proposed site needs to be levelled for construction. Clearing, stripping, and levelling the sites, earth filling, excavation for foundations and construction activities would result in generation of debris and construction wastes. There are some trees in the site but no significant impact.

The combustion of diesel various construction equipment could be one of the possible sources of incremental air pollution during the construction phase. Another potential source of air quality impact arising from the establishment/ construction of the proposed project will be fugitive dust generation.

Noise during construction phase are due to operation of various construction equipment. There will be significant increase in vehicular movement for transportation of construction material. No adverse impacts on noise environment are anticipated during operation phase.

10.1.3 Impacts during Operation Phase

No Major impacts are anticipated during operation phase.

The solid waste generation is envisaged during operation phase could be the disposal of garbage or solid waste generated from various sources and the same could be disposed of at designated sites in a proper manner. Provisions shall be made to separately store the degradable and non-degradable solid waste.

The Liquid waste generation is also envisaged during operation phase that could be managed with the proposed STP.

10.2 Environmental Management Plan (EMP)

While the impacts associated with the project are not major, care has to be taken to ensure that the ambient environmental conditions do not deteriorate. The project, in overall, during the operational phase will improve the living conditions. In order to address the impacts that are predicted, various mitigation measures, monitoring and reporting

schedules are suggested in the Environmental Management Plan (EMP). The EMP addresses the environmental impacts during design, construction, and operation phases of the project.

EMP assigns the responsibilities for various actions identified to limit the adverse impacts of the project. Environmental mitigation measures are incorporated within the design process, including the avoidance of potential impacts. Appropriate measures will be identified for action in the construction and operation phases. Environmental Management Plan (EMP) tabulates the environmental mitigation and enhancement measures identified for all phases of the project i.e., the design, pre-construction, construction and operation, which have, or will be taken by the responsible agency, and, where appropriate, the contractual clause or drawing no. referring to the measure.

10.3 Issues relating to Sustainability

Sustainability of the project depends on integrating economic, environmental, and social aspects in the content and management of project Requires the inclusion of 'People' and 'Planet' performance indicators in the management systems, formats, and governance of the project. Project shall not be dominated by the 'triple-constraint' variables of time, cost, and quality alone. To achieve good development on a planet stressed by climate change and diminishing natural resources, infrastructure needs to be sustainable.

Sustainable infrastructure not only enables sound economic development, job creation and the purchase of local goods and services, it also enhances quality of life for citizens, increases positive impacts (benefits), helps protect our vital natural resources and environment, and promotes a more effective and efficient use of financial resources.

Integrated approaches should be supported by independent planning bodies that provide politicians and other stakeholders with consolidated and essential information upon which to base policy decisions. They play a critical role in ensuring that decisions are made across sectors, taking into account those issues that might not factor into short-term political decision making, and to reduce the cost of projects by assessing costs and benefits at a

systems-level. Key attributes for infrastructure planning that are considered in the design of this project components are the following:

- sustainability as a primary guiding concept.
- an integrated plan for infrastructure development across sectors.
- independent, but cannot be too removed from political decision-making.
- anchored in clearly defined and long-term objectives.
- open and collaborative, seeking stakeholder engagement from the outset of the process.

This is crucial to encourage openness and transparency and to add credibility to the planning exercise. At the same time, stakeholder engagement helps to inform policy makers about relevant business models and technological innovations.

10.4 Green Construction concept in the project

Green construction concept is for the welfare of people and welfare measures are important for all stakeholders i.e. workers, site staff, users and public. The basic green construction concepts that are followed in the design of this project are the following:

- Energy efficient architectural design, use of energy efficient equipment, generation of non-conventional energy and conservation of energy all lead to green construction concept.
- Quality and safety lead to durable structures which in turn lead to green construction. Unsafe structures lead to non-durable structures hence structural safety is of paramount importance for green construction concept.
- Time overrun generally leads to deterioration of quality due to cost overrun and low productivity and thus adversely affects green construction concept. It also leads to more pollution.
- Early completion of work leads to savings of resources, reduction of pollution and early use of assets thus resulting in conservation of resources hence contributing significantly to green construction concept.
- Non preparation of plans and non-availability of drawings in time lead to delay in completion of work, which is against green construction concept.

- Integration of services and their easy maintenance during life cycle of the constructions without generation of waste leads to green construction concept.
- Building materials consume large energy in their creation /manufacturing, transportation and use in buildings. Hence their judicious selection is important for green construction concept.
- Construction of Energy net plus buildings need to be encouraged as they contribute in generation of energy for use in other buildings also besides their own use.
- Use of products from waste resources and non-toxic/non-hazardous products contribute significantly to green construction concept.
- Air, water, and noise pollution adversely affects green construction concept.
- Conservation of water and use of wastewater through recycling effectively contributes to green construction concept.
- New and emerging technologies lead to speedy construction which in turn leads to early completion of work. This contributes to green construction concept.
- Tools, equipment, and technologies not generating C&D waste are very much desirable for green construction concept.
- Innovation leads to out of box thinking and thus needs to be encouraged for green construction concept.
- Trees take longer time in growing hence should be protected by all means. Felling of trees should therefore be avoided and transplantation encouraged in case removal is unavoidable.

CHAPTER -11

RISK ASSESSMENT AND MITIGATION MEASURES

11 RISK ASSESSMENT AND MITIGATION MEASURES

As most of the work involved is construction of the facilities, risks are associated with the project implementation. The occurrence of the unexpected events may adversely affect the timely completion of the project. The chances of such occurrences are verified, and the mitigation measures are proposed.

The major risks identified are as follows:

- Adverse weather condition
- Unforeseeable shortages of labour or materials
- Strikes
- Disputes with slum settlers
- Damage to person and property due to fire, flood, earthquake, etc.

The chances of occurrence of various unexpected and adverse effects are analysed considering the ground condition and the mitigation measures are proposed. **(Table 11)**

Table 11: Risks and mitigation proposed

Sl.No.	Risks	Mitigation measures proposed
1	Adverse whether condition	• Proper planning • Excavations to be completed before monsoon and the super structure to be built up.
2	Shortage of labour and materials	• Proper work scheduling • Shall be handled by the Contractor by making the same available
3	Strikes	• This shall be accounted by additional working hours/ augmentation of resources thereafter
4	Disputes with slum dwellers	• Increased communication and reviews

Sl.No.	Risks	Mitigation measures proposed
		to avoid occurrences of disputes. • Any disputes to be settled without delay by properly assessing the situation and arriving at a win-win situation
5	Damage to person and property due to safety issues or force majeure	• Proper safety measures shall be ensured during construction. • Insurance coverage
6	Project Management risks like change in priorities, overload, communication issues, lack of coordination, in experienced work force, etc.	• Institutionalizing an activity-based project schedule • Regular reviews and assessment of progress • Shall be avoided by appointing well experienced and reputed organizations as implementation agencies. • Proper monitoring • Constant reviews
7	Organizational risk like inexperienced staff, insufficient time to plan, loosing critical staff at critical time, Inconsistent cost, time, scope, and quality objectives	• Each unit in the Project Management Organization is planned considering minimizing the organizational risk
8	Objection from the local community	• Shall be settled by setting a time limit without affecting the work progress
9	Contractual relations: Issues arise due to permit and license, new stake holders, priority changes, funding	• The chance of occurrence of the same is very less as the frame works are completed and finalised in the initial stage itself. However, in case of

Sl.No.	Risks	Mitigation measures proposed
	changes	occurrence immediate measures shall be adopted
10	Security issues due to laborers	• Proper ID cards • Surveillance measures • Entry restrictions • Minimum activities during school time

CHAPTER - 12

PROJECT MANAGEMENT ORGANISATION

12 PROJECT MANAGEMENT ORGANISATION

Among the activities conceived under the IURWTS – Kochi Project, the Rehabilitation and Resettlement proposal for the slum dwellers of P&T colony, Udaya Nagar colony and Kudumbi colony form a part. The SPV of the project has been entrusted to KMRL by Govt of Kerala and Bhavanam Foundations Kerala (BFK), a public sector non-profit company fully owned by Govt. of Kerala under the department of labour the implementing agency for the said R&R project.

12.1 Roles and Responsibilities of various stakeholders

a) Government / Executive committee of KIIFB

The Executive Committee of KIIFB chaired by the Finance Minister will periodically review the progress of the project (duly sanctioned by the KIIF Board chaired by the Hon'ble Chief Minister) and oversee the release of funds through an Inspection Authority constituted under Section 17A of the KIIF Act 1999 (amended by KIIF (Amendment) Act, 2016) to examine the utilisation of funds.

The Government shall also facilitate the linkages between parties and different Ministries and their departments and other stakeholders as required for the smooth implementation of projects. After verifying the invoices, authorized by the SPV, KIIFB shall release the payment

b) Special Purpose Vehicle (SPV)

Vide GO (Ms) No 07/2018/CSIND dated 12th Nov 2018,Govt of Kerala appointed KMRL as the SPV for the same IURWTS-Kochi Project and the R&R proposal is one of the important activities to be implemented for the slum dwellers of P&T colony, Udaya Colony and Kudumbi colony.

The SPV has rendered the job to a general consultant (Antea Group, Nederland) for the various activities like Planning, Implementation, Procurement, Management and Advisory Services using the format of the standard RFP prepared by KIIFB as a guide for preparing the

RFP suited to their specific requirements for the whole project. The Detailed Project Report (DPR) submitted by GC after wetting by SPV shall submit the proposal to KIIFB. The proposal duly examined by the Project Evaluation Team in KIIFB is placed before the KIIF Board chaired by the Hon'ble Chief Minister. This Board will be the sole authority to accord sanction for financing of the project through the Fund.

Once the SPV is registered on the Direct Benefit Transfer (DBT) Portal of KIIFB, the finalization of the tender, contracts and concession agreement will be initiated by BFK for implementation of the project

The detailed scope of SPV for the implementation of the project is as follows:

1. SPV shall identify task or activities in the Project Management Software provided by KIIFB as milestones for release of payment to the contractor.

2. SPV shall enter into a contract with BFK (referred to as Contractor) for implementation of the project. The SPV shall ensure that all the obligations of the contractor such as detailed project tasks and timelines for execution as per the approved WBS, milestones identified by SPV for release of the payment, mechanism for resolution of disputes, conditions for defect liability period, etc shall be incorporated in the contract.

3. SPV shall be ultimately responsible for monitoring the progress of the project, physical verification of the project and ensuring the quality and timely completion of implementation of the project.

4. SPV shall scrutinize the bill raised by BFK (Contractor) and recommend for payment to KIIFB through an invoice showing separately the payment due to the Contractor and statutory deductions/ payments to be made.

5. The SPV shall furnish to KIIFB a monthly progress report and half yearly report of the project in the format (online project management software platform) prescribed by KIIFB.

6. SPV shall ensure the contractors provide safe and healthy working environment for the workers engaged in the implementation of the project.

7. The SPV shall submit the completion report on completion of the implementation of the project through the Owner of the venue/ public agency with whom a tripartite agreement is made by KIIFB and SPV.

12.2 Implementing agency

The works will be carried out by BFK the implementing agency appointed by GoK.

12.3 Project schedule

The work has been considered as a composite work combining the civil, electrical and all other utility work packages combined in one contract. The work in each phase has been scheduled to complete as per Project implementation schedule.

CHAPTER - 13

CONTRACT MANAGEMENT STRATEGY

13 CONTRACT MANAGEMENT STRATEGY

The SPV of the project has been entrusted to KMRL by Govt of Kerala and Bhavanam Foundations Kerala (BFK), a public sector non-profit company fully owned by Govt. of Kerala under the department of labour is the implementing agency for the said R&R project.

The total project activities:

Civil & Infrastructural Works which comprises of

- Civil
- Electrical
- HVAC
- Fire & Safety
- Plumbing, STP etc
- Land scaping

The work will be advertised and awarded as separate works targeted at bidders with relevant expertise and experience.

13.1 Contract Management Strategy for Civil and Infrastructural works

The work will be executed as item rate tender/EPC/lump sum basis, as per CPWD/ PWD procedures and the project will be implemented by adhering to the laid down procedures from the contactor selection to commissioning. The following procedures need to be followed:

13.1.1 Preparation of the tender document

A detailed Bill of Quantities will be got prepared by BFK through the selected contractor and the tender documents will be finalized. Suitable pre-qualification criteria with the experience of completing similar works of equal value will be the eligibility criteria.

13.1.2 Tendering

Tendering process will be undertaken adhering to the existing procedures.

a) Tender evaluation and selection of the contractor:

All the bids received will be evaluated and the selection of contractor as per the existing norms.

b) Award of work

Work order will be issued to the selected bidder based on technical bid analysis and financial evaluation criteria.

c) Signing of Agreement

The contractor to whom which the work is awarded need to sign an agreement with the Implementing Agency.

d) Finalization of the project implementation schedule

Time is the essence of Contract, hence clear timeline with details about the works to be completed in each phase or within stipulated time will be mentioned in detail. The project implementation schedule will be a part of the Agreement.

e) Work execution

The Project manager (BFK), will be in charge of the project and, member of the implementation team will strictly monitor the project in adhering to the contract conditions. The amendments and changes will be properly documented, and necessary approvals will be obtained from the Approving Authority.

f) Quality Analysis and Quality Control (QA/QC) plan

The quality analysis and quality control of the works will be assessed by BFK as per the approved QA/QC plan.

g) Site supervision and bill measurement

The Implementation Agency will set up a proper supervisory plan to check the status of the work and to do bill measurements, to check whether the progress of work is as per the implementation schedule provided.

h) Release of payment

The Contractor can raise the Running Account Bill as per the payment after conducting the joint inspection at site, as certified by the Project Manager of BFK. The same will be wetted by SPV and recommended for payment to KIIFB.

13.1.3Commissioning of the project

After completing all the works including civil works, electrical works, mechanical works plumbing instrumentation works, signage works, security systems, the Implementing Agency were handover the facilities to SPV for inauguration.

CHAPTER - 14

IMPLEMENTATION SCHEDULE

14 IMPLEMENTATION SCHEDULE

The implementation schedule is given in the figure 5 below. Anticipated time for completion of work including the pre-construction phase is 24 months for 7 blocks proposed.

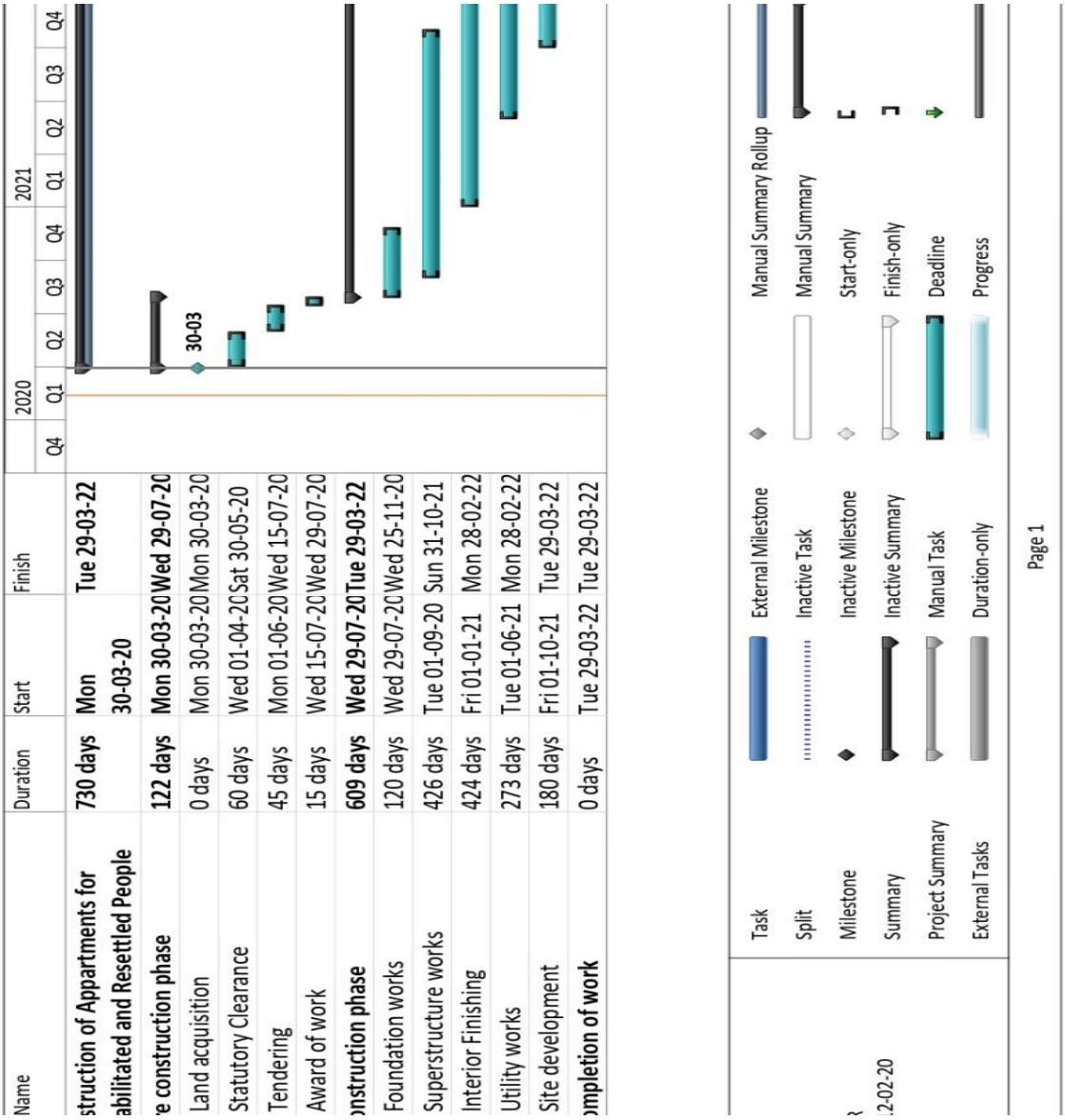


Figure 5: Implementation Schedule

CHAPTER - 15

STATUTORY CLEARANCES

15 STAUTORY CLEARANCES

15.1 Legislative framework for R&R

There is a complex legislative and administrative framework governing a R&R project in the realm of urban infrastructure development and urban management, based on Acts, Rules and Regulations formulated by the Central and State Government. **(Table -12).**

Table 12: Rules and Regulations

Acts and Rules	Applicable Sector
A. Central Acts and Rules	
1. Constitutional Provisions (Article 48 and 51)	Infrastructure and Environment
2. Constitutional Provisions (Project Affected Persons)	Infrastructure and Social
3. The Right to Fair Compensation and Transparency in Land Acquisition, Rehabilitation and Resettlement Act, 2013 (Land Acquisition Act, 2013)	Infrastructure and Social
4. National Policy on Resettlement and Rehabilitation for Project affected Persons, 2003	Infrastructure and Social
5. Labour Welfare Laws	Infrastructure and Social
6. The Public Liability Insurance Act & Rules, 1991	Infrastructure and Social
7. The Building and Other Construction Workers. (Regulation of Employment and Conditions of Service) Act (BOCW), 1996	Infrastructure and Social
8. EIA Notification, 2006	Infrastructure and Environment
B. State Acts, Rules and Policies	
i. Kerala State Policy for Compensation and Transparency in Land Acquisition Rules 2015	Infrastructure and Social

Acts and Rules	Applicable Sector
ii. Kerala Ground Water Control and Regulation Act, 2002	Infrastructure and Environment
iii. Urban Policy and Action Plan, 2002	Infrastructure and Management
iv. Kerala Infrastructure Development Bill, 2001	Infrastructure and Management
v. Kerala Paddy and wetland conservation Act 2008	Infrastructure and Environment
C. Major National Policies (bearing on Urban Development)	
a. National Urban Transport Policy, 2014	Infrastructure, Social and Environment
b. The national slum upgrading and prevention policy,2014	Infrastructure and Social
c. The National Urban Housing & Habitat Policy 2007	Infrastructure and Social

15.2 Statutory Clearance applicable

a) Municipality Building Permit

Kerala Panchayat Building Rules (KPBR)/ Kerala Municipal Building Rules (KMBR) will strictly be followed for construction of the buildings.

b) Fire NOC/ Certificate of Approval

Approval /NOC of the Building will be obtained from the "Department of Fire &Rescue Services, Government of Kerala". 'Checklist cum Application Form' will be submitted for Initial Clearances and then for Final Clearance and then the 'Certificate of Approval' will be obtained.

c) Clearance from State Level Environmental Impact Assessment Authority

As per the item 8(a) of schedule of EIA Notification, 2006, it is made mandatory that building and construction projects ≥25000 m2 and <150000 m2 of built up area are categorized as

Category B and requires clearance from State Level Environmental Impact Assessment Authority. As the total built up area for the present project is and falls far below the minimum limit, the project does not attract EIA Notification, 2006.

d) Tree cutting Permission

Tree cutting permission need to be obtained in order to cut the trees that are present in the land proposed for construction of building. Attempt shall be made to transplant trees, whose girth size is less than 40 cm.

e) Permission under Kerala Paddy and Wetlands conservation Act 2008

As per village records, some portion of the proposed land belongs to paddy/wetland category. Out of the 7.73 acres land there is a paddy land area of 1.73 acres. Permission under Kerala Paddy and Wetlands conservation Act 2008 is applicable for this land parcel only.

CHAPTER - 16

QUALITY MANAGEMENT PLAN

16 QUALITY MANAGEMENT PLAN

In order to manage the quality of the work, specific plan is envisaged. Even though quality is the responsibility of each individual involved in the project, a team will be formed with an objective to assure quality. The team will be headed by a Quality Manager from the BFK side whose activities will be constantly reviewed by the SPV. Under the Quality Manager, there will be a quality team which consist of inspection and testing unit and site engineers.

Before commencement of any work, the Quality Manager shall furnish a detailed work methodology describing the various process for the execution of the specific work. The implementing agency (BFK) shall commence the work only on the approval of the work methodology by the SPV. The Project manager of BFK (Contractor) shall also ensure to provide quality certificates from the respective material suppliers.

The Quality Management Organization Framework is as follows:

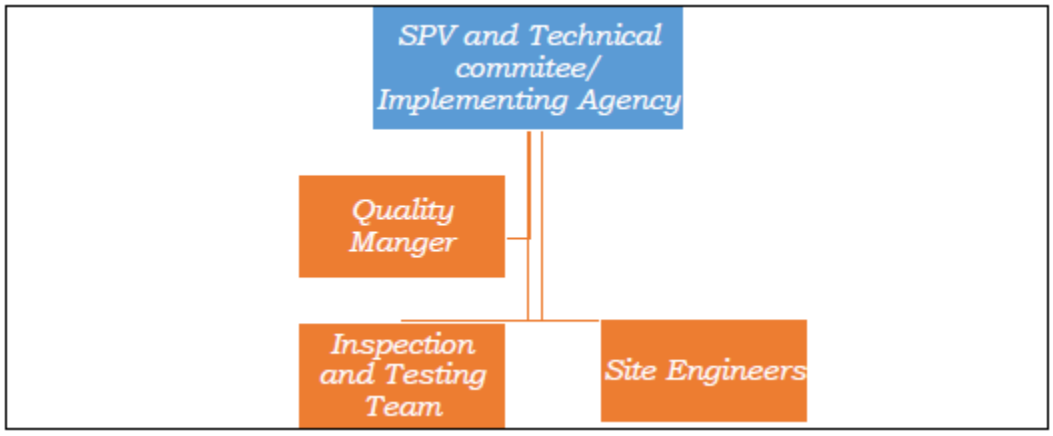


Figure 6: Framework for quality management organization

Following documents need to be maintained in order to facilitate quality assurance **(Table 13).**

Table 13: List of Documents for Quality Assurance

Sl.No.	Description
1	Material Inspection Report - Structural Steel
2	Material Inspection Report - Pipe
3	Welding Inspection Report

Sl.No.	Description
4	Check list for Construction Site Safety
5	Material Inspection Checklist
6	In process / Stage Inspection Report
7	Checklist for Sieve Analysis
8	Checklist for Water
9	Checklist for Masonry
10	Checklist for Plumbing Works
11	Checklist for Woodwork
12	Checklist for Internal Plaster
13	Checklist for External Plaster
14	Checklist for Flooring and Dado
15	Checklist for Painting Work
16	Checklist for Fabrication
17	Checklist for Builder's Hardware
18	Checklist for Prestressing
19	Checklist for Electrical works
20	Checklist for Construction Completed Buildings
21	Checklist for Wiring and Accessories
22	Checklist for Cables and Cabling
23	Checklist for MCB & Distribution Boards
24	Checklist for Earthing & Lighting
25	Checklist for General Mechanical
26	Checklist for Fire Protection System
27	Checklist for HVAC projects
28	Checklist for HVAC system commissioning
29	Checklist for Requirement for recommendation
30	Check list for Checking Measurements

Quality Management System will be as per IS 9001: 2015 standards and all the organizations involved in the implementation will strictly adhere to the Quality Management Manuals issued by CPWD/PWD.

CHAPTER - 17

OPERATION & MAINTENANCE PLAN

17 OPERATIONS AND MAINTENANCE PLAN

Operation & Maintenance plays a vital role in delivering the maximum out of any infrastructure. Public buildings generally lack mechanism/ system for operation and maintenance of its facilities due to various reasons including inadequate fund, lack of dedicated staff etc. A revenue generation stream has been planned to meet the operation & maintenance needs to partly cover the operation and maintenance cost by renting out the parking spaces and the community hall in the ground floor.

The following are the proposed Operation and Maintenance plans:

a) Creation of an Operation & Maintenance Committee under Residents welfare association. It will look after the day to-day operations and maintenance requirements

b) Responsibility of the O&M committee

- Develop routine systems to guarantee constant monitoring of the building services
- Complete necessary repairs and schedule any repairs with vendors as needed.
- Provide constant attention to all safety issues, emergency systems will be made operational through regular inspections and review of the site supervisors and supporting staff
- Observe, direct and follow-up with janitorial service provider about cleaning duties
- Guide manager to coordinate the variable operating expenses for maintenance, repairs, and supplies

c) O&M staff

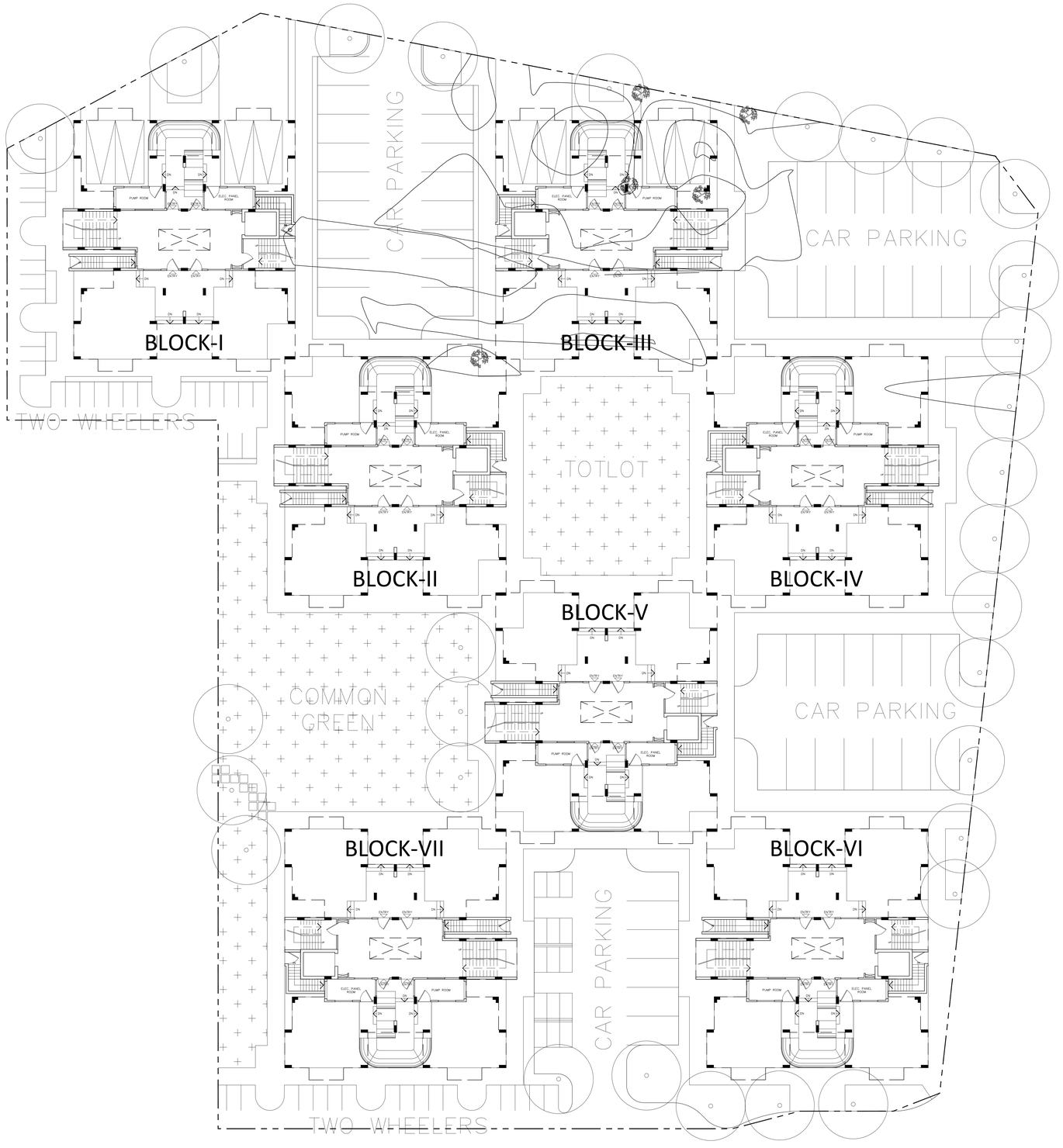
1. Manager 1no.
2. Supervisors: 5 nos.
3. Electricians: 3 nos.
4. Plumbers:3 nos.
5. Security: 4nos.
6. Housekeeping: 15nos.
7. Gardeners: 2 nos.

ANNEXURE 1


anteagroup


anteagroup


anteagroup



NOTES :

30.04.20	R-1	MASTER PLAN, ENTIRE SITE, JOINED BLOCKS
DATE	REV. NO.	DESCRIPTION
REVISIONS		

DETAILED PROJECT REPORT

MASTER PLAN
REHABILATION AND RESETTLEMENT

CLIENT:

IURWTS

Kochi Metro Rail Limited
4th Floor, JLN Stadium Metro Station,
Banerji Road, Kaloor, Kochi,
Kerala – 682017
Ph: 0484 – 284 6700, 284 6770
Fax: 0484 – 297 0810

PROJECT:

INTEGRATED URBAN REGENERATION & WATER TRANSPORT SYSTEM

Approved by:	ANIL KUMAR
Checked by:	SUROJT DASS
Designed by:	SUROJT DASS
Drawn by:	SUROJT DASS

TITLE: SITE PLAN OF R&R HOUSING: IURWTS

GENERAL CONSULTANT:

anteagroup
Antea Nederland B.V. and Antea India (JV)
40/157, Kudiyirickal Building, First Floor,
Palarivattom, Kochi – 682025, Kerala
Telephone–

DRG. NO. WT/2024_IURWTS_R&R_02

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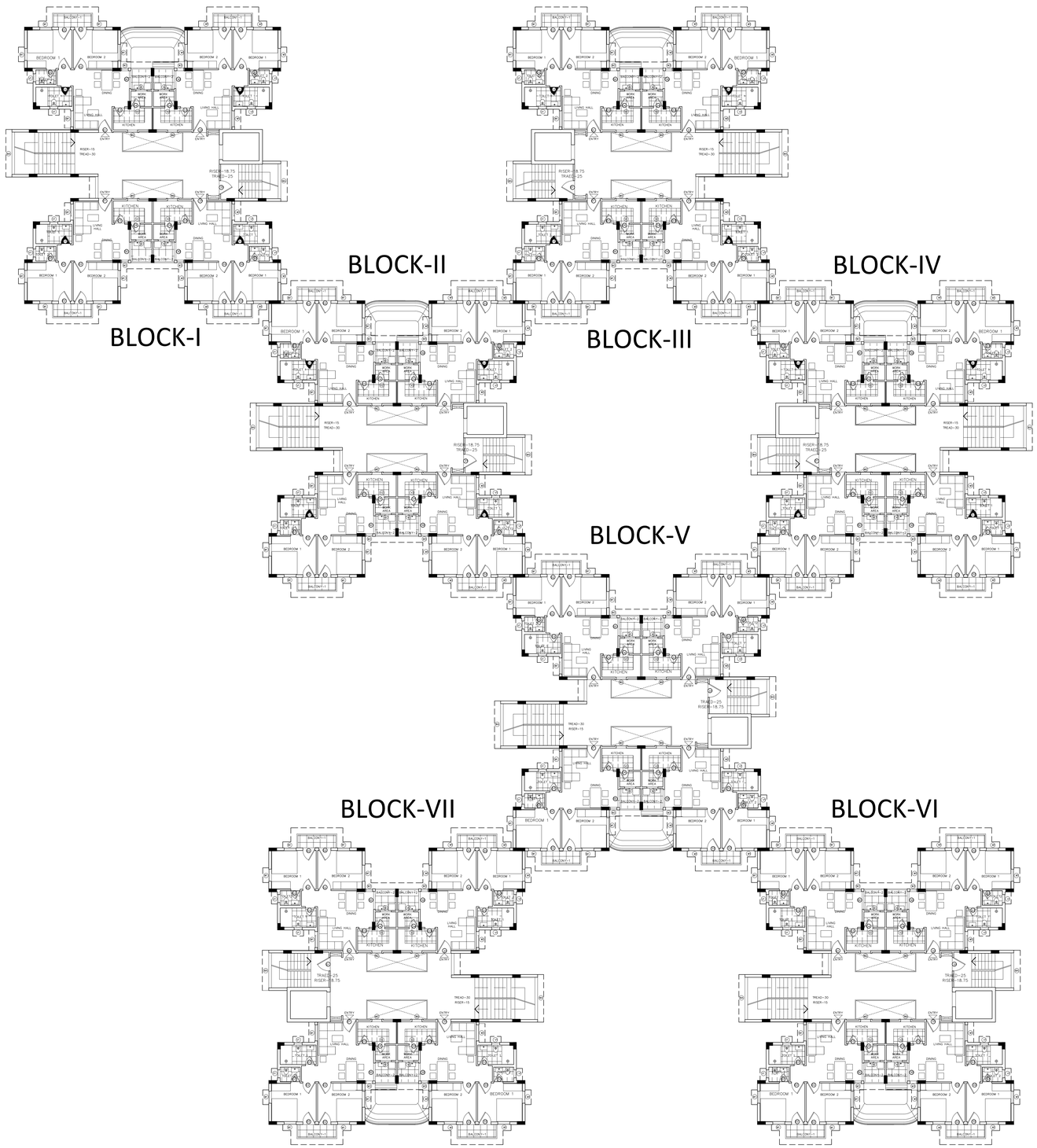

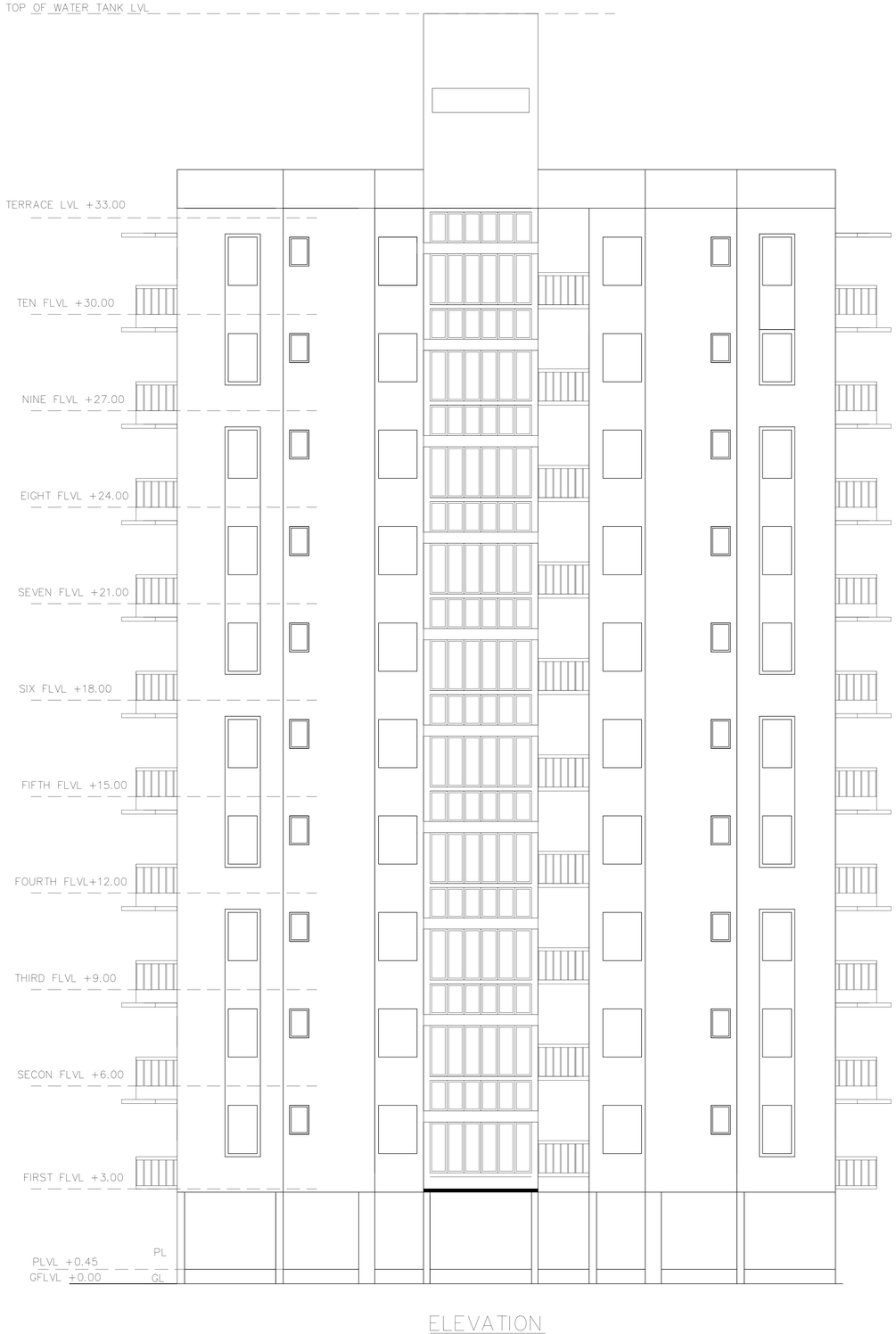

ELEVATION

NOTES :

DATE	REV. NO.	DESCRIPTION
30.04.20	R-1	MASTER PLAN, ENTIRE SITE, JOINED BLOCKS

REVISIONS

DETAILED PROJECT REPORT

MASTER PLAN
REHABILATION AND RESETTLEMENT

CLIENT:
IURWTS
Kochi Metro Rail Limited
4th Floor, JLN Stadium Metro Station,
Banerji Road, Kaloor, Kochi,
Kerala – 682017
Ph: 0484 – 284 6700, 284 6770
Fax: 0484 – 297 0810

PROJECT:
INTEGRATED URBAN REGENERATION & WATER TRANSPORT SYSTEM

Approved by:	ANIL KUMAR
Checked by:	SUROJT DASS
Designed by:	SUROJT DASS
Drawn by:	SUROJT DASS

TITLE: CLUSTER PLAN & ELEVATION

GENERAL CONSULTANT:
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Palarivattom, Kochi – 682025, Kerala
Telephone-

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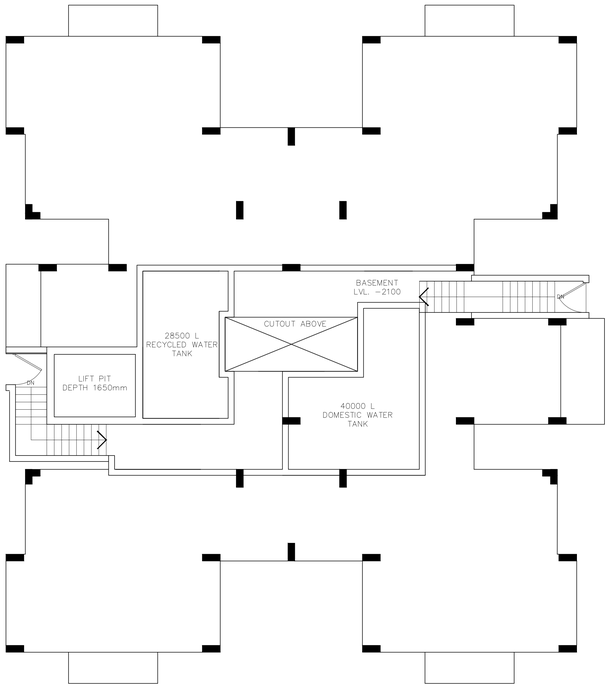
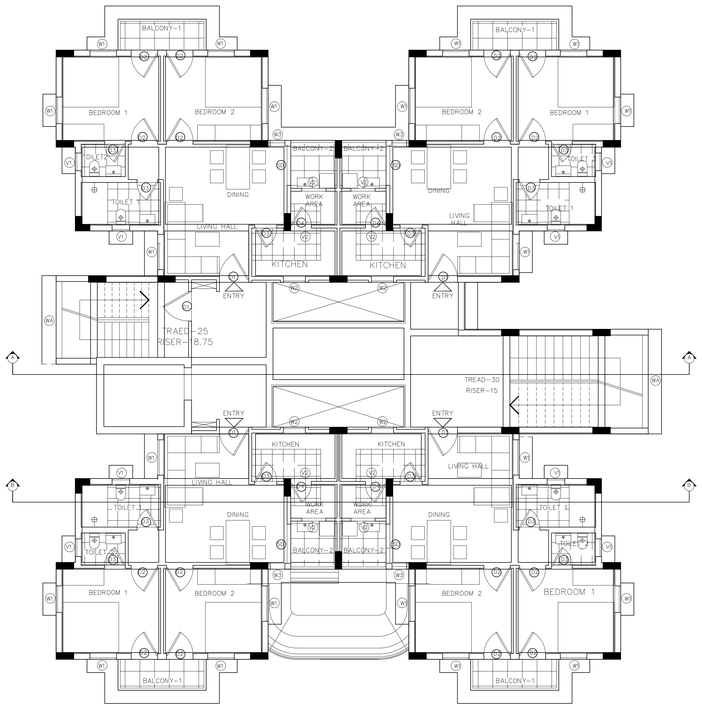
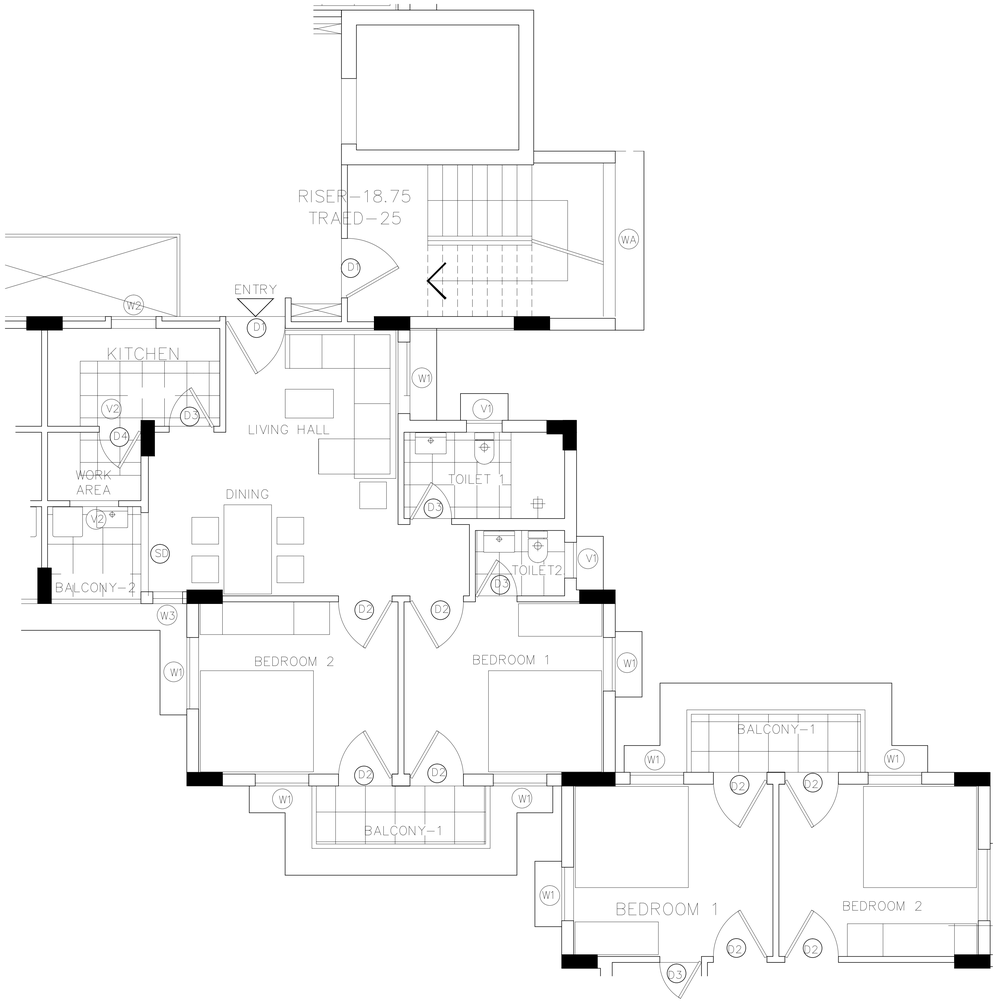


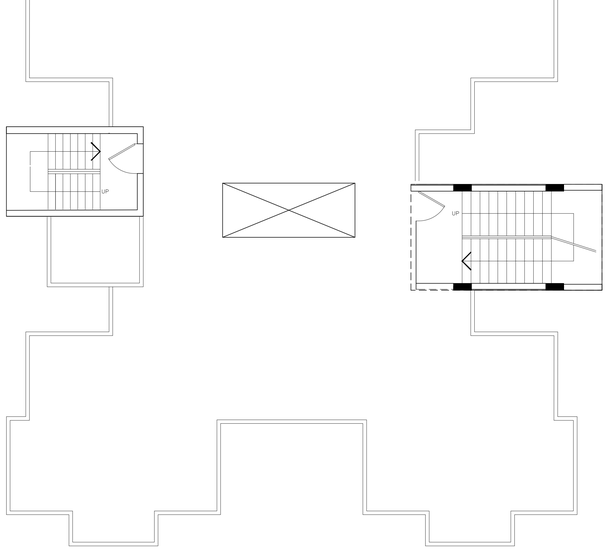
BASEMENT PLAN



TYPICAL FLOOR PLAN



TYPICAL JOINING BEWTWEEN BLOCKS



TERRACE PLAN

NOTES :

DATE	REV. NO.	DESCRIPTION
30.04.20	R-1	MASTER PLAN, ENTIRE SITE, JOINED BLOCKS

REVISIONS

DETAILED PROJECT REPORT

MASTER PLAN
REHABILATION AND RESETTLEMENT

CLIENT:
IURWTS
Kochi Metro Rail Limited
4th Floor, JLN Stadium Metro Station,
Banerji Road, Kaloor, Kochi,
Kerala – 682017
Ph: 0484 – 284 6700, 284 6770
Fax: 0484 – 297 0810

PROJECT:
INTEGRATED URBAN REGENERATION & WATER TRANSPORT SYSTEM

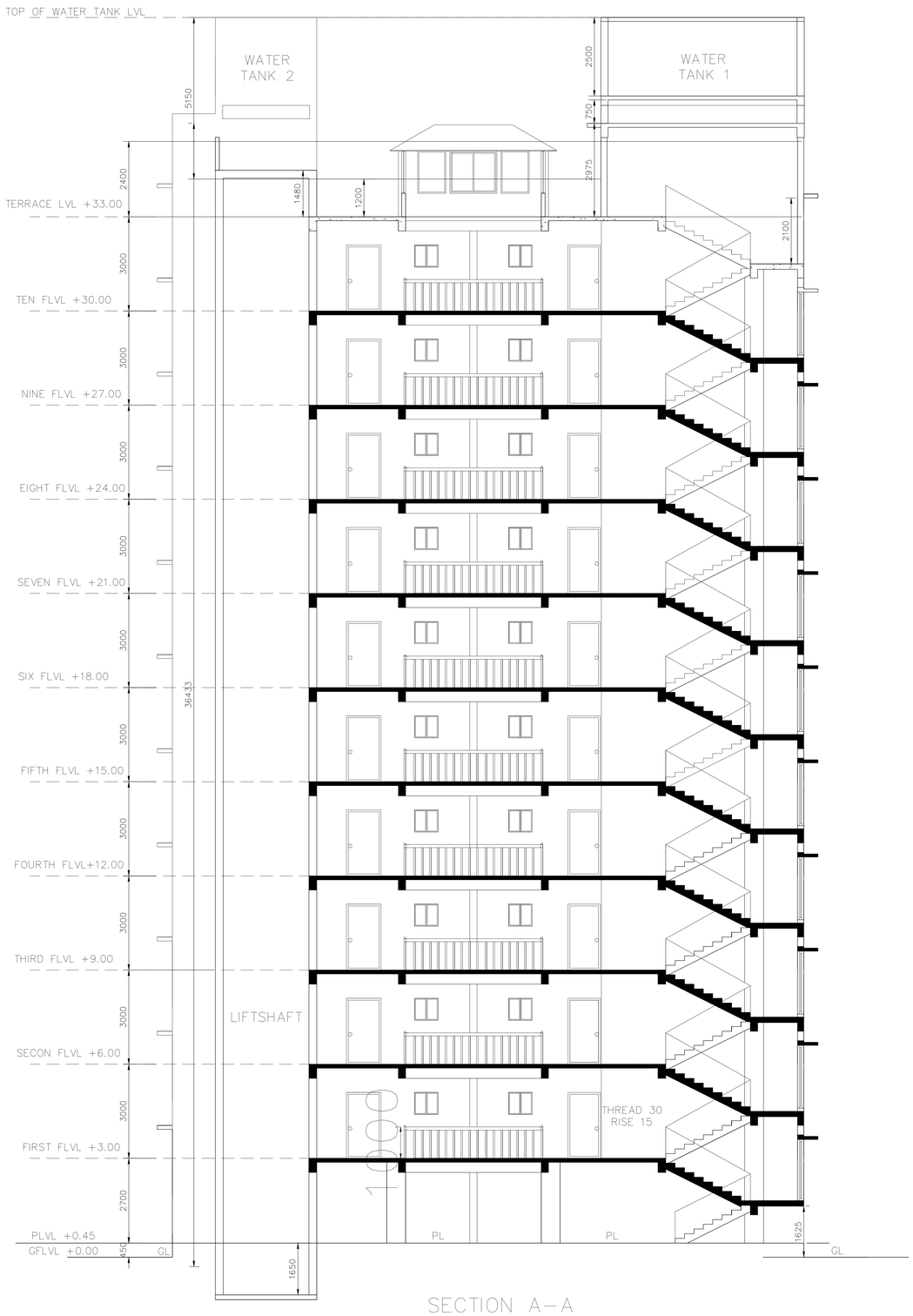
Approved by:	ANIL KUMAR
Checked by:	SUROJT DASS
Designed by:	SUROJT DASS
Drawn by:	SUROJT DASS

TITLE: FLOOR PLANS

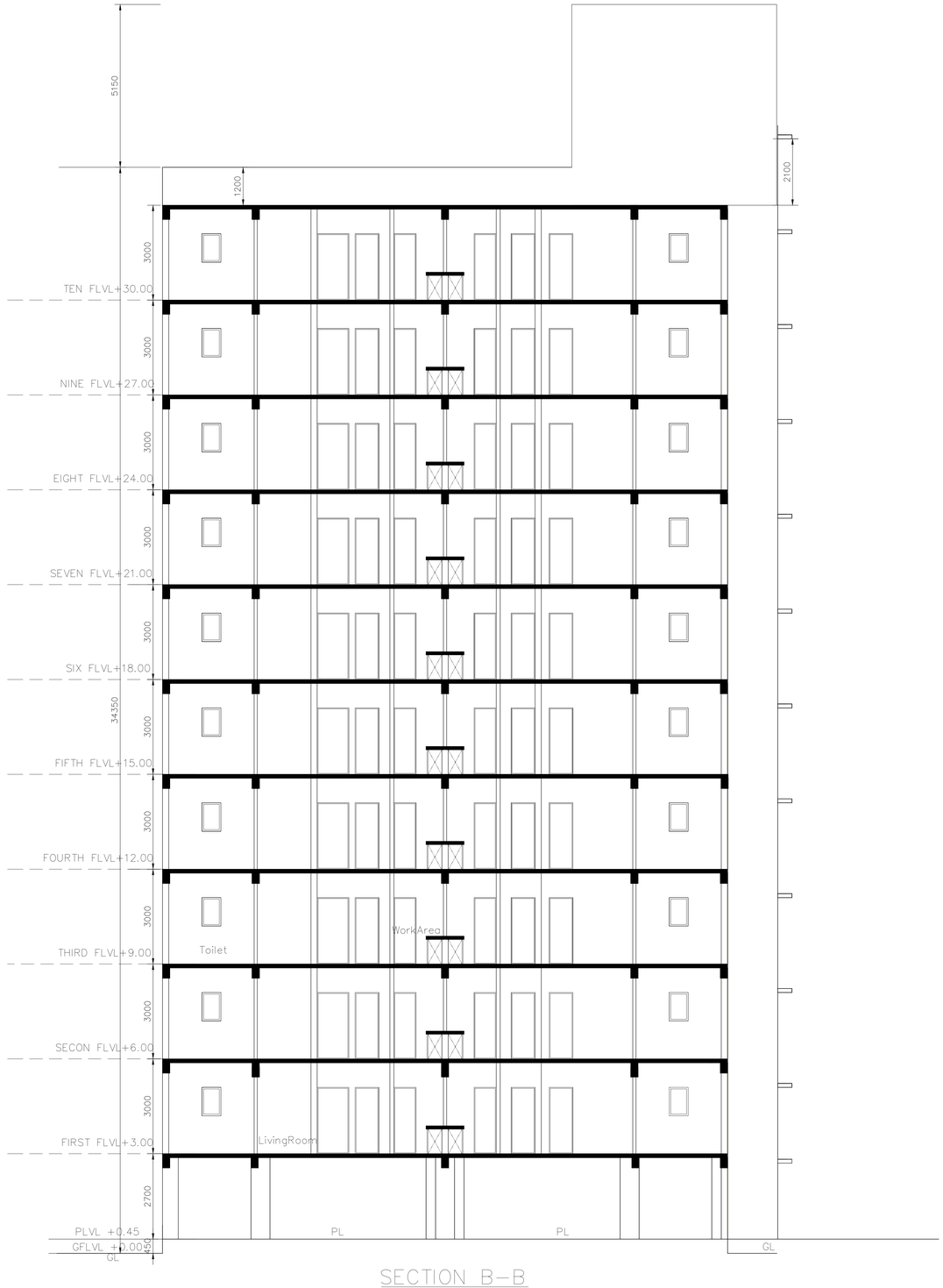
GENERAL CONSULTANT:
anteagroup
Antea Nederland B.V. and Antea India (JV)
40/157, Kudiyirickal Building, First Floor,
Palarivattom, Kochi – 682025, Kerala
Telephone–

DRG. NO. WT/2024_IURWTS_FL. PLAN_05

SCALE: 1:100 in A0
DATE: 24/05/2020
REVISION: R1



SECTION A–A



SECTION B–B

NOTES :

30.04.20	R–1	MASTER PLAN, ENTIRE SITE, JOINED BLOCKS
DATE	REV. NO.	D E S C R I P T I O N

R E V I S I O N S

DETAILED PROJECT REPORT

MASTER PLAN
REHABILITATION AND RESETTLEMENT

CLIENT:

IURWTS
Kochi Metro Rail Limited
4th Floor, JLN Stadium Metro Station,
Banerji Road, Kaloor, Kochi,
Kerala – 682017
Ph: 0484 – 284 6700, 284 6770
Fax: 0484 – 297 0810

PROJECT:
INTEGRATED URBAN REGENERATION & WATER TRANSPORT SYSTEM

Approved by:	ANIL KUMAR
Checked by:	SUROJT DASS
Designed by:	SUROJT DASS
Drawn by:	SUROJT DASS

TITLE: SECTION

GENERAL CONSULTANT:
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Palarivattom, Kochi – 682025, Kerala
Telephone–

DRG. NO. WT/2024_IURWTS_SECTION_03

SCALE:	DATE:	REVISION:
1:100 in A1	24/05/2020	R1

About Antea Group

From city to countryside, from air to water: Antea Group's engineers and consultants have been contributing to our living environment in the Netherlands for years now. We design bridges and roadways, and create residential neighborhoods and water structures. But we are also involved in areas such as the environment, safety, asset management and energy. Under the name Oranjewoud, we expanded into an all-round, independent partner for companies and government bodies. As the Antea Group, we also apply this knowledge at a global level. By combining valuable knowledge, including on technical matters, with a pragmatic approach, we make solutions attainable and workable. Goal-oriented, with an eye for sustainability. In this way, we anticipate today's questions and tomorrow's answers. Just as we have been for over 60 years now.

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1301 AA ALMERE

T. +31-6511428055

www.anteagroup.nl

Report on Resettlement of Project displaced Families and Persons, by KVHS, Kottayam

Integrated Urban Regeneration & Water Transport System, Kochi, India

project number WT/2024

revision # 0

June 08, 2020

Appendix Volume II

Antea Group

Antea Nederland. Antea India

Understanding today.
Improving tomorrow.

Detailed Project Report

Report on Resettlement of Project displaced Families and Persons, by KVHS, Kottayam

Integrated Urban Regeneration and Water Transport System (IURWTS) in Kochi

Project #: WT/2024

Revision #: R0

June 08, 2020

General Consultant - IURWTS:

Antea Nederland B.V. and Antea India Pvt. Ltd.

Client:

Kochi Metro Rail Limited, (A Joint Venture of Govt. of Kerala and Govt. of India)

Resettlement of
Project displaced Families and Persons
of
Integrated Urban Regeneration and Water Transport System Project (IURWTS).

Final Report

Requiring Agency
Kochi Metro Rail Ltd.

By
KERALA VOLUNTARY HEALTH SERVICES
COLLECTORATE P.O.
MULLANKUZHY
KOTTAYAM – 686002
E-mail : keralavhs@yahoo.co.in
Web : www.keralavhs.com

Resettlement of
Project displaced Families and Persons
of
Integrated Urban Regeneration and Water Transport System Project (IURWTS).

Final Report

Requiring Agency
Kochi Metro Rail Ltd.

By
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Abbreviations

IURWTS	Integrated Urban Regeneration and Water Transport System Project.
APL	Above Poverty Line
BPL	Below Poverty Line
CVD	Cardio Vascular Diseases
DLPC	District Level Purchasing Committee
LA	Land Acquisition
NGO	Non - Governmental Organisation
NH	National Highway
NTH	Non - Title Holder
MSW	Master of Social Work
PAP	Project Affected Person
PAF	Project Affected Family
TH	Title Holder
SIA	Social Impact Assessment
SIMP	Social Impact Management Plan
RBDCK	Roads & Bridges Development Corporation Kerala
RTFCTLARR Act	The Right to Fair Compensation and Transparency in Land Acquisition, Rehabilitation and Resettlement Act

CONTENTS

EXECUTIVE SUMMARY

1.1. Introduction: Project and its Public Purpose.

Water ways and Canals were the first organized irrigation and transport system established in the human history. In the 7th century BCE the Assyrian king Sennacherib built a 50-mile (80-km) stone-lined canal 66 feet (20 metres) wide to bring fresh water from Bavian to Nineveh. The Phoenicians, Assyrians, Sumerians, and Egyptians all constructed elaborate canal systems. The most spectacular canal of this period was probably Nahrawān, 400 feet wide and 200 miles long, built to provide a year-round navigation channel from near Sāmarrāʾ to Al-Kūt. Major cities across the world, whether it is Venice, Amsterdam, or London, are known for their well-maintained waterways and canals. They regenerated their waterways, and they are now their life lines. In Kochi, only 20% of waterways are in use for navigation, while the remaining are used as drainage canals.

Mr Logan, Historian and a Traveller who visited Kochi in 1887 wrote that "Cochin possessed great natural facilities for trade as it was the center of an immense area of rich country, tapped in all directions by inland backwaters and navigable creeks. He has recorded that the Cochin River, rather the tidal opening of an immense system of backwaters in which numerous large rivers from the Ghat Mountains lose themselves, stretched north and south into Travancore and Cochin kingdoms and afforded an admirable means of conveying the produce of that immense tract to the markets of Cochin".

Regarding Kochi city, the main canals are navigable for small and medium crafts. The secondary canals used to serve as natural drainage canals in the city for flood waters, but today they are in an advanced stage of deterioration through silting and waste dumping and fail to serve their purpose. The effects of inadequate drainage become visible and real with flooding and water logging of low lying areas during rainy season. The terrain features have adverse influence on the sewerage and drainage system of the area. Percolation of effluent from septic tank and dispersion trenches pollute the ground water. Commercial

wastes are mostly directed to open surface drains. To ensure ruling gradient the drains have to be deepened often below the sea level and the sewage has to be regularly pumped to its outfall regions for disposal. The outfall regions are again the back waters. The back waters further take the load 48 of effluents from the industry, most of which are located in the water fronts and river side. The continued effects of all these factors result in the abuse of water courses, environmental deterioration and public health hazards.

Heavy showers during the monsoons over the whole of the state, sustains a system of rivers and estuaries originating from the Western Ghats. These rivers transport the sediments from high lands and mid lands to the plains and discharge them into Arabian Sea. The interaction between the river discharge and the tidal forces has helped the sediment deposition, there by directly influencing the creation of lagoon system and land forms of the area.

The characteristic physical feature of Kochi is the expanse of backwaters and low lying wet lands. The backwaters of Kochi form part of the Vembanad water basin of the Central Kerala. This, together with a number of canals provides the cheapest means of transportation, especially for bulk goods to and from the city. However due to misuse these canals are not adequately used as waterways for transport. These water bodies are often made to contribute to environmental degradation due to waste dumping and other misuses.

Kochi's lifeline is its waterways. However, the fact is that only 20% of the waterways in the city are being utilized for navigation and transport. The rest 80% have been, across time, reduced to drains. Government of Kerala with its Canal Rejuvenation Project aims to restore and rejuvenate the canals in the city that were once used for navigation and create an extensive and efficient waterway network for Kochi Cites. This will also help to solve the growing concerns over waterlogging during rains, the primary reason for which is poorly maintained canals that serve as rainwater drains.

The project Integrated Urban Regeneration and Water Transport System in Kochi (IURWTS) aim is to restore the city's relationship with canals which were used for navigation until a few decades ago. Now Kochi is facing severe waterlogging

and a reason for that is poor maintenance of canals. This is also emphasis an urgent need to rejuvenate the Kochi's canal network. Through IURWTS Government of Kerala is planning to regenerate five major canals and restore them for the people of Kochi.

1.1. Background of the study

Integrated Urban Regeneration and Water Transport System Project (IURWTS) is a comprehensive efforts of Government of Kerala to rejuvenate the urban life of Kochi City by augmenting five Major canals which are the lifeline of City life in terms of water flow and movement of Vessels. The project also aimed to upscale the standard of human life in both sides of the canal by providing healthy environment. 95 % of the Kochi City is surrounded by water bodies and canals. Five major canals which are having total length of 35km are playing a significant role in the urban life of Kochi City especially in travel and transportation of goods. Historians say that these canals were the major transportation means even before 50-60 years ago. The tide occurred in the backwaters ensure the inflow and out flow of water through the canal. But the inland waterways have been neglected due to the fast development occurred in the roads and rail transportation. The unscientific waste management and dumping of waste into the canal created a dysfunctional in the water ways. But now the Thevara - Perandoor Canal, Thevara Canal, and Market Canal, Chilavannoor Canal and Edappally Canal and their tributary canals is the drainage carrier of the city. But encroachments, Unlawful constructions on banks, putting drainage outlets to the canal etc made the canal become a drainage channel. Many a place the above canals except, Thevara and Market Canal having a width of 2 to 4 mts only. The aim of the project is to develop transportation through canals, regeneration of Kochi city on development basis, strengthen the tourism, and improve the quality of life of the Kochi city and urbanization with proper waste management systems. With the completion of this project, Kochi will have a waterway network of world-class standards, akin to cities like Venice, London and Amsterdam. The project will also improve Kochi's inter-city connectivity by making the canals navigable and double as feeder service to existing public transport systems. Five of Kochi's major canals,

covering a total distance of 34 km will be revived under this project. This includes the Edappally Canal (11.15 km), Chilavanoor Canal (11.023 km), Thevara–Perandoor Canal (9.84 km), Thevara Canal (1.41 km), and Market Canal (0.66 km).

As per plans, these canals will be thoroughly cleaned and freed from pollutants using high-efficiency independent sewage treatment plant and disposal methods. This will curb sewage outfalls, reduce the risk of flooding and help retain and replenish water by ensuring smooth flow. All five canals will be included in the Integrated Urban Regeneration and Water Transport System Project (IURWTS).

As per G.O.(Ms) No.1/2017/CSIND dated 25/03/2017 issued by the Coastal Shipping and Inland Navigation (A) Department, entrusted NATPAC for conducting the feasibility study, for the project "Integrated Urban Regeneration and Water Transport System in Kochi (IURWTS) Project" an Integrated Water Transport Project linking the canals related to Kochi City. Thereafter a Social Impact Assessment Study is conducted for the Rehabilitation and Resettlement of project affected people who will be displaced by the IURWTS project. The study was completed in 2018 and submitted the report. Now the requisition agency of the IURWTS ie Kochi Metro Rail Ltd demanded a revalidation of the data mentioned in the Social Impact Assessment Study before preparing the DPR. Therefore the assignment was included in the TOR of the official consultant agency of the project ie Aneta – Unihom JV. The Consultant agency Aneta - Unihom JV appointed Kerala Voluntary Health Services to do the assessment through a field study by using Social Impact Assessment Tools. This is the background of this report.

1. 3. Benefit of the Project

The project Integrated Urban Regeneration and Water Transport System in Kochi (IURWTS) aim is to restore the city's relationship with canals which were used for navigation until a few decades ago. Now Kochi is facing severe waterlogging and a reason for that is poor maintenance of canals. This is also emphasis an

urgent need to rejuvenate the Kochi's canal network. Through IURWTS Government of Kerala is planning to regenerate five major canals and restore them for the people of Kochi.

The five major canals which are covering a total length of 34 km are Edappally Canal (11.23 km), Chilavanoor Canal (11.15 km), Thevara–Perandoor Canal (9.88 km), Thevara Canal (1.41 km), and Market Canal (0.66 km). These canals will be cleaned and free from the pollutants by setting up independent sewage treatment plant and disposal systems, curbing sewage outfalls, reducing the risk of flooding, and retaining and replenishing water by ensuring its smooth flow. The accessibility will be improved by making canals navigable, improving connectivity and enhancing cross-connectivity by making the navigable routes a feeder service to the existing public transport systems.

Antea India Pvt. Ltd who works for the requisition agency i.e. Kochi Metro Rail Ltd. decided to conduct a social impact assessment study with special focus on Rehabilitation and Resettlement of Project affected and displaced families. The project would acquire land from banks of Thevara-Perandoor, Edappally, Chilavanoor, Thevara and Market canals of Ernakulam district. The preliminary survey identified 14,481 people and 3264 buildings as project affected. The proposed project of widening the canal and improve the water transport will boost the tourism and business transport of the commercial capital of Kerala i.e. Kochi.

1.4. Project Location

The proposed project is located in 27 Corporation wards of Kochi corporation and 12 Municipal wards of Maradu, Trikkakara and Kalamaseery Municipalities of Ernakulam district Kerala. Geographically the area is situated between Northern Latitude 9°58' and Eastern longitude 76°16'. The project area is characterized by sandbars running in the North-South direction with tidal canals in between. The importance of the location in the region is evident from its population size and growth. The project area Agglomeration ranks seventeenth with a population of about 21.17 lakh. It is the largest urban agglomeration in the state. Being a coastal area majority of the project area is

within the low land regions. The average altitude towards the eastern fringes is about 7.5 m above MSL, and towards the west the altitude is less than one meter on an average. The whole of the land slopes gradually from east to west. The flat terrain of the central part of the project area with the low altitude interspersed with a network of canal system provide link to the backwaters.

The annual variation of temperature in the Project region is between 220 C and 320 C and a more or less uniform temperature exists throughout the year. Because of the nearness to the sea and due to the large area of backwaters in the region, the humidity is high all-round the year. The area has a tropical climate with intense solar radiation and abundant precipitation. The region experiences only two major seasons, namely the dry season and the wet season, as in all other places in Kerala. The wet season is usually associated with the months in which the south-west and north-east monsoon occur. The northeast monsoon commences in October and continues till November. The rain fall varies from 1500 mm to 2000 mm during south west monsoon and 400 to 700 mm during the north-east monsoon. The maximum annual rainfall in the region is around 3000 mm.

The soil of the project location can be broadly classified into two categories viz. alluvial and lateritic. The lateritic soil covers the eastern portion of the area. The soil is porous and well drained and hence suited for all garden works. On removal of the top soil, laterite is present as a homogeneous mass which can be cut as building blocks. The alluvial soil is the characteristic type seen over the remaining part of the location. It has been formed from the deposition and consolidation of river discharge laden with fine silt and clay. Soil exploration has revealed that this deposit is present even to a depth of about 50 metre from the sea level. This fact presents the unique foundation engineering problems of this area.

Banks of the five major canals which covering a total length of 34 km ie. Edappally Canal (11.23 km), Chilavanoor Canal (11.15 km), Thevara–Perandoor Canal (9.88 km), Thevara Canal (1.41 km), and Market Canal (0.66 km) are the project affected area. The locations in which these canals are flowing are the

location of the project. Estimate shows that 8% of the total city area is coming under the location. Historians claimed that the city of Ernakulam grown up gradually in the banks of the canals because the major transport and trade means was the canals in ancient times. Therefore, a thickly populated habitation is existing in the project area. The land use pattern shows that 73% are residential, 12. % are commercial 10% are Public or Government land and remaining in other use.

The annual variation of temperature in the Kochi region is between 220 C and 320 C and a more or less uniform temperature exists throughout the year. Because of the nearness to the sea and due to the large area of backwaters in the region, the humidity is high all-round the year. Kochi has a tropical climate with intense solar radiation and abundant precipitation.

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1.5. The Canals under the Project

1.5.1 Thevara Canal

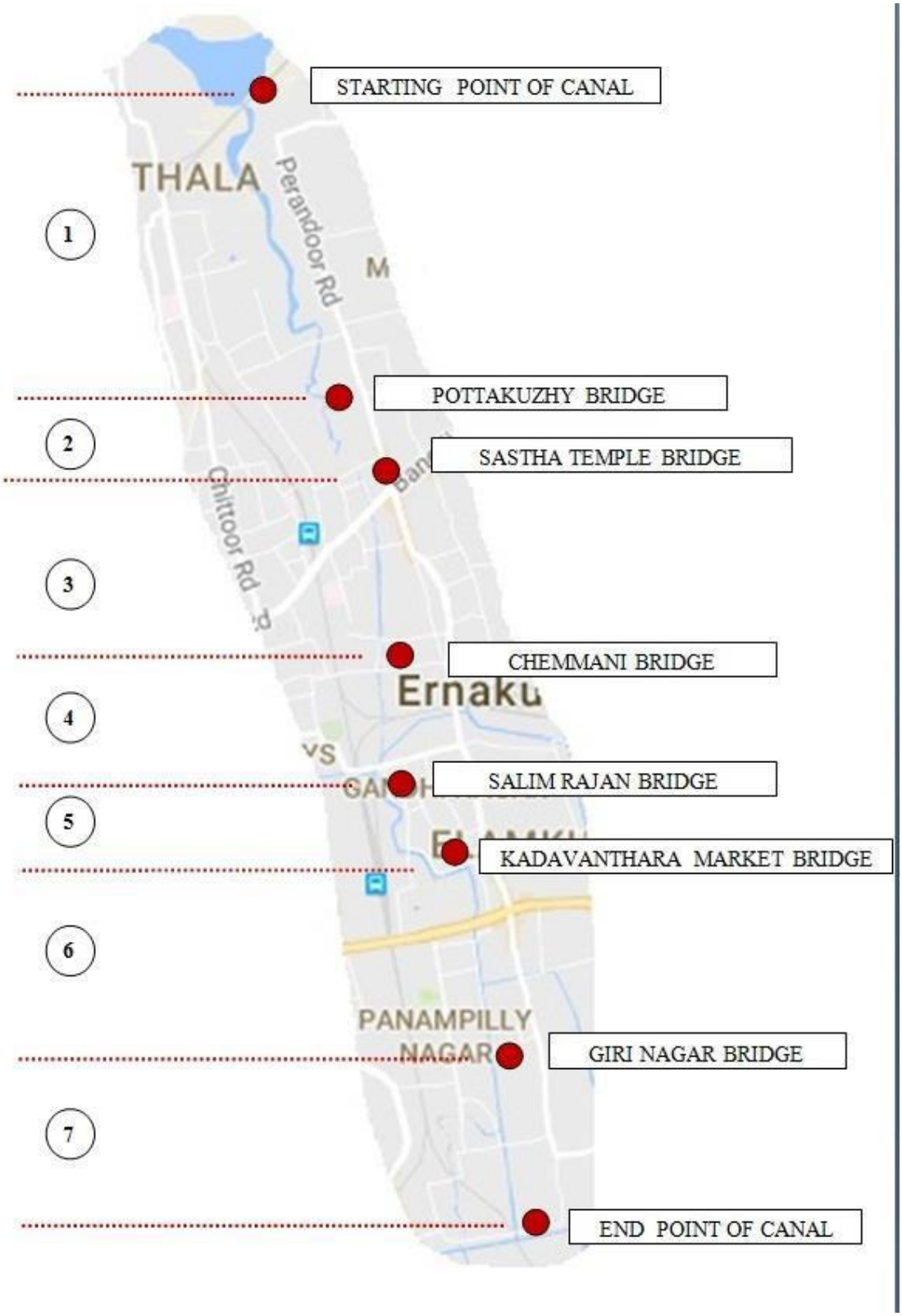
The canal originates from VenduruthyPuzha (9° 56' 37.20"N and 76° 17' 32.50"E) and connects with KundanoorPuzha (9° 56' 47.18"N and 76° 18' 17.57"E). This canal is linked with National Waterways No.3 and Thevera-Perandoor canal. The major places it passes through are Thevara market, Koithara and Kallumpalam.

The developed canal is having potential of connecting Chembakkara canal with Inland Water Authority of India (IWAI) terminal at Maradu. The total length of the canal is 1.41km. The average width and depth of the canal is 18.5m and 1m-1.5m respectively. The flow is towards western side and it is affected by the settlers through dumping of solid waste into the canal. The waste generated from the fish market situated on right bank at 0.2km chainage is another major source of pollution.

1.5.2 Thevara – Perandoor

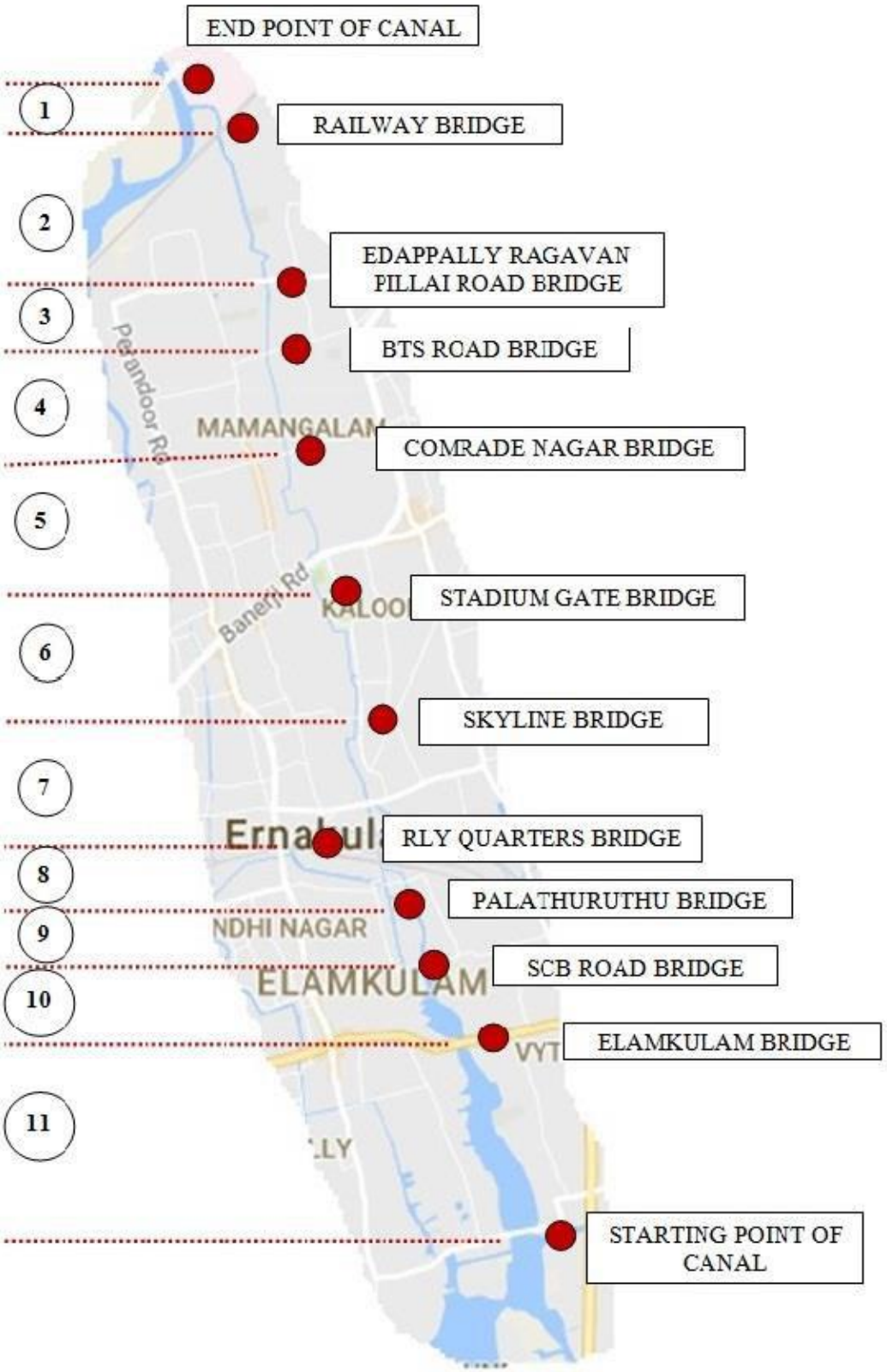
The canal starts from Perandoor Puzha at Railway bridge (10° 01' 12.00"N and 76° 16' 56.00"E) and connects Thevara canal at Railway bridge (9° 56' 44.37"N and76° 18' 02.45"E). The canal passes through the major places like Perandoor, Vaduthala, Pachalam, Kaloor, Ernakulam South, Giri Nagar, Kadavanthara andPanampilly Nagar. The total length of the canal is 9.88km. The width of canal is varying from 8.0m to 48m and the average width is 17.9m. The depth of canal varies between 0.6m and 1.0m.

The canal flow is maintained by Perandoor puzha a branch of Periyar river at northern end and Thevera Canal a branch of Chembakkara canal on southern end. The wider portion of canal exists between staring point (0.00km) and Sastha temple Road Bridge (3.45km). Due to metro construction along Kaloor road corridor the canal is blocked at 3.78km. The canal is stagnant between this point and Judges avenue road bridge due to absence of flow of water. Another bottleneck at chainage 5.33km – 5.356km is observed i.e., the canal is partially blocked and a small channel from 5.40km is started again. The weeds growth is intensive at the section 5.40km – 5.70km due to blockage of canal flow. The wider portion of the canal again starts from SalimRajan road bridge(5.75km) and extended up to ending point of the canal.


STARTING POINT OF CANAL
THALA
Perandoor Rd
1
POTTAKUZHY BRIDGE
2
SASTHA TEMPLE BRIDGE
Chittoor Rd
3
CHEMMANI BRIDGE
4
SALIM RAJAN BRIDGE
5
KADAVANTHARA MARKET BRIDGE
6
PANAMPILLY NAGAR
GIRI NAGAR BRIDGE
7
END POINT OF CANAL

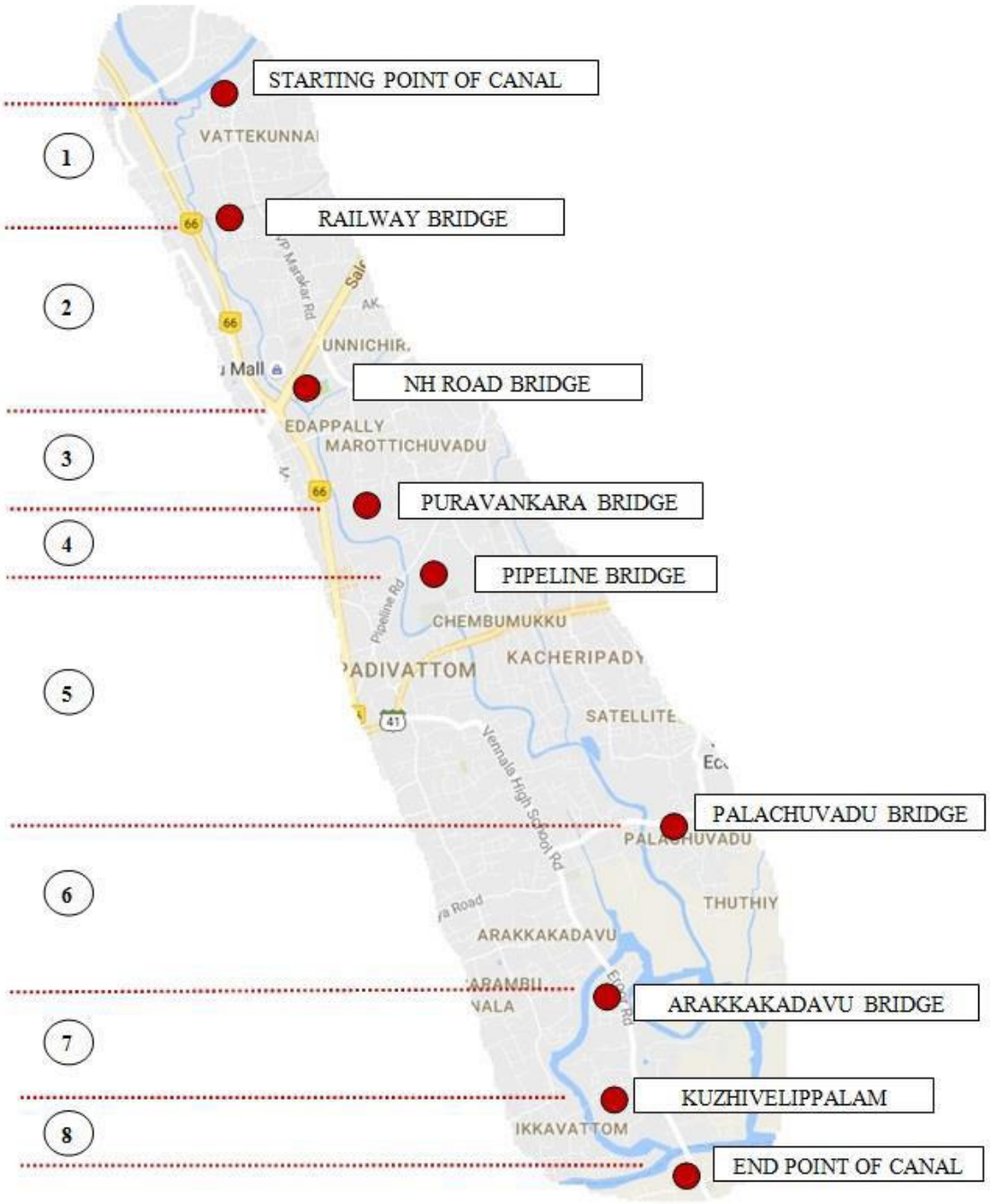
1.5.3 CHILAVANOOR CANAL

Chilavanoor canal originates from Champakkara Canal (09° 57' 11.27"N and 76° 18' 49.22"E) of National Waterway- 3 and ends at PerandoorPuzha (10° 01' 53.39"N and 76° 17' 23.49"E) back side of the Amritha Institute of Medical Science (AIMS), Edapally. The canal passes through Chilavanoor, Elamkulam, Kathrikkadavu, Kaloor, International Stadium and Elamakkara. The wider portion of the canal is existing for the stretches starting point of the canal to SCB road bridge and Edapally Ragavan bridge to end point of the canal. The major bottle neck is missed link between 6.79km -6.86km i.e. the canal portiopassing Kaloor - Palarivattom road. Due to metro construction the canal is diverted through a pipeline and it passes through KSEB Sub-Station, Kaloor premise covered by concrete slabs. The same situation is extended up to the chainage 7.19km i.e., end of KSEB, Kaloor sub-station end. Again the canal is covered by RCC slab between the sections 7.25km – 7.30km and 7.585km – 7.65km. Similarly, average width of 1.5m RCC slabs of 5 Nos. exists between Keerthinagar bridge to BTS Road Bridge. The canal is divided in to eleven stretches according to width, depth, population density and accessibility. The Figure 6.2 shows the study area and its divisions. Total length of the canal is 11.15 km. Canal width varies from 3.5m to 200m and the average width is 34m and depth ranges between 0.6m to 1.1m.


END POINT OF CANAL
1
RAILWAY BRIDGE
2
EDAPPALLY RAGAVAN PILLAI ROAD BRIDGE
3
BTS ROAD BRIDGE
4
MAMANGALAM
COMRADE NAGAR BRIDGE
5
STADIUM GATE BRIDGE
6
SKYLINE BRIDGE
7
RLY QUARTERS BRIDGE
8
PALATHURUTHU BRIDGE
9
SCB ROAD BRIDGE
10
ELAMKULAM
ELAMKULAM BRIDGE
11
STARTING POINT OF CANAL

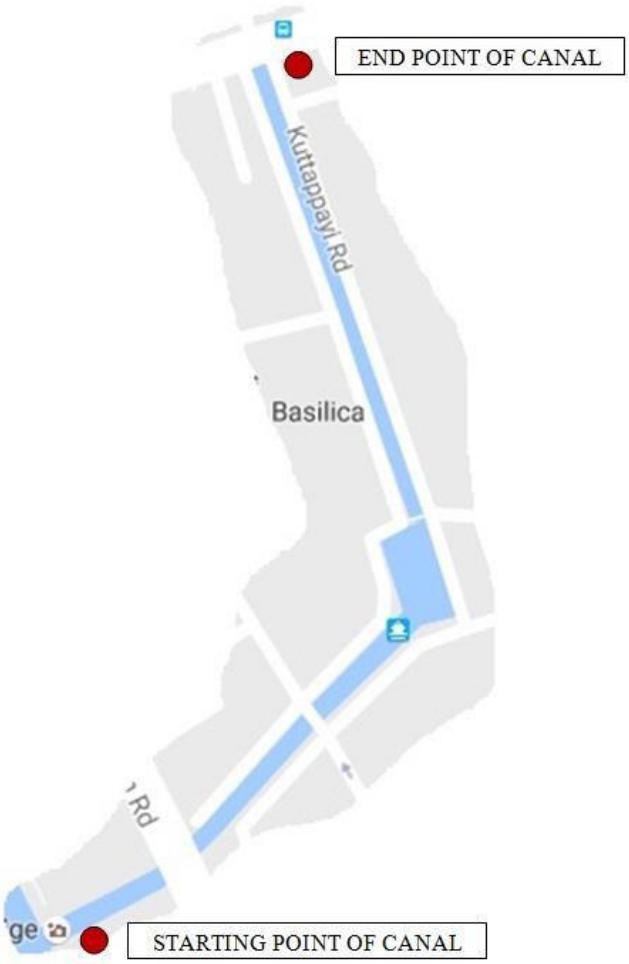
1.5.4 Edappally Canal

Edapally canal starts from Muttar Bridge (10° 02’ 36.78” N and 76° 18’ 12.40” E) and connects with Champakkara Canal (part of NW-3) near Eroor Bridge (09° 58’ 46.47” N and 76° 19’ 56.29” E) as its end point. It passes through Edapally, Vennala, Chakkaraparambu and Chalikkavattom. This canal provides the shortest link between the two industrial hubs of Kochi namely - Udyogamandal and Ambalamugal. Improvement of this canal will facilitate reduction in transportation cost of cargo movement between these two industrial hubs. Total length of the canal is 11.23km. Canal width varies from 28.72m (average) and depth ranges between 0.8m to 1.30m (average). It is perennial water body and presently, there is no visible water flow in most of the portions of the canal.


STARTING POINT OF CANAL
RAILWAY BRIDGE
NH ROAD BRIDGE
PURAVANKARA BRIDGE
PIPELINE BRIDGE
PALACHUVADU BRIDGE
ARAKKAKADAVU BRIDGE
KUZHIVELIPPALAM
END POINT OF CANAL
1
2
3
4
5
6
7
8
VATTEKUNNA
UNNICHIR
EDAPPALLY
MAROTTICHUVADU
CHEMBUMUKKU
KACHERIPADY
SATELLITE
PALACHUVADU
THUTHIY
ARAKKAKADAVU
IKKAVATTOM

1.5.5 Market Canal

The canal starts from Ernakulam channel at Rainbow bridge (09° 58 47.65 N and 76° 16 30.15 E) and it ends at Banerji Road (09° 59 05.09 N and 76° 16 34.31 E). The Market Canal is passing through Broadway and the Market road - the commercial hub of the City - where the bulk of wholesale and retail activities of the city take place. Even though the length of the canal is small, is having tourism potential at starting point i.e., The Marine drive and possibility of cargo movement through Rainbow bridge to market area. The total length of the canal is 0.66km. The average width and depth of the canal is 9.94m and 0.6m-1.0m respectively.



1.5. Size and Attributes of Land Acquisition

Land Acquisition Authority

District Collector, Ernakulam is the Land acquisition Authority. Under his direction Dy. Collector (LA), Ernakulam and Thahasildars prepares the acquisition details including land sketched and extent of acquisition etc. No Boundary stones placed or boundary marked for the project.

1.6. Details of project affected families

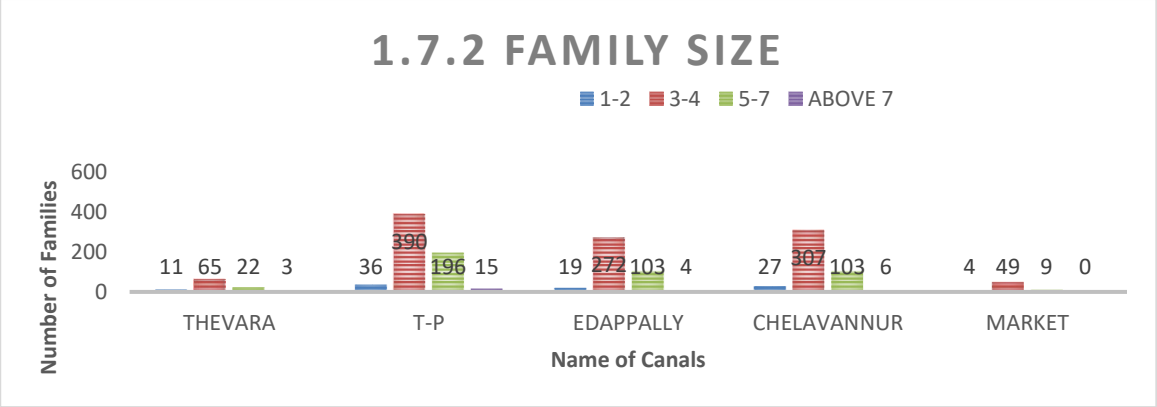
The study finds that out of one thousand six hundred and forty-one families are affected by the project. The cast distribution shows that 8% Title holders belongs to Scheduled Cast and 1% are Scheduled Tribe. But 35% of title holders are belongs to Other Backward Community. The education qualification shows that all THs are literate and 82 % are having SSLC and above qualifications.13% of affected families are squatters and 2% are encroachers. Religious distribution shows that 36% are Hindus and 13% are Muslims and 51% are Christians. The economic status reveals that 43 Title holders are having monthly income of less than Rs.10, 000. 14% families are having BPL status in ration cards. Occupational distribution is showing that self-employment is dominating, followed by business. 95% of Title Holders are married. 66% of the families are having the size of 3-4 members. Only 21% of title holders claimed that they have monthly income more than Rs.24,000/- In the other side 43% title holders claimed that they have monthly income less than Rs.10,000/-

Table 1.7.1 Distribution of Project Affected Title Holders

Name of Canal	Total Families Affected	Title Holders					Squatters					Encroachers				
		Total	SC	ST	OBC	General	TOtal	SC	ST	OBC	General	Total	SC	ST	OBC	General
Thevara	**101**	**95**	17	0	27	51	**2**	0	0	2	0	**4**	2	0	1	1
Thevara – Perandoor Canal	**637**	**475**	5	0	159	311	**145**	69	6	54	16	**17**	3	0	3	11
Edappally Canal	**398**	**356**	4	4	109	239	**29**	17	0	9	3	**13**	1	0	0	12
Chilavanoor Canal	**443**	**396**	1	0	152	243	**31**	13	2	11	5	**16**	0	0	6	10
Market Canal	**62**	**62**	1	1	33	27	**0**	0	0	0	0	**0**	0	0	0	0
Total	**1641**	**1384**	28	5	480	871	**207**	99	8	76	24	**50**	6	0	10	34

Name of Canal	Size of Family				
	1-2	3 - 4	5-7	Above 7	Total
Thevara	11	65	22	3	101
Thevara-Perandoor	36	390	196	15	637
Edappally	19	272	103	4	398
Chellavannur	27	307	103	6	443
Market	4	49	9	0	62
Total	97	1083	433	28	1641

Table 1.7.2 Family Size



1.7. Details of the acquiring land

The total land need to acquire for the project is approximately 41 Hectares. 1151 structures are affected by the project. Out of it 311 are displaced. 33% of acquiring land is owned by Government. Only 41% of acquiring land is in the possession of title holders. All the acquiring land is commercial in nature except few hectares of land with Orchard. 32% of the land is having structures. 80% of the acquiring land is not having any type of road frontage.

Name of Canal	Land Required in Hector	Govt. Land	Govt. Land in Private Possession	Private land	No. of Residence displaced											
					Squatter				Encroacher				Owner			
					Multi storied	Pucca	Hut with shed	**Total**	Multi storied	Pucca	Hut with shed	Total	Multi storied	Pucca	Hut with shed	**Total**
Thevara Canal	1.00 Htr.	0.90 Htr	0.10 Htr	0	0	1	1	**2**	2	2	0	**4**	0	2	0	**2**
Thevara – Perandoor Canal	12.5 Htr.	4.20	3.40	4.90 Htr.	0	13	123	**145**	5	12	0	**17**	3	17	0	**20**
Edappally Canal	9.00 Htr.	3.90	2.30	2.80 Htr.	0	0		**29**	4	9	0	**13**	4	6	0	**10**
Chilavano or Canal	17.5 Htr.	4.10	3.80	9.60	0	13	0	**31**	8	8	0	**16**	4	18	0	**22**
Market Canal	1.00 Htr.	0.58	0.05	.07	0	0	0	**0**	0	0	0	**0**	0	0	0	**0**
Total	41.00	13.68	9.65 *	17.37	0	27	124	**207**	19	31	0	**40**	11	43	0	**4**

Table 1.8.1. DISTRIBUTION OF ACQUIRED LAND BASED ON OWNERSHIP & RESIDENTIAL PROPERTIES AFFECTED

Name of Canal	**Total Length (Both Side)**	**Access with**		
		Approach road (k.m.)	Walk Way	No Access
Thevara Canal	2.800	1.200	0	1.600
Thevara – Perandoor Canal	19.5	5.950	0.960	12.590
Edappally Canal	22.30	1.150	1.200	19.950
Chilavanoor Canal	22.5	1.800	0.600	20.100
Market Canal	1.20	0.900	0	0.300

Table 1.8.2. DISTRIBUTION OF THE PROJECT AREA BASED ON ACCESS

Name of Canal	**Land Required in Hectare**	**Land with Orchard**	**Barren Land**	**Land with Structure (Hectare)**
Thevara	1.00 Hectare	0	0	0.1
Thevara – Perandoor Canal	12.5 Hectare	1.5	1.7	5.1
Edappally Canal	9.00 Hectare	0.8	1.2	3.1
Chilavanoor Canal	17.5 Hectare	1.3	2.0	4.60
Market Canal	1.00 Hectare	0	0	0.12
Total	**41.00 Hectare**	**3.6**	**4.9**	**12.92**

Table 1.8.3 TYPE OF PRIVATE LAND ACQUIRED

1.9. Socio Economic Profile of the Influence Area

1.9.1 Socio Economic pattern

1.9.1.1 Kochi Corporation Wards: There are 41 Corporation wards of Kochi Corporation are coming under the influence of the project. As per the 2011 censes total population of Kochi corporation is 6,33,553 and density of population 5,914/km2.The average literacy rate is 96.29%(Male:97.64 and Female:94.99).Sex ratio shows that 1000 Males having 1030 female and it is just below the state average. 3.85% of population are belongs to scheduled cast (socially vulnerable).Only 2,344 people are schedule tribe (Indigenous).As per the 2011 censes 58% of population is unemployed.

1.9.1.2 Maradu Municippality: Five wards of Maradu Municipplality coming under the project influence. Total population recorded in 2011 censes is 44,704. Religious distribution says that 49.23% are Hindus, 35.67% are Christians and 14.87% are muslims. Cast wise 8.81 % are scheduled cast and 0.58% are Sheduled tribes. Literacy rate is 85.5%. Sex ratio shows that 1000 male having 1016 female and it is below the state average.

1.9.1.3. Thrikkakkara Municipality: Seven wards of Thrikkakkara Municipality coming under the influence of the project. As per the 2011 censes the total population of the municipality is

77,319 and density of population is 2800/km2.Religious distribution says that 49.42% are Hindus, 27.01% are Christians and 21.92% are Muslims. The Cast distribution shows that 15.71 % are Scheduled cast and 0.44% are scheduled tribes. Literacy rate is 93.75 and sex ratio is 1000: 1002.

1.9.1.4 Kalamassery Municipality: Three wards of Kalamasserry Municipality coming under the project influence. As per the 2011 cense the total population of the municipality is 70776 having literacy rate of 95.87%.Sex ratio is 1000:1011. Religious distribution says that 41.77% are Hindus, followed by 34.53% Muslims and23.42% Christians. Cast distribution shows that 7.93% are scheduled cast and 0.54% is scheduled tribe.

Name of Canal	Social Category					
	Scheduled Cast (SC)	Scheduled Tribe (ST)	Other Back Ward Class (OBC)	General	Other	Total
Thevara	19	0	30	52	0	101
Thevara-Perandoor	77	6	216	338	0	637
Edappally	22	4	118	254	0	398
Chellavannur	14	2	169	258	0	443
Market	1	1	33	27	0	62
Total	133	13	566	929	0	1641

Table 1.9.1.1 Social Category of Affected Families

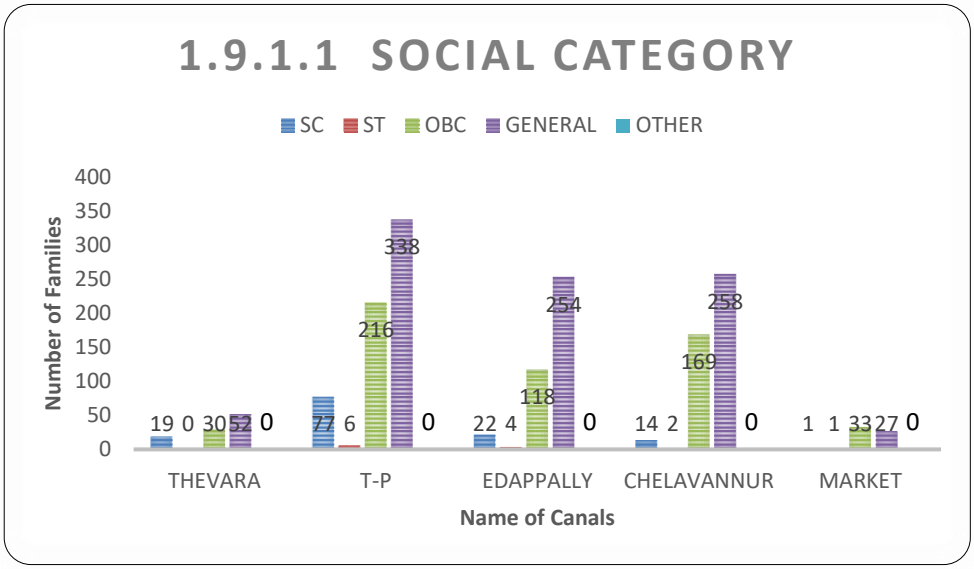
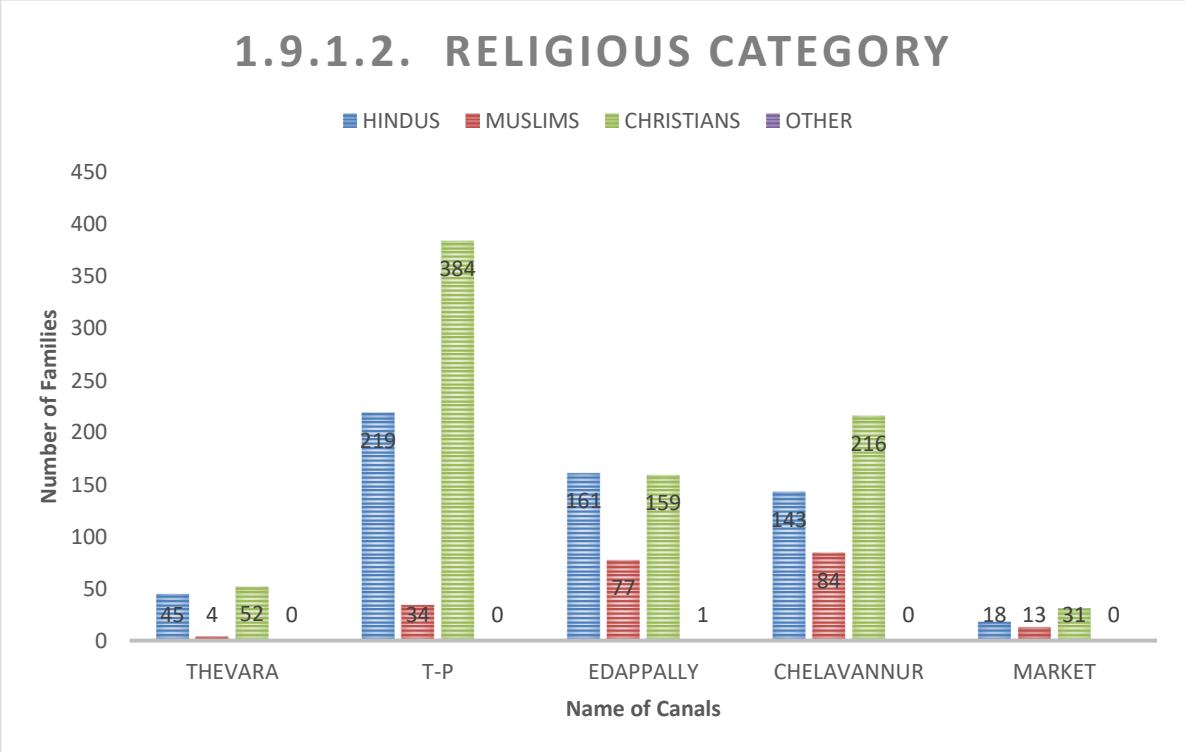


Table 1.9.1.2. Religious wise distribution of Affected Families

Name of Canal	Religious Category				
	Hindus	Muslims	Christians	Other	Total
Thevara	45	4	52	0	101
Thevara-Perandoor	219	34	384	0	637
Edappally	161	77	159	1	398
Chillavanoor	143	84	216	0	443
Market	18	13	31	0	62
Total	586	211	842	1	1640



Name of Canal	Literacy Level							
	Illiterate	Below 10th	SSLC	11th & 12th	Degree	PG/ professional	Other	Total
Thevara	0	13	44	16	7	4	17	101
Thevara-Perandoor	0	133	245	143	42	24	50	637
Edappally	0	62	144	89	51	25	27	398
Chilavanoor	0	71	195	69	39	34	35	443
Market	0	19	15	12	6	7	3	62
Total	0	298	643	329	145	94	132	1641

Table 1.9.1.3 Literacy Level of Affected Families

Name of Canal	Marital Status of PAPs					
	Married	Unmarried	Widow	Separated	Other	Total
Thevara	90	3	3	0	5	101
Thevara-Perandoor	611	18	8	0	0	637
Edappally	375	12	11	0`	0	398
Chilavanoor	419	9	13	2	0	443
Market	60	2	0	0	0	62
Total	1555	44	35	2	5	1641

Table 1.9.1.4 Marital Status of Affected Title Holders

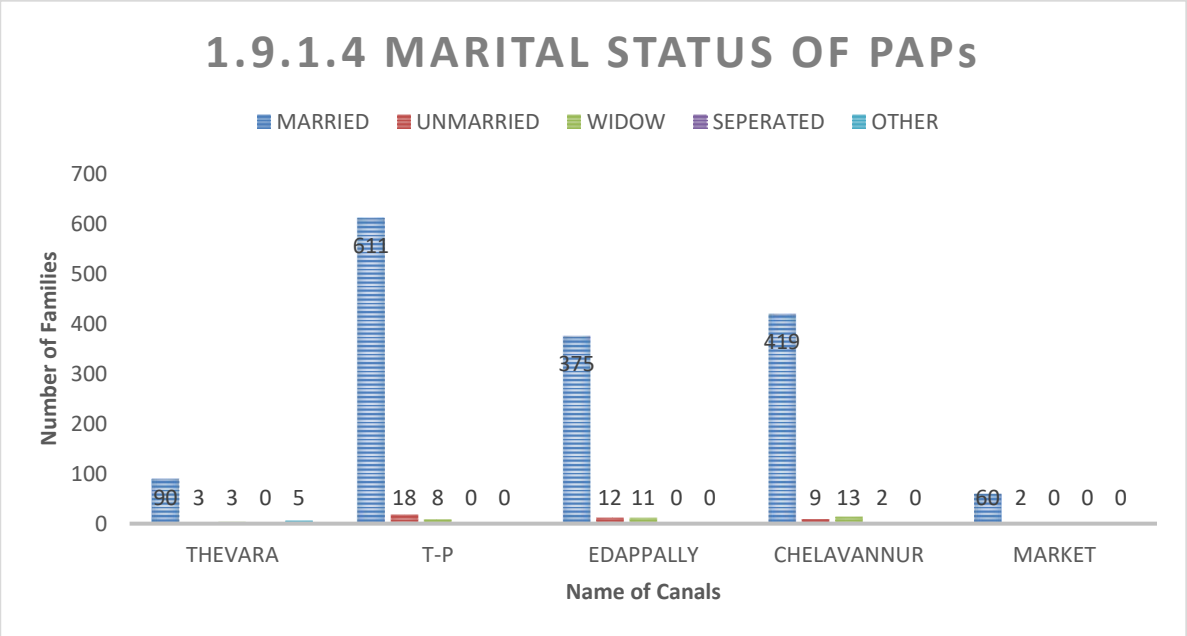
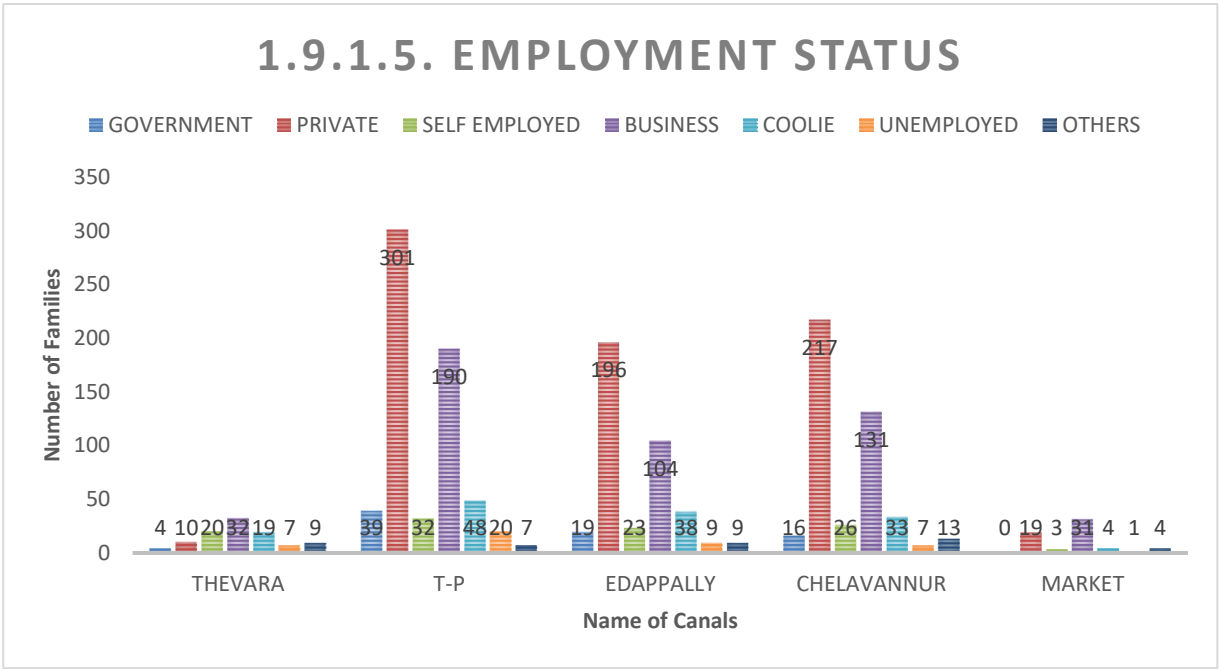


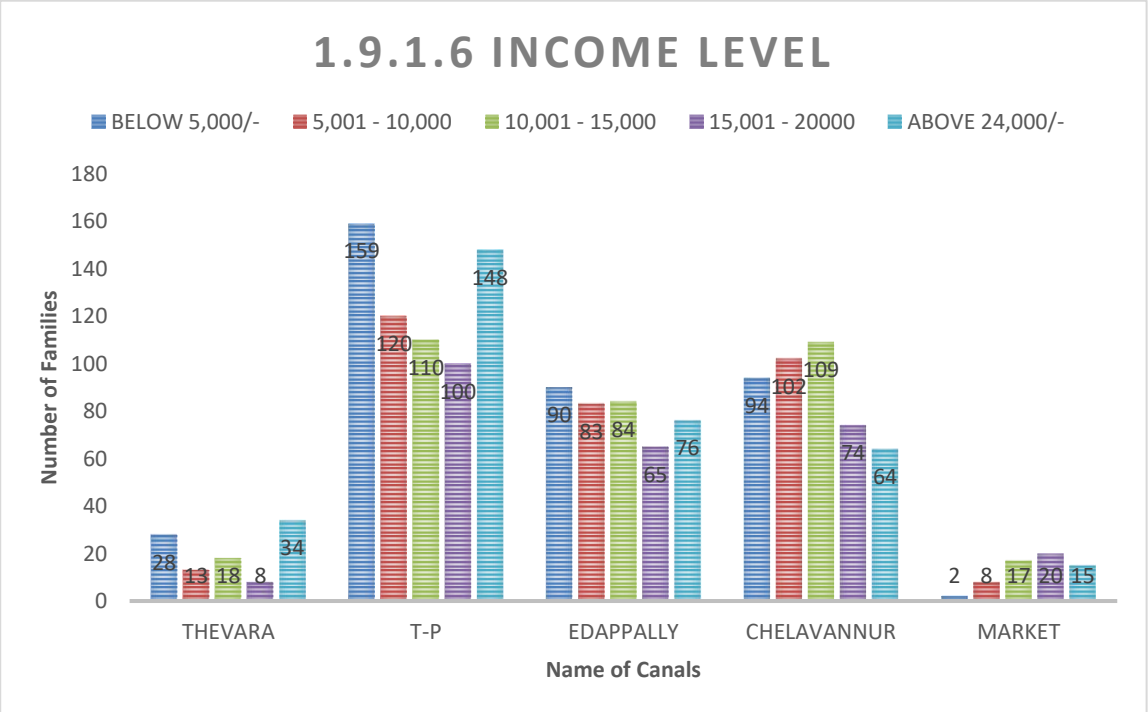
Table 1.9.1.5 Distribution of Title Holders on Employment Status

Name of Canal	Employment Status							
	Government	Private	Self-Employed	Business	Coolie	Unemployed	Others	Total
Thevara	4	10	20	32	19	7	9	101
Thevara-Perandoor	39	301	32	190	48	20	7	637
Edappally	19	196	23	104	38	9	9	398
Chilavanoor	16	217	26	131	33	7	13	443
Market	0	19	3	31	4	1	4	62
Total	78	743	104	488	142	44	42	1641



Name of Canal	Monthly Income Level					
	Below 5,000/-	5000 – 10000	10,000 – 15000	15001 – 20000	Above 20,000/-	Total
Thevara	28	13	18	8	34	101
Thevara-Perandoor	159	120	110	100	148	637
Edappally	90	83	84	65	76	398
Chilavanoor	94	102	109	74	64	443
Market	2	8	17	20	15	62
Total	373	326	338	267	337	1641

Table 1.9.1.6 Monthly Income base distribution of Title Holder



1.10. Alternatives Considered

Sl.No.	Alternatives proposed	Analysis
1	Deepening the existing canals and widen the necessary areas without displacing structures.	This will not help to achieve the project objective.
2	Widen the canals throughout the length with 20.5 mtr width and displaced all structures in the canal side for walk way/road.	Huge number of structures will be displaced.

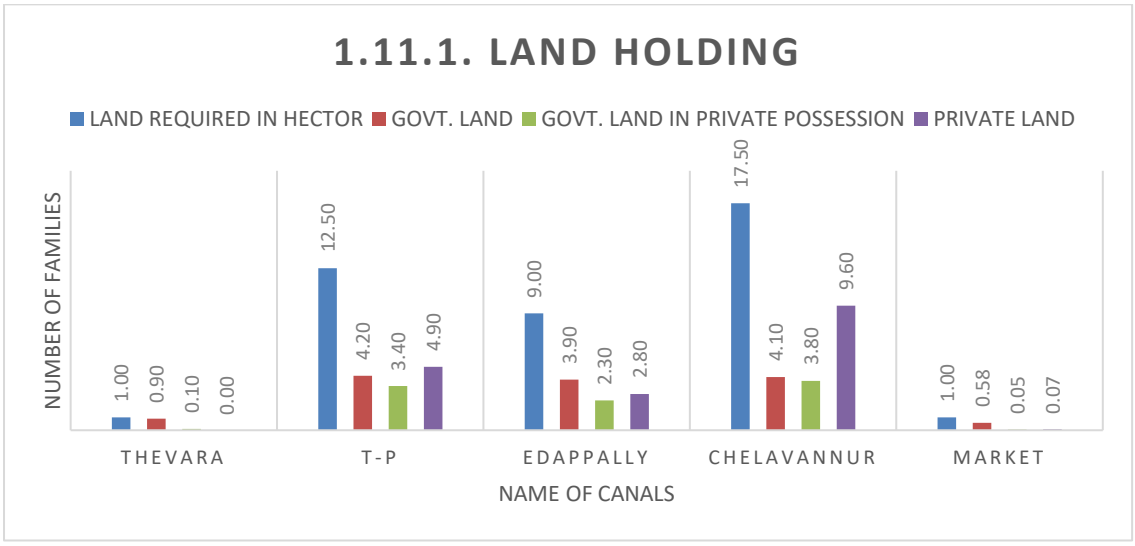
Table 1.10.1.Alternative proposed

1.11. Social Impact

The major impact of the project is the loss of land and structure. The study shows that 653 residential structures and 114 commercial structures are affected by the project. 41 hectors of land needs to be acquired. Out of it 13 hector is having structures. 514 trees are needs to be cut down and 548 livestock units either affected or need to be shifted. 207 squatter residences are affected by the project. Most of these squatters are living in four major colonies. 40 encroachers are also losing their residential structure. The positive impact of the project is the up gradation of major canals with navigation facilities. This may improve environmental hygiene in an around the canal and will solve water logging problems in the city.

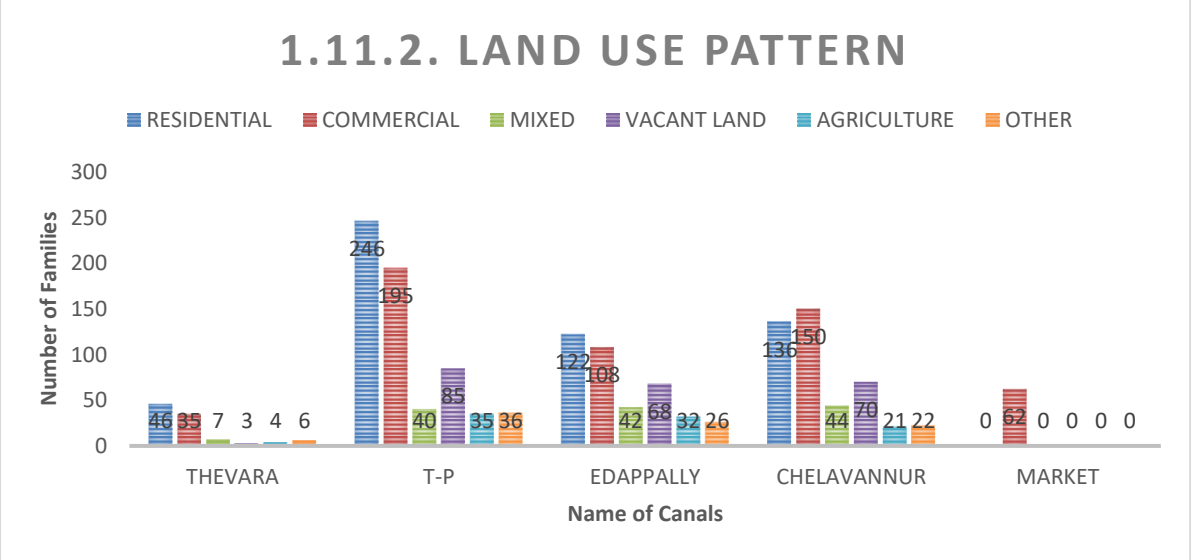
Name of Canal	Land Holdings				
	Land Required in Hector	Govt. Land	Govt. Land in Private possession	Private Land	Total
Thevara	1.00	0.90	0.10	0	2
Thevara-Perandoor	12.5	4.20	3.40	4.90	25
Edappally	9.00	3.90	2.30	2.80	18
Chilavanoor	17.5	4.10	3.80	9.60	35
Market	1.00	0.58	0.05	0.07	1.7
Total	41	13.68	9.65	17.37	81.7

Table 1.11.1.Land Holding Pattern



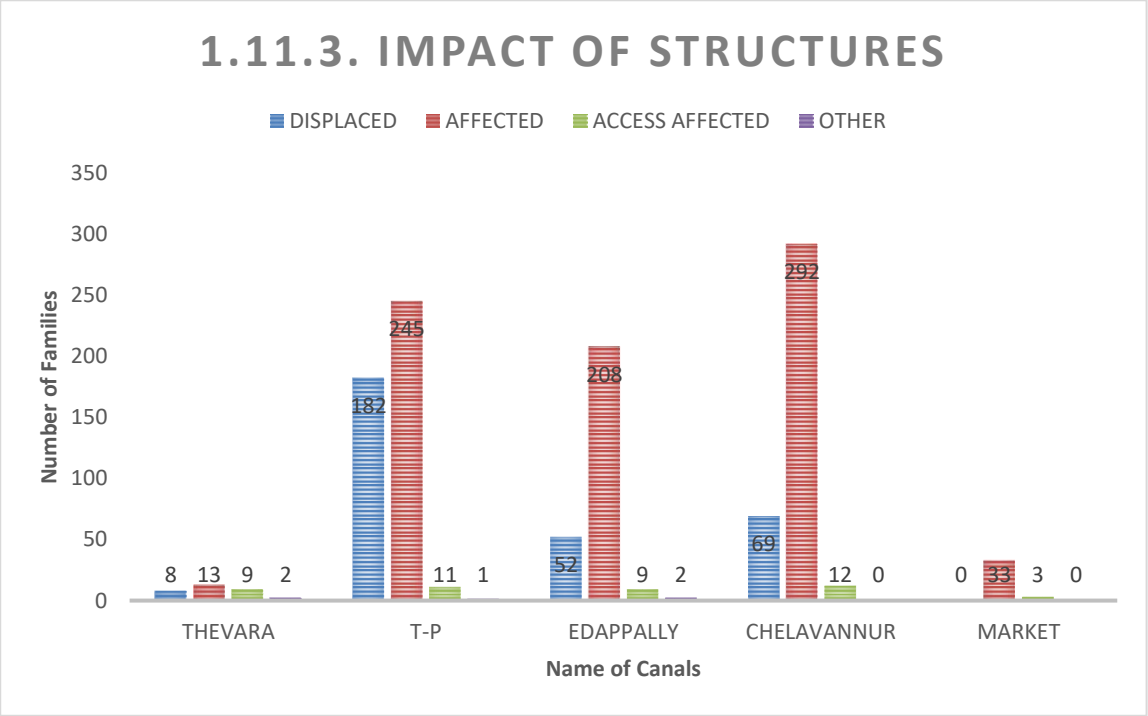
Name of Canal	Land Use Pattern						
	Residential	Commercial	Mixed	Vacant land	Agriculture	Other	Total
Thevara	46	35	7	3	4	6	101
Thevara-Perandoor	246	195	40	85	35	36	637
Edappally	122	108	42	68	32	26	398
Chilavanoor	136	150	44	70	21	22	443
Market	0	62	0	0	0	0	62
Total	550	550	133	226	92	90	1641

Table 1.11.2 Land Use Pattern



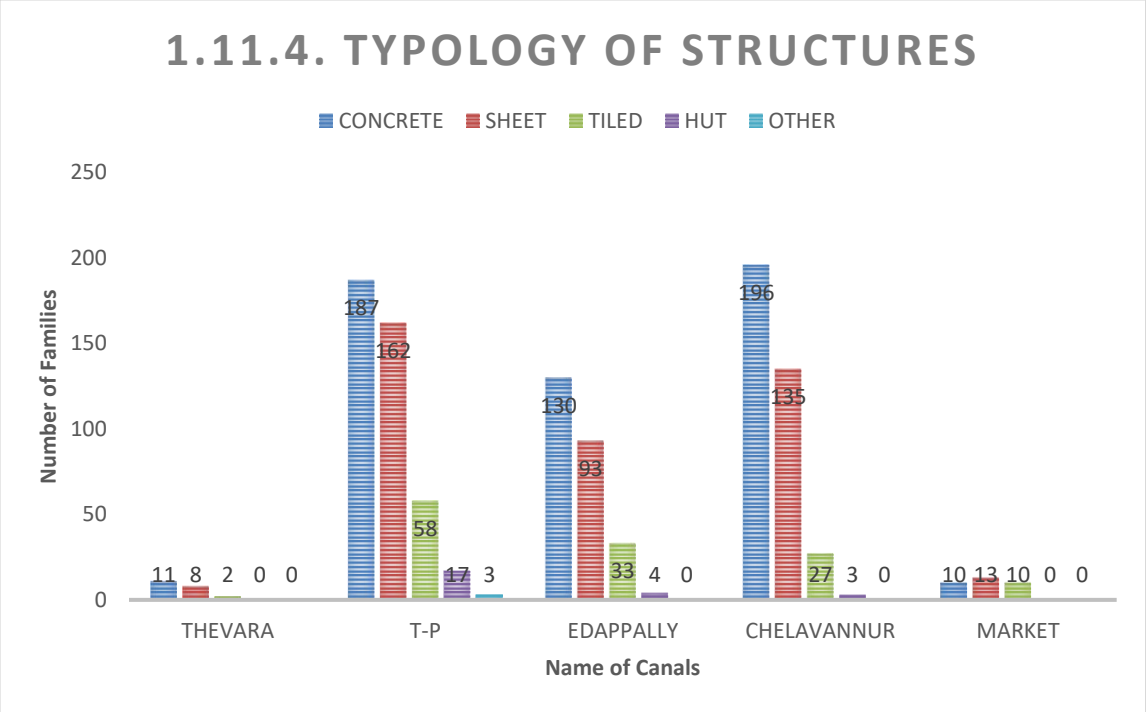
Name of Canal	Impact on Structure				
	Displaced	Affected	Access affected	Other	Total
Thevara	8	13	9	2	32
Thevara-Perandoor	182	245	11	1	439
Edappally	52	208	9	2	271
Chilavanoor	69	292	12	0	373
Market	0	33	3	0	36
Total	311	791	44	5	1151

Table 1.11.3.Impact on Structure



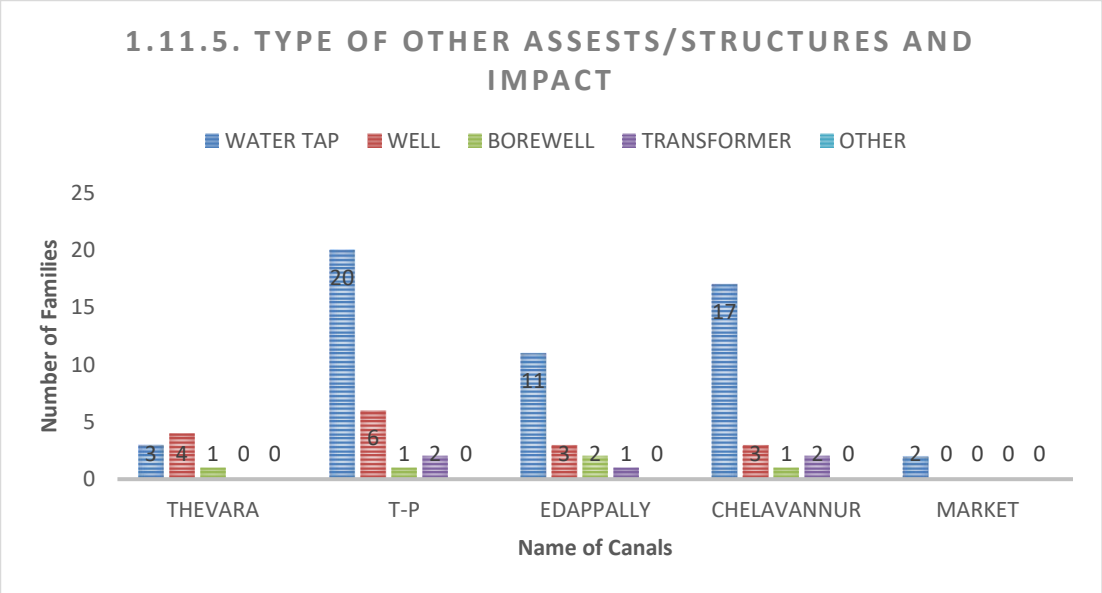
Name of Canal	Type of structure					
	Concrete	Sheet	Tiled	Hut	Other	Total
Thevara	11	8	2	0	0	21
Thevara-Perandoor	187	162	58	17	3	427
Edappally	130	93	33	4	0	260
Chilavanoor	196	135	27	3	0	361
Market	10	13	10	0	0	33
Total	534	411	130	24	3	1102

Table 1.11.4.Type of Structure



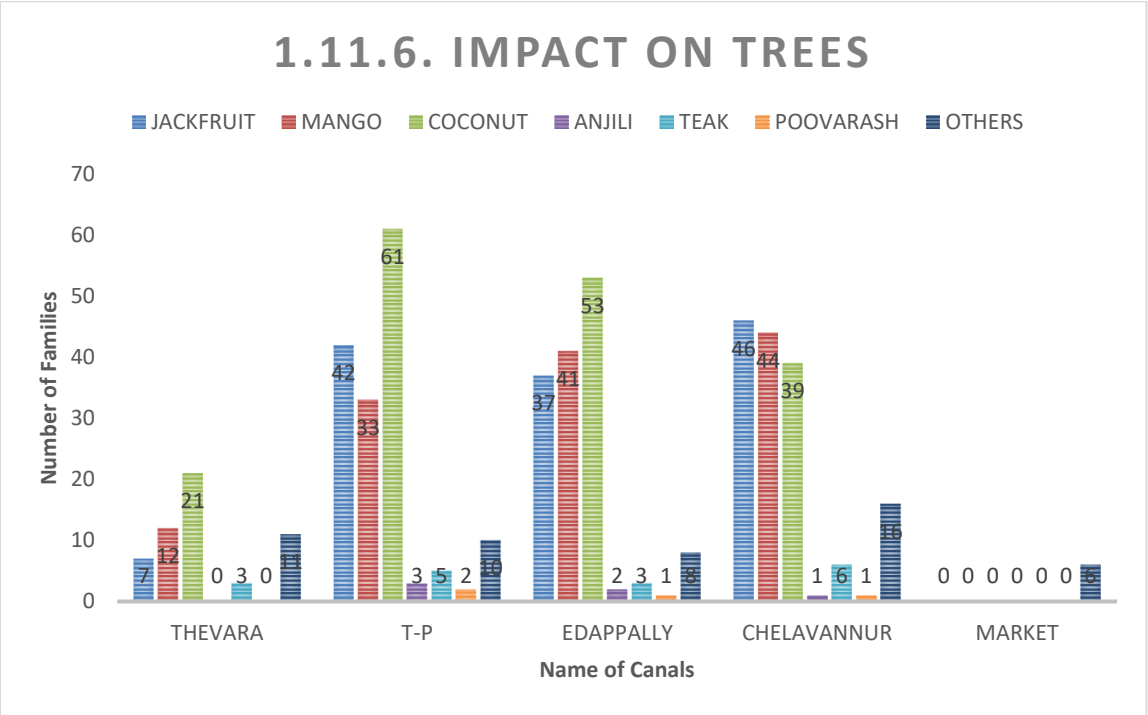
Name of Canal	Structure Use Pattern					
	Water Tap	Well	Bore well	Transformer	Other	Total
Thevara	3	4	1	0	0	8
Thevara-Perandoor	20	6	1	2	0	29
Edappally	11	3	2	1	0	17
Chilavanoor	17	3	1	2	0	23
Market	2	0	0	0	0	2
Total	53	16	5	5	0	79

Table 1.11.5 Structure Use Pattern



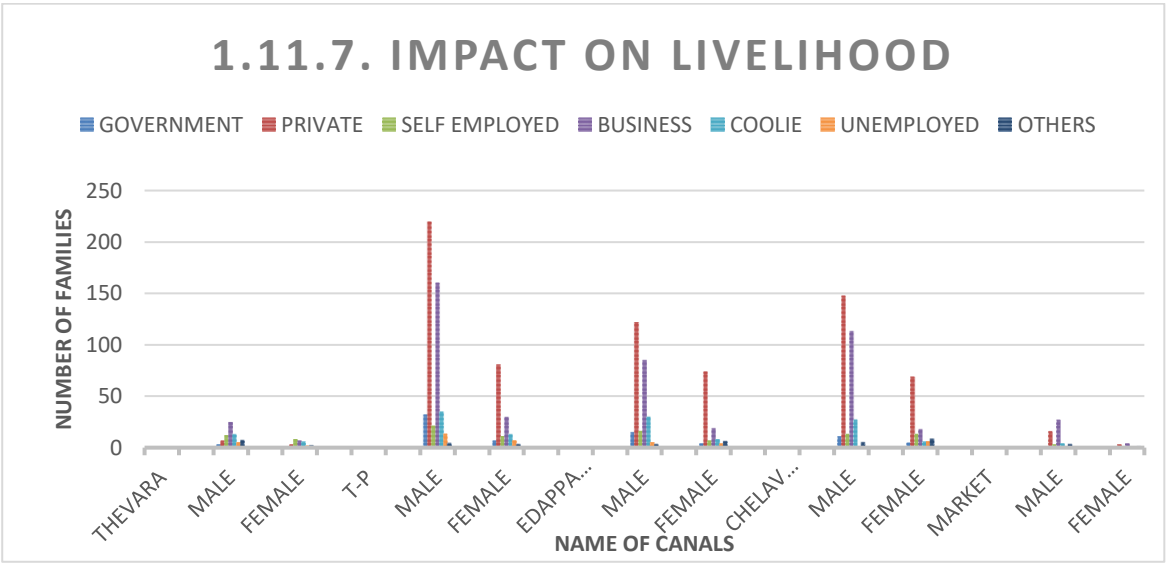
Name of Canal	Tree Pattern							
	Jack Fruit	Mango	Coconut	Anjili	Teak	Poovarash	Others	Total
Thevara	7	12	21	0	3	0	11	54
Thevara-Perandoor	42	33	61	3	5	2	10	156
Edappally	37	41	53	2	3	1	8	145
Chilavanoor	46	44	39	1	6	1	16	153
Market	0	0	0	0	0	0	6	6
Total	132	130	174	6	17	4	51	514

Table 1.11.6. Impact on Trees



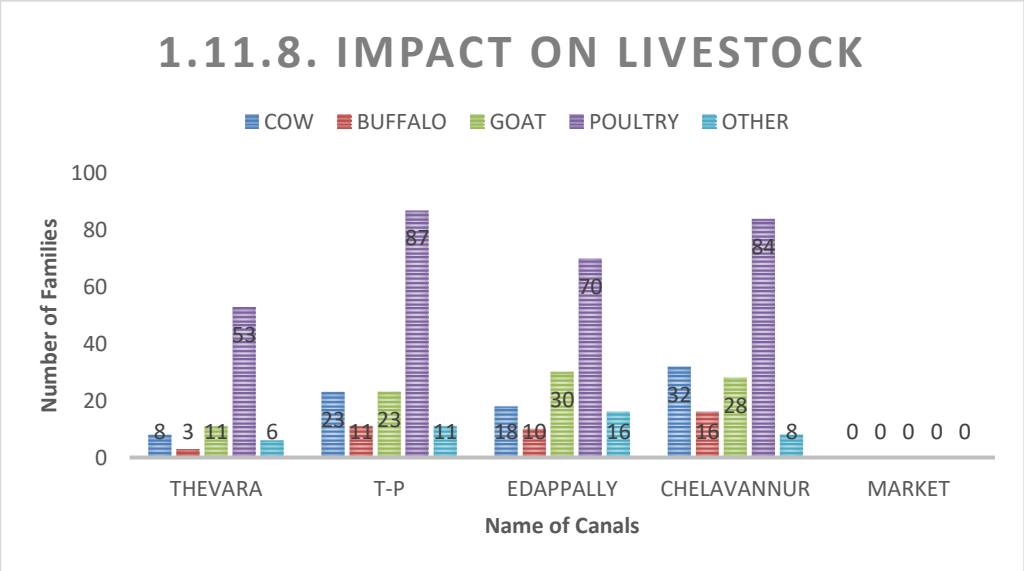
Name of Canal	Gender	Employment Status							
		Government	Private	Self-Employed	Business	Coolie	Unemployed	Others	Total
Thevara	Male	3	7	12	25	13	5	7	72
	Female	1	3	8	7	6	2	2	29
Thevara-Perandoor	Male	32	220	21	160	35	13	4	485
	Female	7	81	11	30	13	7	3	152
Edappally	Male	15	122	16	85	30	5	3	276
	Female	4	74	7	19	8	4	6	122
Chilavanoor	Male	11	148	13	113	27	1	5	318
	Female	5	69	13	18	6	6	8	125
Market	Male	0	16	3	27	4	1	3	54
	Female	0	3	0	4	0	0	1	8
Total	Male	61	513	65	410	109	25	22	1205
	Female	17	230	39	78	33	19	20	436

Table 1.11.7. Impact on Livelihood



Name of Canal	Livestock Use Pattern					
	Cow	Buffalo	Goat	Poultry	Other	Total
Thevara	**8**	**3**	**11**	**53**	**6**	**81**
Thevara-Perandoor	**23**	**11**	**23**	**87**	**11**	**155**
Edappally	**18**	**10**	**30**	**70**	**16**	**144**
Chilavanoor	**32**	**16**	**28**	**84**	**8**	**168**
Market	**0**	**0**	**0**	**0**	**0**	**0**
Total	**81**	**40**	**92**	**294**	**41**	**548**

Table 1.11.8. Impact on Livestock



1.11.9. Families need to support R&R in specified colonies

Sl.No	Name of Colony	Total Houses	Houses Surveyed
1	P&T C	91	91
2	Udaya	150	10
3	Krithala	60	9
4	Kudumbi	31	7
	Total	**201**	**117**

1.12. Mitigation Measures

Sl.No.	Risk Assumed	Approach	Mitigation Strategy
1	Loss of Residential House	Compensation and Rehabilitation	Compensate the loss and develop rehabilitation package.
2	Loss of Residential Building	Compensation	Compensate the loss
3	Loss of Commercial Building	Compensation	Compensation & Resettlement of Tenants
4	Loss of part of Commercial Building	Compensate	Compensate the loss
5.	Loss of Business	Compensation	Compensate the Loss
6.	Loss of water bodies like well, pounds etc.	Control, Avoid	Saving & protecting
7.	Loss of structure	Compensation	Compensate the lose
8.	Loss of existing access	Control	Study and include the plan of resettlement in the implementation plan
9.	Formation of uneconomic holdings(bit lands)	Control	Acquire the uneconomic holdings
10.	Lose of crops	Compensate	Compensate the lose
11.	Loss of common/Public irrigation sources	Control/Resettle	Resettle or protect the sources.
12.	Lose of trees	Compensate & Control	Compensate the lose and plant equal number of trees in government lands.
14.	Lose of livelihood	Compensate	Paid appropriate compensation
15.	Involved in land acquisition process	Control	Ensure community participation in the whole process.
16.	Grievance	Control	Functional grievance redressal committee at village and district level.
17.	Restriction on the productive use of remaining land	Control	Include provisions in the compensation package.

1.13. Detailed Mitigation Plan

Potential Impact	Positive/ Negative	Likeli Hood	Magnitude	Pre-Mitigation Level of Impact	Post – Mitigation Level of Impact
Loss of Residential House	Negative	Possible	High	High	Medium
Loss of Residential Building	Negative	Possible	Low	Medium	Low
Loss of Building	Negative	Possible	High	High	Medium
Loss of land	Negative	Possible	Moderate	Medium	Low
Lose of water bodies like well, pounds etc.	Negative	Possible	Low	Low	Low
Lose of structure	Negative	Possible	Low	Low	Low
Lose of existing access	Negative	Possible	Moderate	Medium	Low
Loss of Irrigation Canals	Negative	Possible	High	Medium	Low
Increased uneconomic holdings	Negative	Possible	Moderate	Medium	Low
Lose of cash crops	Negative	Possible	Moderate	Medium	Low
Lose of trees	Negative	Possible	Moderate	Medium	Low
Loss of Business	Negative	Possible	Major	Medium	Moderate
Grievance	Negative	Possible	Moderate	Medium	Low
Restriction on the productive use of remaining land.	Negative	Possible	Moderate	Moderate	Moderate
High land remaining	Negative	Possible	Moderate	Moderate	Low
Low land/water land remaining	Negative	Possible	Moderate	Moderate	Low

1.14 Assessment of Social Costs and Benefits

Since there are 301 families need to rehabilitate the impact of the project considered as major and necessary to prepare comprehensive rehabilitation and resettlement plan to mitigate the impact. 92% of the displaces residential houses either squatter or encroacher. This increases the importance of prepared rehabilitation plan. Most of the displaced families are living in the project location since before the year 2000. Moreover most of the family members are having their livelihood in an around the project area. Therefore rehabilitation not far away from the project location may mitigate the impact. The project area is commercial in nature and the cost of land and living standards are increasing day by day. Therefore fixing compensation in consultation with people and local body leadership may mitigate the impact and minimize the grievance. The proposed project is one of the long due development initiative of the government. The water logging happened during the last two years flood made an attitudinal change in people's mind regarding the canal development. But absences of authentic communication regarding the project development, lot of confusion develop in the minds of people regarding the project and it gives scope for misleading information. Developing a system for regular communication and addressing the grievance may mitigate the impact an ensure community participation

About Antea Group

From city to countryside, from air to water: Antea Group's engineers and consultants have been contributing to our living environment in the Netherlands for years now. We design bridges and roadways, and create residential neighborhoods and water structures. But we are also involved in areas such as the environment, safety, asset management and energy. Under the name Oranjewoud, we expanded into an all-round, independent partner for companies and government bodies. As the Antea Group, we also apply this knowledge at a global level. By combining valuable knowledge, including on technical matters, with a pragmatic approach, we make solutions attainable and workable. Goal-oriented, with an eye for sustainability. In this way, we anticipate today's questions and tomorrow's answers. Just as we have been for over 60 years now.

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Results of Water Quality Monitoring by Standard Laboratories (NABL accredited), Ernakulam

Integrated Urban Regeneration & Water Transport System, Kochi, India

project number WT/2024

revision # 0

June 08, 2020

Appendix Volume III

Antea Group

Antea Nederland. Antea India

Understanding today.
Improving tomorrow.

Detailed Project Report

Results of Water Quality Monitoring by Standard Laboratories (NABL accredited), Ernakulam

Integrated Urban Regeneration and Water Transport System (IURWTS) in Kochi

Project #: WT/2024

Revision #: R0

June 08, 2020

General Consultant - IURWTS:

Antea Nederland B.V. and Antea India Pvt. Ltd.

Client:

Kochi Metro Rail Limited, (A Joint Venture of Govt. of Kerala and Govt. of India)

Standard[S]
Environmental Monitoring

TEST REPORT

NABL(TC-5402)

Test Report No: TC540219000006123F	Date: 24.03.2020	Page 1 of 1

CUSTOMER DETAILS	
Customer Name & Address	M/s Antea Group Ist Floor, Kudiyirikkal Building, Palarivattom, Ernakulam District.
Customer Reference	Test Request Form Dated 20.03.2020

SAMPLE DETAILS			
Sample Code	19000006123	Sample Received On	20.03.2020
Sample Name	Water	Sampling Procedure	SEAAL/ENL/GEN/SOP/01& SEAAL/MBL/SOP/06
Sample Description	Edappally Canal	Sampling Location	Near Proposed STP
Identification By Customer	---	Sample Condition	Good
Sampled On	20.03.2020	Test Started On	20.03.2020
Sampled By	Laboratory	Test Completed On	24.03.2020

SL NO	TEST PARAMETER	TEST METHOD	UNIT	RESULT
01	pH	IS 3025 Part 11: 1983 RA 2017	---	6.84
02	Total Dissolved Solids	IS 3025 Part 16: 1984 RA 2017	mg/L	2529
03	Total Hardness (as $CaCO_3$)	IS 3025 Part 21: 2009 RA 2019	mg/L	446
04	Nitrate (as NO_3)	APHA 23rdEdition 4500-NO3 B 2017	mg/L	6.19
05	Nitrite (as NO_2)	IS 3025 Part 21: 2009 RA 2019	mg/L	0.12
06	Total Solids	IS 3025 Part 15: 1984 RA 2019	mg/L	2574
07	Total Suspended Solids	IS 3025 Part 17: 1984 RA 2019	mg/L	14.6
08	Dissolved Oxygen	IS 3025 Part 38: 1989 RA 2019	mg/L	<0.20
09	Biochemical Oxygen Demand (3 days at 27 ^oC)	IS 3025 Part 44: 1993 RA 2019	mg/L	41.8
10	Chemical Oxygen Demand	IS 3025 Part 58: 2006 RA 2017	mg/L	238
11	Salinity	APHA 23rdEdition 2520 B Edn 2017	mg/L	1.83
12	Sodium as Na	IS 3025 Part 45: 1993 RA 2019	mg/L	481
13	Total Nitrogen	IS 3025 Part 34: 1988 RA 2019	mg/L	31.0
14	Phosphates	IS 3025 Part 31: 1988 RA 2019	mg/L	3.50
15	Total Coliform	IS 15185 : 2016	---	Present/100 ml
16	Faecal Coliform	IS 1622:1981 RA 2014	MPN/100ml	40

End of Report

For and on behalf of
Standards Environmental & Analytical Laboratories

Salini T. S.
Microbiologist

Authorized Signatory

Authorized Signatory

Laiju P. N.
Laboratory Head

Standard[S] Environmental & Analytical Laboratories
Accreditation and Approval: NABL as per ISO 17025: 2017 & "A" Grade Laboratory of KSPCB
K.J. Tower, Pathalam, Udyogamandal P.O., Ernakulam-683 501, Tel. 0484-2546660, 93 87 27 24 02, 90 74 34 14 43
Web: www.sealabs.in, E-mail: seaalab@gmail.com

Standard[S] Environmental Monitoring

TEST REPORT

NABL(TC-5402)

Test Report No: TC540219000006123F	Date: 24.03.2020	Page 1 of 1

CUSTOMER DETAILS	
Customer Name & Address	M/s Antea Group Ist Floor, Kudiyirikkal Building, Palarivattom, Ernakulam District.
Customer Reference	Test Request Form Dated 20.03.2020

SAMPLE DETAILS			
Sample Code	19000006123	Sample Received On	20.03.2020
Sample Name	Water	Sampling Procedure	SEAAL/ENL/GEN/SOP/01& SEAAL/MBL/SOP/06
Sample Description	Edappally Canal	Sampling Location	Near Proposed STP
Identification By Customer	---	Sample Condition	Good
Sampled On	20.03.2020	Test Started On	20.03.2020
Sampled By	Laboratory	Test Completed On	24.03.2020

SL NO	TEST PARAMETER	TEST METHOD	UNIT	RESULT
01	pH	IS 3025 Part 11: 1983 RA 2017	---	6.84
02	Total Dissolved Solids	IS 3025 Part 16: 1984 RA 2017	mg/L	2529
03	Total Hardness (as $CaCO_3$)	IS 3025 Part 21: 2009 RA 2019	mg/L	446
04	Nitrate (as NO_3)	APHA 23rdEdition 4500-NO3 B 2017	mg/L	6.19
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07	Total Suspended Solids	IS 3025 Part 17: 1984 RA 2019	mg/L	14.6
08	Dissolved Oxygen	IS 3025 Part 38: 1989 RA 2019	mg/L	<0.20
09	Biochemical Oxygen Demand (3 days at 27 °C)	IS 3025 Part 44: 1993 RA 2019	mg/L	41.8
10	Chemical Oxygen Demand	IS 3025 Part 58: 2006 RA 2017	mg/L	238
11	Salinity	APHA 23rdEdition 2520 B Edn 2017	mg/L	1.83
12	Sodium as Na	IS 3025 Part 45: 1993 RA 2019	mg/L	481
13	Total Nitrogen	IS 3025 Part 34: 1988 RA 2019	mg/L	31.0
14	Phosphates	IS 3025 Part 31: 1988 RA 2019	mg/L	3.50
15	Total Coliform	IS 15185 : 2016	---	Present/100 ml
16	Faecal Coliform	IS 1622:1981 RA 2014	MPN/100ml	40

End of Report

For and on behalf of
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Salini T. S.
Microbiologist

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Standard[S] Environmental & Analytical Laboratories
Accreditation and Approval: NABL as per ISO 17025: 2017 & "A" Grade Laboratory of KSPCB
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Web: www.sealabs.in, E-mail: seaalab@gmail.com

Laiju P. N.
Laboratory Head

Standard[S]
Environmental Monitoring

TEST REPORT

NABL(TC-5402)

Test Report No: TC540219000006124F	Date: 24.03.2020	Page 1 of 1

CUSTOMER DETAILS	
Customer Name & Address	M/s Antea Group Ist Floor, Kudiyirikkal Building, Palarivattom, Ernakulam District.
Customer Reference	Test Request Form Dated 20.03.2020

SAMPLE DETAILS			
Sample Code	19000006124	Sample Received On	20.03.2020
Sample Name	Water	Sampling Procedure	SEAAL/ENL/GEN/SOP/01& SEAAL/MBL/SOP/06
Sample Description	Edappally Canal	Sampling Location	Near Lulu Mall
Identification By Customer	---	Sample Condition	Good
Sampled On	20.03.2020	Test Started On	20.03.2020
Sampled By	Laboratory	Test Completed On	24.03.2020

SL NO	TEST PARAMETER	TEST METHOD	UNIT	RESULT
01	pH	IS 3025 Part 11: 1983 RA 2017	---	6.56
02	Total Dissolved Solids	IS 3025 Part 16: 1984 RA 2017	mg/L	400
03	Total Hardness (as $CaCO_3$)	IS 3025 Part 21: 2009 RA 2019	mg/L	63.4
04	Nitrate (as NO_3)	APHA 23rdEdition 4500-NO3 B 2017	mg/L	12.4
05	Nitrite (as NO_2)	IS 3025 Part 21: 2009 RA 2019	mg/L	<0.02
06	Total Solids	IS 3025 Part 15: 1984 RA 2019	mg/L	481
07	Total Suspended Solids	IS 3025 Part 17: 1984 RA 2019	mg/L	26.4
08	Dissolved Oxygen	IS 3025 Part 38: 1989 RA 2019	mg/L	<0.20
09	Biochemical Oxygen Demand (3 days at 27 °C)	IS 3025 Part 44: 1993 RA 2019	mg/L	0.20
10	Chemical Oxygen Demand	IS 3025 Part 58: 2006 RA 2017	mg/L	49.0
11	Salinity	APHA 23rdEdition 2520 B Edn 2017	mg/L	0.10
12	Sodium as Na	IS 3025 Part 45: 1993 RA 2019	mg/L	30.9
13	Total Nitrogen	IS 3025 Part 34: 1988 RA 2019	mg/L	37.1
14	Phosphates	IS 3025 Part 31: 1988 RA 2019	mg/L	0.84
15	Total Coliform	IS 15185 : 2016	---	Present/100 ml
16	Faecal Coliform	IS 1622:1981 RA 2014	MPN/100ml	13

End of Report

For and on behalf of
Standards Environmental & Analytical Laboratories

Salini T. S.
Microbiologist

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Web: www.sealabs.in, E-mail: seaalab@gmail.com

Laju P. N.
Laboratory Head

Standard^{S} Environmental Monitoring

TEST REPORT

NABL(TC-5402)

Test Report No: TC540219000006124F	Date: 24.03.2020	Page 1 of 1

CUSTOMER DETAILS			
Customer Name & Address		M/s Antea Group Ist Floor, Kudiyirikkal Building, Palarivattom, Ernakulam District.	
Customer Reference		Test Request Form Dated 20.03.2020	
SAMPLE DETAILS			
Sample Code	19000006124	Sample Received On	20.03.2020
Sample Name	Water	Sampling Procedure	SEAAL/ENL/GEN/SOP/01& SEAAL/MBL/SOP/06
Sample Description	Edappally Canal	Sampling Location	Near Lulu Mall
Identification By Customer	---	Sample Condition	Good
Sampled On	20.03.2020	Test Started On	20.03.2020
Sampled By	Laboratory	Test Completed On	24.03.2020

SL NO	TEST PARAMETER	TEST METHOD	UNIT	RESULT
01	pH	IS 3025 Part 11: 1983 RA 2017	---	6.56
02	Total Dissolved Solids	IS 3025 Part 16: 1984 RA 2017	mg/L	400
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04	Nitrate (as NO_3)	APHA 23rdEdition 4500-NO3 B 2017	mg/L	12.4
05	Nitrite (as NO_2)	IS 3025 Part 21: 2009 RA 2019	mg/L	<0.02
06	Total Solids	IS 3025 Part 15: 1984 RA 2019	mg/L	481
07	Total Suspended Solids	IS 3025 Part 17: 1984 RA 2019	mg/L	26.4
08	Dissolved Oxygen	IS 3025 Part 38: 1989 RA 2019	mg/L	<0.20
09	Biochemical Oxygen Demand (3 days at 27 ^{o}C)	IS 3025 Part 44: 1993 RA 2019	mg/L	0.20
10	Chemical Oxygen Demand	IS 3025 Part 58: 2006 RA 2017	mg/L	49.0
11	Salinity	APHA 23rdEdition 2520 B Edn 2017	mg/L	0.10
12	Sodium as Na	IS 3025 Part 45: 1993 RA 2019	mg/L	30.9
13	Total Nitrogen	IS 3025 Part 34: 1988 RA 2019	mg/L	37.1
14	Phosphates	IS 3025 Part 31: 1988 RA 2019	mg/L	0.84
15	Total Coliform	IS 15185 : 2016	---	Present/100 ml
16	Faecal Coliform	IS 1622:1981 RA 2014	MPN/100ml	13

End of Report

For and on behalf of
Standard^{s} Environmental & Analytical Laboratories

Salini T. S.
Microbiologist

Authorized Signatory

Authorized Signatory

Laiju P. N.
Laboratory Head

Standard^{S} Environmental & Analytical Laboratories
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Standard[S] Environmental Monitoring

TEST REPORT

NABL(TC-5402)

Test Report No: TC540219000006125F	Date: 24.03.2020	Page 1 of 1

CUSTOMER DETAILS	
Customer Name & Address	M/s Antea Group Ist Floor, Kudiyirikkal Building, Palarivattom, Ernakulam District.
Customer Reference	Test Request Form Dated 20.03.2020

SAMPLE DETAILS			
Sample Code	19000006125	Sample Received On	20.03.2020
Sample Name	Water	Sampling Procedure	SEAAL/ENL/GEN/SOP/01& SEAAL/MBL/SOP/06
Sample Description	Edappally Canal	Sampling Location	Near Railway
Identification By Customer	---	Sample Condition	Good
Sampled On	20.03.2020	Test Started On	20.03.2020
Sampled By	Laboratory	Test Completed On	24.03.2020

SL NO	TEST PARAMETER	TEST METHOD	UNIT	RESULT
01	pH	IS 3025 Part 11: 1983 RA 2017	---	6.85
02	Total Dissolved Solids	IS 3025 Part 16: 1984 RA 2017	mg/L	2581
03	Total Hardness (as $CaCO_3$)	IS 3025 Part 21: 2009 RA 2019	mg/L	345
04	Nitrate (as NO_3)	APHA 23rdEdition 4500-NO3 B 2017	mg/L	4.49
05	Nitrite (as NO_2)	IS 3025 Part 21: 2009 RA 2019	mg/L	0.09
06	Total Solids	IS 3025 Part 15: 1984 RA 2019	mg/L	2648
07	Total Suspended Solids	IS 3025 Part 17: 1984 RA 2019	mg/L	26
08	Dissolved Oxygen	IS 3025 Part 38: 1989 RA 2019	mg/L	<0.20
09	Biochemical Oxygen Demand (3 days at 27 °C)	IS 3025 Part 44: 1993 RA 2019	mg/L	12.1
10	Chemical Oxygen Demand	IS 3025 Part 58: 2006 RA 2017	mg/L	39.3
11	Salinity	APHA 23rdEdition 2520 B Edn 2017	mg/L	1.97
12	Sodium as Na	IS 3025 Part 45: 1993 RA 2019	mg/L	568
13	Total Nitrogen	IS 3025 Part 34: 1988 RA 2019	mg/L	21.4
14	Phosphates	IS 3025 Part 31: 1988 RA 2019	mg/L	0.18
15	Total Coliform	IS 15185 : 2016	---	Present/100 ml
16	Faecal Coliform	IS 1622:1981 RA 2014	MPN/100ml	14

End of Report

For and on behalf of
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Laiju P. N.
Laboratory Head

standards
Environmental Monitoring

TEST REPORT

NABL(TC-5402)

Test Report No: TC540219000006125F	Date: 24.03.2020	Page 1 of 1

CUSTOMER DETAILS	
Customer Name & Address	M/s Antea Group Ist Floor, Kudiyirikkal Building, Palarivattom, Ernakulam District.
Customer Reference	Test Request Form Dated 20.03.2020

SAMPLE DETAILS			
Sample Code	19000006125	Sample Received On	20.03.2020
Sample Name	Water	Sampling Procedure	SEAAL/ENL/GEN/SOP/01& SEAAL/MBL/SOP/06
Sample Description	Edappally Canal	Sampling Location	Near Railway
Identification By Customer	---	Sample Condition	Good
Sampled On	20.03.2020	Test Started On	20.03.2020
Sampled By	Laboratory	Test Completed On	24.03.2020

SL NO	TEST PARAMETER	TEST METHOD	UNIT	RESULT
01	pH	IS 3025 Part 11: 1983 RA 2017	---	6.85
02	Total Dissolved Solids	IS 3025 Part 16: 1984 RA 2017	mg/L	2581
03	Total Hardness (as $CaCO_3$)	IS 3025 Part 21: 2009 RA 2019	mg/L	345
04	Nitrate (as NO_3)	APHA 23rdEdition 4500-NO3 B 2017	mg/L	4.49
05	Nitrite (as NO_2)	IS 3025 Part 21: 2009 RA 2019	mg/L	0.09
06	Total Solids	IS 3025 Part 15: 1984 RA 2019	mg/L	2648
07	Total Suspended Solids	IS 3025 Part 17: 1984 RA 2019	mg/L	26
08	Dissolved Oxygen	IS 3025 Part 38: 1989 RA 2019	mg/L	<0.20
09	Biochemical Oxygen Demand (3 days at 27 °C)	IS 3025 Part 44: 1993 RA 2019	mg/L	12.1
10	Chemical Oxygen Demand	IS 3025 Part 58: 2006 RA 2017	mg/L	39.3
11	Salinity	APHA 23rdEdition 2520 B Edn 2017	mg/L	1.97
12	Sodium as Na	IS 3025 Part 45: 1993 RA 2019	mg/L	568
13	Total Nitrogen	IS 3025 Part 34: 1988 RA 2019	mg/L	21.4
14	Phosphates	IS 3025 Part 31: 1988 RA 2019	mg/L	0.18
15	Total Coliform	IS 15185 : 2016	---	Present/100 ml
16	Faecal Coliform	IS 1622:1981 RA 2014	MPN/100ml	14

End of Report

For and on behalf of
Standards Environmental & Analytical Laboratories

Salini T. S.
Microbiologist

Authorized Signatory

Laiju P. N.
Laboratory Head

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Standard[S] Environmental Monitoring

TEST REPORT

NABL(TC-5402)

Test Report No: TC540219000006126F	Date: 24.03.2020	Page 1 of 1

CUSTOMER DETAILS	
Customer Name & Address	M/s Antea Group Ist Floor, Kudiyirikkal Building, Palarivattom, Ernakulam District.
Customer Reference	Test Request Form Dated 20.03.2020

SAMPLE DETAILS			
Sample Code	19000006126	Sample Received On	20.03.2020
Sample Name	Water	Sampling Procedure	SEAAL/ENL/GEN/SOP/01& SEAAL/MBL/SOP/06
Sample Description	Chelavannoor Canal	Sampling Location	Near Amrita
Identification By Customer	---	Sample Condition	Good
Sampled On	20.03.2020	Test Started On	20.03.2020
Sampled By	Laboratory	Test Completed On	24.03.2020

SL NO	TEST PARAMETER	TEST METHOD	UNIT	RESULT
01	pH	IS 3025 Part 11: 1983 RA 2017	---	7.75
02	Total Dissolved Solids	IS 3025 Part 16: 1984 RA 2017	mg/L	8970
03	Total Hardness (as $CaCO_3$)	IS 3025 Part 21: 2009 RA 2019	mg/L	1535
04	Nitrate (as NO_3)	APHA 23rdEdition 4500-NO3 B 2017	mg/L	14.4
05	Nitrite (as NO_2)	IS 3025 Part 21: 2009 RA 2019	mg/L	<0.02
06	Total Solids	IS 3025 Part 15: 1984 RA 2019	mg/L	9038
07	Total Suspended Solids	IS 3025 Part 17: 1984 RA 2019	mg/L	34.0
08	Dissolved Oxygen	IS 3025 Part 38: 1989 RA 2019	mg/L	<0.20
09	Biochemical Oxygen Demand (3 days at 27 °C)	IS 3025 Part 44: 1993 RA 2019	mg/L	24.2
10	Chemical Oxygen Demand	IS 3025 Part 58: 2006 RA 2017	mg/L	157
11	Salinity	APHA 23rdEdition 2520 B Edn 2017	mg/L	8.31
12	Sodium as Na	IS 3025 Part 45: 1993 RA 2019	mg/L	2225
13	Total Nitrogen	IS 3025 Part 34: 1988 RA 2019	mg/L	36.5
14	Phosphates	IS 3025 Part 31: 1988 RA 2019	mg/L	2.62
15	Total Coliform	IS 15185 : 2016	---	Present/100 ml
16	Faecal Coliform	IS 1622:1981 RA 2014	MPN/100ml	21

End of Report

For and on behalf of
Standard[s] Environmental & Analytical Laboratories

Salini T. S.
Microbiologist

Authorized Signatory

Authorized Signatory

Laboratory Head

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Environmental Monitoring

TEST REPORT

NABL(TC-5402)

Test Report No: TC540219000006126F	Date: 24.03.2020	Page 1 of 1

CUSTOMER DETAILS	
Customer Name & Address	M/s Antea Group Ist Floor, Kudiyirikkal Building, Palarivattom, Ernakulam District.
Customer Reference	Test Request Form Dated 20.03.2020

SAMPLE DETAILS

Sample Code	19000006126	Sample Received On	20.03.2020
Sample Name	Water	Sampling Procedure	SEAAL/ENL/GEN/SOP/01& SEAAL/MBL/SOP/06
Sample Description	Chelavannoor Canal	Sampling Location	Near Amrita
Identification By Customer	---	Sample Condition	Good
Sampled On	20.03.2020	Test Started On	20.03.2020
Sampled By	Laboratory	Test Completed On	24.03.2020

SL NO	TEST PARAMETER	TEST METHOD	UNIT	RESULT
01	pH	IS 3025 Part 11: 1983 RA 2017	---	7.75
02	Total Dissolved Solids	IS 3025 Part 16: 1984 RA 2017	mg/L	8970
03	Total Hardness (as $CaCO_3$)	IS 3025 Part 21: 2009 RA 2019	mg/L	1535
04	Nitrate (as NO_3)	APHA 23rdEdition 4500-NO3 B 2017	mg/L	14.4
05	Nitrite (as NO_2)	IS 3025 Part 21: 2009 RA 2019	mg/L	<0.02
06	Total Solids	IS 3025 Part 15: 1984 RA 2019	mg/L	9038
07	Total Suspended Solids	IS 3025 Part 17: 1984 RA 2019	mg/L	34.0
08	Dissolved Oxygen	IS 3025 Part 38: 1989 RA 2019	mg/L	<0.20
09	Biochemical Oxygen Demand (3 days at 27 ^{o}C)	IS 3025 Part 44: 1993 RA 2019	mg/L	24.2
10	Chemical Oxygen Demand	IS 3025 Part 58: 2006 RA 2017	mg/L	157
11	Salinity	APHA 23rdEdition 2520 B Edn 2017	mg/L	8.31
12	Sodium as Na	IS 3025 Part 45: 1993 RA 2019	mg/L	2225
13	Total Nitrogen	IS 3025 Part 34: 1988 RA 2019	mg/L	36.5
14	Phosphates	IS 3025 Part 31: 1988 RA 2019	mg/L	2.62
15	Total Coliform	IS 15185 : 2016	---	Present/100 ml
16	Faecal Coliform	IS 1622:1981 RA 2014	MPN/100ml	21

End of Report

For and on behalf of
Standard^{s} Environmental & Analytical Laboratories

Salini T. S.
Microbiologist

Authorized Signatory

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Laiju P. N.
Laboratory Head

Standard[S] Environmental Monitoring

TEST REPORT

NABL(TC-5402)

Test Report No: TC540219000006127F	Date: 24.03.2020	Page 1 of 1

CUSTOMER DETAILS	
Customer Name & Address	M/s Antea Group Ist Floor, Kudiyirikkal Building, Palarivattom, Ernakulam District.
Customer Reference	Test Request Form Dated 20.03.2020

SAMPLE DETAILS			
Sample Code	19000006127	Sample Received On	20.03.2020
Sample Name	Water	Sampling Procedure	SEAAL/ENL/GEN/SOP/01& SEAAL/MBL/SOP/06
Sample Description	Chelavannoor Canal	Sampling Location	Behind KSEB
Identification By Customer	---	Sample Condition	Good
Sampled On	20.03.2020	Test Started On	20.03.2020
Sampled By	Laboratory	Test Completed On	24.03.2020

SL NO	TEST PARAMETER	TEST METHOD	UNIT	RESULT
01	pH	IS 3025 Part 11: 1983 RA 2017	---	7.17
02	Total Dissolved Solids	IS 3025 Part 16: 1984 RA 2017	mg/L	569
03	Total Hardness (as $CaCO_3$)	IS 3025 Part 21: 2009 RA 2019	mg/L	123
04	Nitrate (as NO_3)	APHA 23rdEdition 4500-NO3 B 2017	mg/L	23.2
05	Nitrite (as NO_2)	IS 3025 Part 21: 2009 RA 2019	mg/L	<0.02
06	Total Solids	IS 3025 Part 15: 1984 RA 2019	mg/L	659
07	Total Suspended Solids	IS 3025 Part 17: 1984 RA 2019	mg/L	39.2
08	Dissolved Oxygen	IS 3025 Part 38: 1989 RA 2019	mg/L	< 0.20
09	Biochemical Oxygen Demand (3 days at 27 °C)	IS 3025 Part 44: 1993 RA 2019	mg/L	24.9
10	Chemical Oxygen Demand	IS 3025 Part 58: 2006 RA 2017	mg/L	126
11	Salinity	APHA 23rdEdition 2520 B Edn 2017	mg/L	0.15
12	Sodium as Na	IS 3025 Part 45: 1993 RA 2019	mg/L	58.9
13	Total Nitrogen	IS 3025 Part 34: 1988 RA 2019	mg/L	72.7
14	Phosphates	IS 3025 Part 31: 1988 RA 2019	mg/L	3.22
15	Total Coliform	IS 15185 : 2016	---	Present/100 ml
16	Faecal Coliform	IS 1622:1981 RA 2014	MPN/100ml	22

End of Report

For and on behalf of
Standard[S] Environmental & Analytical Laboratories

Salini T. S.
Microbiologist

Authorized Signatory

Authorized Signatory

Laiju P. N.
Laboratory Head

Standard[S] Environmental Monitoring

TEST REPORT

NABL(TC-5402)

Test Report No: TC540219000006127F	Date: 24.03.2020	Page 1 of 1

CUSTOMER DETAILS	
Customer Name & Address	M/s Antea Group Ist Floor, Kudiyirikkal Building, Palarivattom, Ernakulam District.
Customer Reference	Test Request Form Dated 20.03.2020

SAMPLE DETAILS			
Sample Code	19000006127	Sample Received On	20.03.2020
Sample Name	Water	Sampling Procedure	SEAAL/ENL/GEN/SOP/01& SEAAL/MBL/SOP/06
Sample Description	Chelavannoor Canal	Sampling Location	Behind KSEB
Identification By Customer	---	Sample Condition	Good
Sampled On	20.03.2020	Test Started On	20.03.2020
Sampled By	Laboratory	Test Completed On	24.03.2020

SL NO	TEST PARAMETER	TEST METHOD	UNIT	RESULT
01	pH	IS 3025 Part 11: 1983 RA 2017	---	7.17
02	Total Dissolved Solids	IS 3025 Part 16: 1984 RA 2017	mg/L	569
03	Total Hardness (as $CaCO_3$)	IS 3025 Part 21: 2009 RA 2019	mg/L	123
04	Nitrate (as NO_3)	APHA 23rdEdition 4500-NO3 B 2017	mg/L	23.2
05	Nitrite (as NO_2)	IS 3025 Part 21: 2009 RA 2019	mg/L	<0.02
06	Total Solids	IS 3025 Part 15: 1984 RA 2019	mg/L	659
07	Total Suspended Solids	IS 3025 Part 17: 1984 RA 2019	mg/L	39.2
08	Dissolved Oxygen	IS 3025 Part 38: 1989 RA 2019	mg/L	< 0.20
09	Biochemical Oxygen Demand (3 days at 27 °C)	IS 3025 Part 44: 1993 RA 2019	mg/L	24.9
10	Chemical Oxygen Demand	IS 3025 Part 58: 2006 RA 2017	mg/L	126
11	Salinity	APHA 23rdEdition 2520 B Edn 2017	mg/L	0.15
12	Sodium as Na	IS 3025 Part 45: 1993 RA 2019	mg/L	58.9
13	Total Nitrogen	IS 3025 Part 34: 1988 RA 2019	mg/L	72.7
14	Phosphates	IS 3025 Part 31: 1988 RA 2019	mg/L	3.22
15	Total Coliform	IS 15185 : 2016	---	Present/100 ml
16	Faecal Coliform	IS 1622:1981 RA 2014	MPN/100ml	22

End of Report

For and on behalf of
Standard[S] Environmental & Analytical Laboratories

Salini T. S.
Microbiologist

Authorized Signatory

Authorized Signatory

Standard^{S} Environmental Monitoring

TEST REPORT

NABL(TC-5402)

Test Report No: TC540219000006128F	Date: 24.03.2020	Page 1 of 1

CUSTOMER DETAILS	
Customer Name & Address	M/s Antea Group Ist Floor, Kudiyirikkal Building, Palarivattom, Ernakulam District.
Customer Reference	Test Request Form Dated 20.03.2020

SAMPLE DETAILS			
Sample Code	19000006128	Sample Received On	20.03.2020
Sample Name	Water	Sampling Procedure	SEAAL/ENL/GEN/SOP/01& SEAAL/MBL/SOP/06
Sample Description	Chelavannoor Canal	Sampling Location	Near Elamkulam
Identification By Customer	---	Sample Condition	Good
Sampled On	20.03.2020	Test Started On	20.03.2020
Sampled By	Laboratory	Test Completed On	24.03.2020

SL NO	TEST PARAMETER	TEST METHOD	UNIT	RESULT
01	pH	IS 3025 Part 11: 1983 RA 2017	---	7.30
02	Total Dissolved Solids	IS 3025 Part 16: 1984 RA 2017	mg/L	3107
03	Total Hardness (as $CaCO_3$)	IS 3025 Part 21: 2009 RA 2019	mg/L	495
04	Nitrate (as NO_3)	APHA 23rdEdition 4500-NO3 B 2017	mg/L	13.1
05	Nitrite (as NO_2)	IS 3025 Part 21: 2009 RA 2019	mg/L	0.05
06	Total Solids	IS 3025 Part 15: 1984 RA 2019	mg/L	3202
07	Total Suspended Solids	IS 3025 Part 17: 1984 RA 2019	mg/L	34.6
08	Dissolved Oxygen	IS 3025 Part 38: 1989 RA 2019	mg/L	0.71
09	Biochemical Oxygen Demand (3 days at 27 ^{o}C)	IS 3025 Part 44: 1993 RA 2019	mg/L	20.2
10	Chemical Oxygen Demand	IS 3025 Part 58: 2006 RA 2017	mg/L	59.0
11	Salinity	APHA 23rdEdition 2520 B Edn 2017	mg/L	2.59
12	Sodium as Na	IS 3025 Part 45: 1993 RA 2019	mg/L	568
13	Total Nitrogen	IS 3025 Part 34: 1988 RA 2019	mg/L	42.2
14	Phosphates	IS 3025 Part 31: 1988 RA 2019	mg/L	2.66
15	Total Coliform	IS 15185 : 2016	---	Present/100 ml
16	Faecal Coliform	IS 1622:1981 RA 2014	MPN/100ml	26

End of Report

For and on behalf of
Standard^{s} Environmental & Analytical Laboratories

Salini T. S.
Microbiologist

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Authorized Signatory

Laju P. N.
Laboratory Head

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TEST REPORT

NABL(TC-5402)

Test Report No: TC540219000006128F	Date: 24.03.2020	Page 1 of 1

CUSTOMER DETAILS	
Customer Name & Address	M/s Antea Group Ist Floor, Kudiyirikkal Building, Palarivattom, Ernakulam District.
Customer Reference	Test Request Form Dated 20.03.2020

SAMPLE DETAILS			
Sample Code	19000006128	Sample Received On	20.03.2020
Sample Name	Water	Sampling Procedure	SEAAL/ENL/GEN/SOP/01& SEAAL/MBL/SOP/06
Sample Description	Chelavannoor Canal	Sampling Location	Near Elamkulam
Identification By Customer	---	Sample Condition	Good
Sampled On	20.03.2020	Test Started On	20.03.2020
Sampled By	Laboratory	Test Completed On	24.03.2020

SL NO	TEST PARAMETER	TEST METHOD	UNIT	RESULT
01	pH	IS 3025 Part 11: 1983 RA 2017	---	7.30
02	Total Dissolved Solids	IS 3025 Part 16: 1984 RA 2017	mg/L	3107
03	Total Hardness (as $CaCO_3$)	IS 3025 Part 21: 2009 RA 2019	mg/L	495
04	Nitrate (as NO_3)	APHA 23rdEdition 4500-NO3 B 2017	mg/L	13.1
05	Nitrite (as NO_2)	IS 3025 Part 21: 2009 RA 2019	mg/L	0.05
06	Total Solids	IS 3025 Part 15: 1984 RA 2019	mg/L	3202
07	Total Suspended Solids	IS 3025 Part 17: 1984 RA 2019	mg/L	34.6
08	Dissolved Oxygen	IS 3025 Part 38: 1989 RA 2019	mg/L	0.71
09	Biochemical Oxygen Demand (3 days at 27 °C)	IS 3025 Part 44: 1993 RA 2019	mg/L	20.2
10	Chemical Oxygen Demand	IS 3025 Part 58: 2006 RA 2017	mg/L	59.0
11	Salinity	APHA 23rdEdition 2520 B Edn 2017	mg/L	2.59
12	Sodium as Na	IS 3025 Part 45: 1993 RA 2019	mg/L	568
13	Total Nitrogen	IS 3025 Part 34: 1988 RA 2019	mg/L	42.2
14	Phosphates	IS 3025 Part 31: 1988 RA 2019	mg/L	2.66
15	Total Coliform	IS 15185 : 2016	---	Present/100 ml
16	Faecal Coliform	IS 1622:1981 RA 2014	MPN/100ml	26

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Authorized Signatory

Laju K. N.
Laboratory Head

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Standard[S] Environmental Monitoring

TEST REPORT

NABL(TC-5402)

Test Report No: TC540219000006129F	Date: 24.03.2020	Page 1 of 1

CUSTOMER DETAILS	
Customer Name & Address	M/s Antea Group Ist Floor, Kudiyirikkal Building, Palarivattom, Ernakulam District.
Customer Reference	Test Request Form Dated 20.03.2020

SAMPLE DETAILS			
Sample Code	19000006129	Sample Received On	20.03.2020
Sample Name	Water	Sampling Procedure	SEAAL/ENL/GEN/SOP/01& SEAAL/MBL/SOP/06
Sample Description	ThevaraPerandoor Canal	Sampling Location	Near JalVayuVihar
Identification By Customer	---	Sample Condition	Good
Sampled On	20.03.2020	Test Started On	20.03.2020
Sampled By	Laboratory	Test Completed On	24.03.2020

SL NO	TEST PARAMETER	TEST METHOD	UNIT	RESULT
01	pH	IS 3025 Part 11: 1983 RA 2017	---	7.04
02	Total Dissolved Solids	IS 3025 Part 16: 1984 RA 2017	mg/L	2698
03	Total Hardness (as $CaCO_3$)	IS 3025 Part 21: 2009 RA 2019	mg/L	446
04	Nitrate (as NO_3)	APHA 23rdEdition 4500-NO3 B 2017	mg/L	8.05
05	Nitrite (as NO_2)	IS 3025 Part 21: 2009 RA 2019	mg/L	0.08
06	Total Solids	IS 3025 Part 15: 1984 RA 2019	mg/L	2766
07	Total Suspended Solids	IS 3025 Part 17: 1984 RA 2019	mg/L	28.5
08	Dissolved Oxygen	IS 3025 Part 38: 1989 RA 2019	mg/L	<0.20
09	Biochemical Oxygen Demand (3 days at 27 ^{o}C)	IS 3025 Part 44: 1993 RA 2019	mg/L	24.2
10	Chemical Oxygen Demand	IS 3025 Part 58: 2006 RA 2017	mg/L	128
11	Salinity	APHA 23rdEdition 2520 B Edn 2017	mg/L	2.23
12	Sodium as Na	IS 3025 Part 45: 1993 RA 2019	mg/L	402
13	Total Nitrogen	IS 3025 Part 34: 1988 RA 2019	mg/L	49.7
14	Phosphates	IS 3025 Part 31: 1988 RA 2019	mg/L	3.42
15	Total Coliform	IS 15185 : 2016	---	Present/100 ml
16	Faecal Coliform	IS 1622:1981 RA 2014	MPN/100ml	27

End of Report

For and on behalf of
Standard[s] Environmental & Analytical Laboratories

Salini T. S.
Microbiologist Authorized Signatory

Authorized Signatory

Laiju P. N.
Laboratory Head

Standard[S]
Environmental Monitoring

TEST REPORT

NABL(TC-5402)

Test Report No: TC540219000006129F	Date: 24.03.2020	Page 1 of 1

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Customer Name & Address	M/s Antea Group Ist Floor, Kudiyirikkal Building, Palarivattom, Ernakulam District.
Customer Reference	Test Request Form Dated 20.03.2020

SAMPLE DETAILS			
Sample Code	19000006129	Sample Received On	20.03.2020
Sample Name	Water	Sampling Procedure	SEAAL/ENL/GEN/SOP/01& SEAAL/MBL/SOP/06
Sample Description	ThevaraPerandoor Canal	Sampling Location	Near JalVayuVihar
Identification By Customer	---	Sample Condition	Good
Sampled On	20.03.2020	Test Started On	20.03.2020
Sampled By	Laboratory	Test Completed On	24.03.2020

SL NO	TEST PARAMETER	TEST METHOD	UNIT	RESULT
01	pH	IS 3025 Part 11: 1983 RA 2017	---	7.04
02	Total Dissolved Solids	IS 3025 Part 16: 1984 RA 2017	mg/L	2698
03	Total Hardness (as $CaCO_3$)	IS 3025 Part 21: 2009 RA 2019	mg/L	446
04	Nitrate (as NO_3)	APHA 23rdEdition 4500-NO3 B 2017	mg/L	8.05
05	Nitrite (as NO_2)	IS 3025 Part 21: 2009 RA 2019	mg/L	0.08
06	Total Solids	IS 3025 Part 15: 1984 RA 2019	mg/L	2766
07	Total Suspended Solids	IS 3025 Part 17: 1984 RA 2019	mg/L	28.5
08	Dissolved Oxygen	IS 3025 Part 38: 1989 RA 2019	mg/L	<0.20
09	Biochemical Oxygen Demand (3 days at 27 °C)	IS 3025 Part 44: 1993 RA 2019	mg/L	24.2
10	Chemical Oxygen Demand	IS 3025 Part 58: 2006 RA 2017	mg/L	128
11	Salinity	APHA 23rdEdition 2520 B Edn 2017	mg/L	2.23
12	Sodium as Na	IS 3025 Part 45: 1993 RA 2019	mg/L	402
13	Total Nitrogen	IS 3025 Part 34: 1988 RA 2019	mg/L	49.7
14	Phosphates	IS 3025 Part 31: 1988 RA 2019	mg/L	3.42
15	Total Coliform	IS 15185 : 2016	---	Present/100 ml
16	Faecal Coliform	IS 1622:1981 RA 2014	MPN/100ml	27

End of Report

For and on behalf of
Standards Environmental & Analytical Laboratories

Salini T. S.
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Authorized Signatory

Laiju P. N.
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Standard^{S} Environmental Monitoring

TEST REPORT

NABL(TC-5402)

Test Report No: TC540219000006130F	Date: 24.03.2020	Page 1 of 1

CUSTOMER DETAILS	
Customer Name & Address	M/s Antea Group Ist Floor, Kudiyirikkal Building, Palarivattom, Ernakulam District.
Customer Reference	Test Request Form Dated 20.03.2020

SAMPLE DETAILS			
Sample Code	19000006130	Sample Received On	20.03.2020
Sample Name	Water	Sampling Procedure	SEAAL/ENL/GEN/SOP/01& SEAAL/MBL/SOP/06
Sample Description	ThevaraPerandoor Canal	Sampling Location	Near P&T Colony
Identification By Customer	---	Sample Condition	Good
Sampled On	20.03.2020	Test Started On	20.03.2020
Sampled By	Laboratory	Test Completed On	24.03.2020

SL NO	TEST PARAMETER	TEST METHOD	UNIT	RESULT
01	pH	IS 3025 Part 11: 1983 RA 2017	---	6.84
02	Total Dissolved Solids	IS 3025 Part 16: 1984 RA 2017	mg/L	6498
03	Total Hardness (as $CaCO_3$)	IS 3025 Part 21: 2009 RA 2019	mg/L	95.0
04	Nitrate (as NO_3)	APHA 23rdEdition 4500-NO3 B 2017	mg/L	7.23
05	Nitrite (as NO_2)	IS 3025 Part 21: 2009 RA 2019	mg/L	0.04
06	Total Solids	IS 3025 Part 15: 1984 RA 2019	mg/L	6549
07	Total Suspended Solids	IS 3025 Part 17: 1984 RA 2019	mg/L	42.0
08	Dissolved Oxygen	IS 3025 Part 38: 1989 RA 2019	mg/L	1.20
09	Biochemical Oxygen Demand (3 days at 27 ^{o}C)	IS 3025 Part 44: 1993 RA 2019	mg/L	24.5
10	Chemical Oxygen Demand	IS 3025 Part 58: 2006 RA 2017	mg/L	108
11	Salinity	APHA 23rdEdition 2520 B Edn 2017	mg/L	0.61
12	Sodium as Na	IS 3025 Part 45: 1993 RA 2019	mg/L	33.9
13	Total Nitrogen	IS 3025 Part 34: 1988 RA 2019	mg/L	43.7
14	Phosphates	IS 3025 Part 31: 1988 RA 2019	mg/L	2.98
15	Total Coliform	IS 15185 : 2016	---	Present/100 ml
16	Faecal Coliform	IS 1622:1981 RA 2014	MPN/100ml	33

End of Report

For and on behalf of
Standard^{s} Environmental & Analytical Laboratories

Salini T. S.
Microbiologist

Authorized Signatory

Laiju P. N.
Laboratory Head

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Standard^{S} Environmental & Analytical Laboratories
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Customer Reference	Test Request Form Dated 20.03.2020

SAMPLE DETAILS			
Sample Code	19000006130	Sample Received On	20.03.2020
Sample Name	Water	Sampling Procedure	SEAAL/ENL/GEN/SOP/01& SEAAL/MBL/SOP/06
Sample Description	ThevaraPerandoor Canal	Sampling Location	Near P&T Colony
Identification By Customer	---	Sample Condition	Good
Sampled On	20.03.2020	Test Started On	20.03.2020
Sampled By	Laboratory	Test Completed On	24.03.2020

SL NO	TEST PARAMETER	TEST METHOD	UNIT	RESULT
01	pH	IS 3025 Part 11: 1983 RA 2017	---	6.84
02	Total Dissolved Solids	IS 3025 Part 16: 1984 RA 2017	mg/L	6498
03	Total Hardness (as $CaCO_3$)	IS 3025 Part 21: 2009 RA 2019	mg/L	95.0
04	Nitrate (as NO_3)	APHA 23rdEdition 4500-NO3 B 2017	mg/L	7.23
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15	Total Coliform	IS 15185 : 2016	---	Present/100 ml
16	Faecal Coliform	IS 1622:1981 RA 2014	MPN/100ml	33

End of Report

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Standard^{S} Environmental Monitoring

TEST REPORT

NABL(TC-5402)

Test Report No: TC540219000006131F	Date: 24.03.2020	Page 1 of 1

CUSTOMER DETAILS	
Customer Name & Address	M/s Antea Group Ist Floor, Kudiyirikkal Building, Palarivattom, Ernakulam District.
Customer Reference	Test Request Form Dated 20.03.2020

SAMPLE DETAILS			
Sample Code	19000006131	Sample Received On	20.03.2020
Sample Name	Water	Sampling Procedure	SEAAL/ENL/GEN/SOP/01& SEAAL/MBL/SOP/06
Sample Description	ThevaraPerandoorCanal	Sampling Location	Near Mini India
Identification By Customer	---	Sample Condition	Good
Sampled On	20.03.2020	Test Started On	20.03.2020
Sampled By	Laboratory	Test Completed On	24.03.2020

SL NO	TEST PARAMETER	TEST METHOD	UNIT	RESULT
01	pH	IS 3025 Part 11: 1983 RA 2017	---	8.13
02	Total Dissolved Solids	IS 3025 Part 16: 1984 RA 2017	mg/L	12324
03	Total Hardness (as $CaCO_3$)	IS 3025 Part 21: 2009 RA 2019	mg/L	1931
04	Nitrate (as NO_3)	APHA 23rdEdition 4500-NO3 B 2017	mg/L	13.1
05	Nitrite (as NO_2)	IS 3025 Part 21: 2009 RA 2019	mg/L	0.06
06	Total Solids	IS 3025 Part 15: 1984 RA 2019	mg/L	12392
07	Total Suspended Solids	IS 3025 Part 17: 1984 RA 2019	mg/L	18.0
08	Dissolved Oxygen	IS 3025 Part 38: 1989 RA 2019	mg/L	< 0.20
09	Biochemical Oxygen Demand (3 days at 27 °C)	IS 3025 Part 44: 1993 RA 2019	mg/L	92.1
10	Chemical Oxygen Demand	IS 3025 Part 58: 2006 RA 2017	mg/L	315
11	Salinity	APHA 23rdEdition 2520 B Edn 2017	mg/L	11.3
12	Sodium as Na	IS 3025 Part 45: 1993 RA 2019	mg/L	2825
13	Total Nitrogen	IS 3025 Part 34: 1988 RA 2019	mg/L	29.4
14	Phosphates	IS 3025 Part 31: 1988 RA 2019	mg/L	1.44
15	Total Coliform	IS 15185 : 2016	---	Present/100 ml
16	Faecal Coliform	IS 1622:1981 RA 2014	MPN/100ml	17

End of Report

For and on behalf of
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Microbiologist

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TEST REPORT

NABL(TC-5402)

Test Report No: TC540219000006131F	Date: 24.03.2020	Page 1 of 1

CUSTOMER DETAILS	
Customer Name & Address	M/s Antea Group Ist Floor, Kudiyirikkal Building, Palarivattom, Ernakulam District.
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Sample Code	19000006131	Sample Received On	20.03.2020
Sample Name	Water	Sampling Procedure	SEAAL/ENL/GEN/SOP/01& SEAAL/MBL/SOP/06
Sample Description	ThevaraPerandoorCanal	Sampling Location	Near Mini India
Identification By Customer	---	Sample Condition	Good
Sampled On	20.03.2020	Test Started On	20.03.2020
Sampled By	Laboratory	Test Completed On	24.03.2020

SL NO	TEST PARAMETER	TEST METHOD	UNIT	RESULT
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13	Total Nitrogen	IS 3025 Part 34: 1988 RA 2019	mg/L	29.4
14	Phosphates	IS 3025 Part 31: 1988 RA 2019	mg/L	1.44
15	Total Coliform	IS 15185 : 2016	---	Present/100 ml
16	Faecal Coliform	IS 1622:1981 RA 2014	MPN/100ml	17

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Web: www.sealabs.in, E-mail: seaalab@gmail.com

Laiju P. N.
Laboratory Head

About Antea Group

From city to countryside, from air to water: Antea Group's engineers and consultants have been contributing to our living environment in the Netherlands for years now. We design bridges and roadways, and create residential neighborhoods and water structures. But we are also involved in areas such as the environment, safety, asset management and energy. Under the name Oranjewoud, we expanded into an all-round, independent partner for companies and government bodies. As the Antea Group, we also apply this knowledge at a global level. By combining valuable knowledge, including on technical matters, with a pragmatic approach, we make solutions attainable and workable. Goal-oriented, with an eye for sustainability. In this way, we anticipate today's questions and tomorrow's answers. Just as we have been for over 60 years now.

Contact information

29, Monitorweg

1322 BK ALMERE

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1301 AA ALMERE

T. +31-6511428055

www.anteagroup.nl

Detailed Project Report

Tidal Data (CoPT), Kochi

Integrated Urban Regeneration & Water Transport System, Kochi, India

project number WT/2024

revision # 0

June 08, 2020

Appendix Volume IV

Antea Group

Antea Nederland. Antea India

Understanding today.
Improving tomorrow.

Detailed Project Report

Tidal Data (CoPT), Kochi

Integrated Urban Regeneration and Water Transport System (IURWTS) in Kochi

Project #: WT/2024

Revision #: R0

June 08, 2020

General Consultant - IURWTS:

Antea Nederland B.V. and Antea India Pvt. Ltd.

Client:

Kochi Metro Rail Limited, (A Joint Venture of Govt. of Kerala and Govt. of India)

Chart Datum 0.582 below IMSL (Source -CoPT)

2014 January

	0		1		2		3		4		5		6		7		8		9		10		11		12		13		14		15		16		17		18		19		20		21		22		23	
1	125	125	124	123	118	113	105	100	98	94	90	86	84	81	80	81	84	85	87	90	95	95	96	96	96	95	90	83	72	63	53	44	38	33	31	30	30	30	33	39	47	57	68	79	90	106	118	126
2	129	132	134	134	132	127	121	114	104	100	96	91	88	85	84	82	82	84	86	90	94	99	103	105	107	108	104	101	98	93	83	72	56	96	39	35	33	31	30	34	41	47	56	67	79	92	108	117
3	124	132	134	138	139	136	131	124	117	107	99	91	84	79	75	73	71	72	74	77	82	86	90	96	103	106	106	105	103	99	95	87	76	68	60	51	44	39	37	35	36	41	47	54	64	75	85	102
4	115	122	129	135	138	139	136	131	122	113	105	98	91	80	72	69	67	66	65	65	66	71	78	85	91	94	100	105	106	105	102	99	96	87	76	67	60	54	47	42	41	42	46	50	56	62	73	86
5	106	115	122	128	135	140	141	137	130	124	115	106	99	92	85	75	68	65	63	62	61	60	62	67	75	82	88	92	96	102	104	103	91	98	93	96	80	69	62	55	52	48	45	45	49	56	62	70
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2014 February

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29																																																
30																																																
31																																																

Chart Datum 0.582 below IMSL (Source -CoPT)

2014 March

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Chart Datum 0.582 below IMSL (Source -CoPT)

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31																																																

Chart Datum 0.582 below IMSL (Source -CoPT)

2014 May

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Chart Datum 0.582 below IMSL (Source -CoPT)

2014 June

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31																																																

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30																																															
31																																															

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2014 August

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Chart Datum 0.582 below IMSL (Source -CoPT)

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31																																																

Chart Datum 0.582 below IMSL (Source -CoPT)

2014 October

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Chart Datum 0.582 below IMSL (Source -CoPT)

2014 November

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21	123	121	122	118	114	106	107	101	98	96	94	92	90	89	89	91	92	93	96	101	104	104	103	103	102	100	97	92	86	79	73	64	60	55	53	51	51	52	56	61	66	73	79	87	102	114	121	123
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23	120	126	130	127	126	123	118	108	103	100	98	94	89	88	84	83	83	83	86	90	92	94	99	100	100	99	99	96	93	91	84	72	64	55	50	45	42	39	39	40	46	52	57	64	72	80	100	120
24	124	126	128	132	132	130	126	120	113	104	101	98	94	89	85	83	82	82	82	83	85	88	94	101	102	102	101	100	98	93	84	71	62	55	46	39	34	32	32	32	35	38	44	51	60	68	78	90
25	112	120	124	129	130	131	130	124	119	112	104	100	93	87	83	78	76	75	74	74	76	78	83	88	90	94	95	96	96	96	93	87	76	64	54	47	40	34	32	31	31	34	38	42	48	56	64	74
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31																																															

Chart Datum 0.582 below IMSL (Source -CoPT)

2014 December

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6	120	124	124	120	118	115	106	101	97	92	89	84	82	80	79	80	80	81	83	87	91	94	95	96	97	96	94	87	77	68	58	49	41	35	34	34
7	119	122	126	125	125	120	111	103	101	97	87	80	77	76	75	74	74	74	77	79	83	86	89	92	94	95	95	94	89	83	75	65	53	43	36	33
8															74	71	70	69	69	70	73	77	79	83	87	89	90	90	90	88	83	73	62	51	44	36
9	91	105	112	115	119	122	118	112	106	102	99	91	82	76	72	68	64	62	63	64	65	66	67	72	77	82	84	84	85	84	84	81	74	61	53	45
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11	73	81	96	109	113	114	115	118	117	113	108	104	101	98	90	80	72	68	66	65	65	65	66	67	69	73	77	81	83	85	86	86	86	84	78	73
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21	134	132	130	126	122	118	110	104	101	100	98	96	94	94	94	94	94	94	99	101	104	105	105	104	103	100	92	83	74	67	60	52	45	41	39	38
22	131	132	133	134	131	126	120	112	106	103	101	98	96	95	95	95	96	96	98	100	100	104	110	115	110	105	104	101	92	84	76	66	56	48	44	41
23	132	136	140	142	139	138	133	127	117	108	104	100	97	94	90	88	88	89	90	93	96	101	112	113	114	114	110	106	104	99	89	78	65	58	53	45
24	130	132	136	138	142	144	140	135	128	116	109	104	100	94	88	86	84	79	75	76	79	86	90	96	102	106	108	108	105	102	98	92	83	73	63	52
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27	68	77	91	109	116	120	123	127	129	127	119	114	108	101	96	84	75	67	61	57	55	53	53	53	55	59	64	69	74	79	85	89	91	92	91	91
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Chart Datum 0.582 below IMSL (Source -CoPT)

2015 January

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7	110	116	118	120	124	124	124	117	110	103	99	95	85	77	73	71	70	70	70	70	70	72	76	81	84	86	88	89	90	90	85	80	75	65	56	47	42	36	34	33	35	37	41	46	53	60	68	78
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9	80	92	107	113	116	116	116	118	117	113	106	101	97	89	82	75	71	67	65	63	63	63	64	66	69	73	78	82	84	86	88	89	89	88	88	87	82	76	30	62	59	57	56	56	56	60	64	68
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19	128	126	124	123	119	112	105	102	101	100	99	98	97	96	96	96	97	97	98	102	104	102	101	100	99	94	86	79	72	66	59	52	47	44	42	42	42	44	49	55	62	69	77	94	115	120	123	126
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21	130	133	134	138	132	129	122	115	106	100	97	91	86	83	82	82	81	81	82	85	88	93	104	108	110	108	105	101	99	95	86	76	63	52	44	40	38	36	36	38	42	47	54	62	70	80	106	120
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31	116	111	109	109	108	105	102	100	99	100	101	101	101	102	104	104	104	104	101	100	99	98	95	91	85	76	67	63	60	57	56	53	52	52	55	60	64	68	72	78	88	104	108	112	118	124	125	125

Chart Datum 0.582 below IMSL (Source -CoPT)

2015 February

	0		1		2		3		4		5		6		7		8		9		10		11		12		13		14		15		16		17		18		19		20		21		22		23	
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Chart Datum 0.582 below IMSL (Source -CoPT)

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31																																																

Chart Datum 0.582 below IMSL (Source -CoPT)

2015 May

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29																	55	60	65	65	65	65	70	70	70	70	70	65	65	65	60	60	65															

Chart Datum 0.582 below IMSL (Source -CoPT)

2015 June

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1																																																
2																																																
3																																																
4																							76	86	105	110	118	117	113	107	105	100	96	88	80	70	66	84	63	63	64	64	67	68	71	76	78	80
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13																		104	108	109	110	105	100	90	85	85		94	92	90	88	87	86	85	87	89	92	94	96	101	106	107	104	104	102	96	91	89
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Chart Datum 0.582 below IMSL (Source -CoPT)

2015 July

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Chart Datum 0.582 below IMSL (Source -CoPT)

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2015 October Chart Datum 0.582 below IMSL Position of CT

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31	75	106	114	118	116	119	121	119	115	112	102	98	95	92	82	72	69	Out of order																																

Chart Datum 0.582 below IMSL (Source -CoPT)

2015 November

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Chart Datum 0.582 below IMSL (Source -CoPT)

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Chart Datum 0.582 below IMSL (Source -CoPT)

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30																																															
31																																															

Chart Datum 0.582 below IMSL (Source -CoPT)

2016 March

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Chart Datum 0.582 below IMSL (Source -CoPT)

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31																																															

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Chart Datum 0.582 below IMSL (Source -CoPT)

2016 June

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13																			89	87	86	85	84	80	79	80	84	86	86	87	90	95	102	102	100	104	106	108	104	100	98	97	95	93	88	83	78	83
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31																																															

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2016 July

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Chart Datum 0.582 below IMSL (Source -CoPT)

2016 August

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31																																															

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Chart Datum 0.582 below IMSL (Source -CoPT)

2016 November

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31																																															

Chart Datum 0.582 below IMSL (Source -CoPT)

2016 December

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24																		102	101	100	100	99	96	89	82	76	71	66	63	61	59	58	58	59	60	63	66	69	73	77	81	86	93	104	110	111	111	110
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Chart Datum 0.582 below IMSL (Source -CoPT)

2017 January

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Chart Datum 0.582 below IMSL (Source -CoPT)

2017 February

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Chart Datum 0.582 below IMSL (Source -CoPT)

2017 March

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Chart Datum 0.582 below IMSL (Source -CoPT)

2017 April

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13	48	50	54	59	64	70	75	79	83	87	91	94	96	96	95	93	90	88	85	83	80	79	79	78	78	80	83	85	87	89	92	95	96	96	96	95	94	92	88	81	76	72	67	62	57	53	50	49
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15	53	52	50	50	51	52	55	58	62	66	70	75	79	82	85	87	90	91	90	90	88	88	87	85	83	81	79	79	79	78	78	79	81	83	83	84	85	85	86	87	86	85	82	79	77	73	68	63
16	61	58	57	55	53	53	54	55	57	60	64	68	73	77	80	85	91	96	100	100	99	98	98	97	94	92	90	88	86	84	82	81	81	82	84	84	85	86	87	90	91	92	92	92	91	90	87	83
17	78	75	72	69	65	61	58	58	59	60	63	65	68	73	77	83	88	90	106	108	110	110	108	105	103	101	99	96	94	90	87	87	87	87	86	87	87	87	89	90	97	102	107	104	103	101	98	96
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19	98	97	94	90	85	79	73	67	61	57	53	53	53	55	59	63	67	73	77	83	90	105	107	107	106	103	105	100	97	93	87	81	75	70	66	62	60	60	61	64	67	71	75	80	84	88	91	96
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22	87	91	96	100	99	98	97	94	89	85	80	76	71	66	62	60	60	61	63	64	68	73	79	84	87	90	93	98	98	97	94	91	87	82	75	67	59	53	49	47	46	47	48	50	54	59	64	70
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25	55	59	65	71	75	79	82	85	86	87	87	86	83	80	77	72	68	65	63	62	62	63	65	66	69	72	75	78	81	82	83	83	83	82	79	75	71	67	62	59	53	49	46	45	45	46	47	48
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27	52	56	60	63	67	72	76	79	82	85	86	87	88	88	87	85	82	81	79	76	74	74	74	74	73	74	77	79	80	82	83	84	84	85	83	82	79	76	72	69	65	61	58	55	53	52	52	52
28	53	54	57	60	64	68	72	75	77	80	83	84	86	87	87	86	85	84	82	80	78	77	75	74	74	74	74	75	76	77	78	80	80	80	80	80	78	77	75	72	69	66	63	60	58	56	54	53
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Chart Datum 0.582 below IMSL (Source -CoPT)

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2	73	72	70	68	66	64	62	62	62	63	64	65	67	70	73	76	79	82	85	88	91	92	93	94	93	91	90	87	85	81	76	73	70	69	68	67	68	70	71	73	75	77	79	80	81	81	81	81
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4	86	86	84	81	77	72	68	64	61	59	57	56	58	61	64	67	70	74	78	83	86	90	94	98	99	98	96	93	89	85	81	76	70	65	61	58	56	57	59	62	66	70	74	78	82	85	89	91
5	92	92	92	91	88	83	79	74	69	64	59	57	56	58	61	64	67	71	77	82	87	92	97	105	108	105	100	98	93	89	85	80	74	67	61	57	54	52	52	54	57	62	67	73	78	84	88	95
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16	82	80	77	74	72	70	69	68	69	70	71	74	76	78	81	85	91	95	103	102	102	100	99	98	96	93	96	87	83	79	76	73	71	69	68	69	70	71	73	76	79	82	84	86	88	90	92	92
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18	87	88	87	86	84	80	76	72	69	67	66	65	65	64	66	68	70	73	76	79	83	89	93	94	94	93	91	89	86	80	75	68	62	58	56	54	53	53	54	56	59	63	68	73	77	81	87	91
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21	90	108	109	106	103	100	99	97	94	89	86	82	77	74	71	70	68	68	70	72	75	78	82	85	87	89	90	90	90	88	85	82	77	70	62	55	49	45	44	43	43	45	47	51	55	61	67	75
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25	59	64	70	76	82	87	90	92	94	96	96	94	93	90	87	83	79	76	73	71	69	69	70	71	72	74	76	79	80	81	81	82	80	78	75	72	68	65	63	59	56	54	53	52	52	52	53	56
26	59	62	66	72	78	83	87	91	98	102	102	100	99	98	96	93	90	87	85	83	80	78	77	76	76	76	77	78	80	81	82	82	82	81	80	77	74	70	65	62	59	56	53	51	50	51	53	54
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Chart Datum 0.582 below IMSL (Source -CoPT)

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2	99	98	97	96	94	91	88	86	83	82	82	82	82	84	87	90	93	97	105	109	111	109	107	107	102	100	97	94	89	85	81	76	72	68	66	65	65	66	69	72	76	80	85	102	111	112	116	117
3	115	113	111	100	104	100	98	95	93	91	89	88	87	87	89	91	99	106	109	113	117	119	118	115	112	99	93	100	97	95	89	85	80	75	71	69	67	66	66	68	71	76	80	90	109	116	121	123
4	125	125	123	119	114	108	103	100	98	95	91	88	87	86	86	87	88	90	104	109	109	109	112	114	116	110	103	100	97	94	89	82	74	69	62	58	56	54	54	54	57	61	66	72	77	97	114	120
5	126	128	130	127	123	119	113	106	100	98	95	91	88	87	87	86	86	88	95	105	107	110	114	117	118	114	110	105	102	100	96	90	83	75	67	60	55	52	50	50	51	54	58	64	70	78	105	118
6	123	129	130	130	130	129	126	120	112	104	100	98	96	92	89	83	86	86	87	89	91	105	112	112	112	110	110	111	106	100	97	93	87	80	72	64	57	50	46	44	44	45	48	53	59	66	73	85
7	111	119	126	128	129	128	128	123	119	111	105	99	97	93	89	87	85	83	82	82	82	87	94	104	107	107	107	107	106	102	100	97	94	88	81	75	67	59	51	46	44	44	45	46	49	55	61	68
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9	70	76	93	113	119	121	129	128	130	128	125	120	116	112	104	100	96	93	92	90	84	83	82	88	86	90	96	101	104	106	105	105	99	97	96	94	92	87	82	77	72	68	64	62	61	61	62	65
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12	78	77	78	79	81	83	86														98	97	94	91	89	87	84	82	81	82	82	83	84	85	87	88	90	91	93	94	95	96	96	95	94	93	91	89
13	87	86	85	85	86	86	87	88	91	95	103	105	109	112	114	113	112	111	110	106	102	100	98	95	92	89	86	82	80	77	76	76	76	76	78	79	82	84	86	88	90	95	101	100	100	99	99	98
14	96	93	92	90	89	88	87	87	87	88	89	91	93	102	108	108	108	110	110	110	107	102	99	98	96	93	89	85	81	77	75	72	70	70	69	71	73	74	76	80	83	89	100	104	106	106	106	103
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17	108	105	106	102	100	97	95	91	89	86	83	80	78	78	78	78	79	80	82	84	86	88	89	90	90	90	90	88	84	77	74	69	63	58	53	51	50	50	51	52	55	59	63	69	74	80	96	109
18	113	112	112	111	106	104	101	98	95	91	38	84	81	80	78	78	78	78	79	82	84	86	88	89	90	91	90	89	87	83	80	75	68	62	57	55	53	52	52	525	53	56	59	64	69	75	95	111
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20	113	115	118	122	121	118	115	108	102	99	98	95	91	88	85	83	82	81	80	79	79	81	84	86	87	88	89	89	89	88	86	83	79	73	66	61	55	51	49	48	49	49	51	55	59	65	71	85
21	118	111	116	120	120	118	115	112	111	105	100	97	94	91	89	85	83	80	79	79	79	79	80	81	84	86	87	88	88	88	87	85	82	77	73	67	62	58	54	51	50	50	51	53	55	59	64	70
22	79	96	108	116	119	119	119	116	114	108	104	100	97	94	91	88	86	83	81	79	79	79	79	80	83	84	86	87	87	87	87	85	83	80	76	72	65	60	56	53	52	51	51	53	55	59	63	67
23	73	79	100	108	112	116	116	117	118	116	106	100	98	97	94	91	88	86	84	82	81	80	80	80	82	84	85	86	87	88	88	89	89	88	86	80	77	73	69	66	63	60	59	59	59	61	63	66
24	70	75	81	97	110	111	114	116	116	117	112	107	104	100	98	96	93	90	87	84	82	80	80	80	80	80	81	83	85	86	87	87	87	87	86	84	80	77	74	71	68	66	64	62	62	63	64	65
25	68	71	75	80	91	106	109	112	114	114	113	110	107	105	101	99	96	93	91	88	85	83	81	80	80	80	81	81	82	83	85	86	86	86	86	86	85	82	80	77	75	72	70	69	68	68	68	69
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27	73	74	74	77	80	83	86	93	108	109	113	112	108	110	110	106	101	99	98	96	93	88	85	83	81	78	76	75	74	74	75	76	76	77	78	79	80	82	82	82	82	82	80	78	77	76	76	75
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29	80	80	80	80	80	81	82	82	83	85	87	89	94	101	104	105	104	102	100	99	98	95	92	89	85	81	77	74	71	68	65	64	63	64	64	66	68	70	72	75	78	80	82	84	86	86	87	87
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Chart Datum 0.582 below IMSL (Source -CoPT)

2017 December

	0		1		2		3		4		5		6		7		8		9		10		11		12		13		14		15		16		17		18		19		20		21		22		23	
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2	120	117	112	109	104	99	97	95	94	91	89	88	88	89	90	91	92	94	102	103	101	99	98	94	94	91	87	79	71	62	56	51	47	42	39	38	37	38	41	45	50	57	64	72	90	111	113	113
3	114	113	113	108	103	99	97	94	90	87	84	81	79	78	78	78	79	80	82	85	87	89	90	91	90	90	87	82	74	67	60	52	46	41	37	35	33	32	32	32	38	44	51	58	66	76	108	116
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5	121	126	130	130	130	123	119	113	106	100	98	95	92	89	86	84	82	81	81	81	83	85	88	90	92	95	95	95	93	89	84	77	67	57	48	42	38	36	34	33	32	33	35	39	45	52	61	71
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19	115	118	122	123	123	119	116	116	104	99	97	94	91	88	86	84	82	81	80	80	82	83	85	87	89	90	90	89	87	85	83	79	74	67	60	56	51	49	46	46	47	49	53	57	62	68	78	103
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Chart Datum : 0.582 Below IMSL (SOURCE: CoPT)

2018 January

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15	123	120	119	118	115	110	105	100	99	98	97	96	94	93	92	92	93	93	94	95	95	96	98	98	98	95	93	89	85	81	76	70	65	60	58	56	54	53	55	58	63	67	73	78	94	113	119	124
16	125	125	128	127	125	119	115	109	102	99	98	97	95	93	92	91	91	91	92	93	94	95	97	97	98	97	95	93	90	85	80	74	67	61	57	53	50	49	49	51	55	60	65	71	77	94	112	121
17	122	127	127	127	126	124	120	124	106	100	98	97	94	91	88	87	86	86	86	87	88	91	93	95	96	96	95	94	91	88	83	79	73	67	61	56	52	49	49	49	52	56	60	66	72	80	97	115
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21	90	111	116	124	126	129	129	128	126	119	116	107	100	98	95	90	86	82	79	77	73	73	75		80	83	87	91	96	101	100	99	97	95	92	88	83	78	73	68	64	61	59	59	60	64	69	75
22	82	96	111	116	120	125	125	120	123	122	117	107	100	97	94	91	87	83	79	74	71	70	69		71	75	80	84	88	92	95	97	98	97	96	93	90	86	83	79	75	71	69	67	67	69	72	76
23	80	86	106	116	118	123	126	128	127	126	119	116	109	101	98	94	90	85	80	75	71	69	67		67	69	71	75	80	84	87	91	95	95	95	95	94	92	88	84	81	78	74	71	70	70	71	74
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26	93	93	94	96	100	106	112	117	118	114	119	117	115	113	109	105	101	96	91	87	78	71	65		54	52	52	55	54	64	70	76	82	87	91	97	104	104	109	109	108	107	106	105	100	102	101	100
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Chart Datum : 0.582 Below IMSL (SOURCE: CoPT)

	2018 February																																															
	0		1		2		3		4		5		6		7		8		9		10		11		12		13		14		15		16		17		18		19		20		21		22		23	
1																					88	95	103	107	109	107	103	101	98	96	92	86	74	72	63	55	50	46	45	44	46	51	58	65	72	90	115	120
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16	117	119	120	121	118	114	109	103	100	97	92	88	83	79	78	73	71	71	72	75	77	81	85	89	93	94	94	93	91	89	85	80	75	69	64	59	55	51	49	49	50	54	58	64	70	77	87	108
17	117	120	122	123	121	118	115	107	101	99	95	90	84	78	73	69	69	68	69	70	73	76	81	86	90	95	98	99	98	97	95	91	87	80	73	67	60	55	51	49	49	51	56	62	67	74	81	99
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22	85	89	95	109	116	121	117	116	116	116	112	108	100	95	88	80	71	62	54	48	47	47	48	49	50	55	62	69	75	81	87	97	105	106	107	107	104	102	99	96	93	89	86	82	80	80	81	82
23	83	87	90	99	108	109	112	113	116	114	109	105	101	98	95	87	78	68	60	54																												
24																					53	47	44	40	39	38	39	42	47	51	57	65	71	76	81	85	89	93	100	101	101	101	101	99	98	97	95	93
25	91	91	92	93	95	96	96	101	104	105	105	104	103	101	99	97	92	86	79	73	74	67	57	45	40	37	35	35	34	38	42	46	50	56	61	66	72	77	82	87	91	95	102	102	101	101	100	99
26	98	97	97	97	96	95	95	95	95	96	96	96	96	96	96	94	94	91	88	84	79	74	67	61	55	51	46	42	40	38	39	41	44	48	53	58	63	67	74	79	86	94	107	111	110	110	110	107
27	106	104	102	101	100	98	95	92	90	90	90	89	90	91	92	93	94	95	96	95	94	92	87	83	77	71	64	58	53	48	45	44	43	44	47	50	55	60	66	72	78	86	93	109	115	117	117	116
28	116	114	113	106	102	100	98	95	92	87	85	84	84	85	85	86	88	91	93	96	98	99	100	99	96	90	83	76	70	64	57	51	47	45	45	45	47	51	56	63	70	77	85	93	110	118	122	124

Chart Datum : 0.582 Below IMSL (SOURCE: CoPT)

	2018 March																																															
	0		1		2		3		4		5		6		7		8		9		10		11		12		13		14		15		16		17		18		19		20		21		22		23	
1	126	123	120	115	110	104	101	98	93	88	84	81	79	78	78	78	80	83	86	90	93	99	106	107	104	101	99	95	89	83	75	67	59	53	48	46	45	46	47	51	57	63	70	77	87	105	117	123
2	126	128	126	123	119	113	106	101	97	91	83	76	72	71	70	69	70	73	77	81	85	90	103	111	112	111	108	105	102	100	97	89	78	70	63	57	52	49	50	52	57	61	67	74	81	100	115	120
3	129	132	134	130	122	112	109	108	102	97	89	80	73	68	64	69	62	63	66	71	77	83	89	101	116	117	115	117	117	112	116	101	95	88	79	71	63	56	52	53	54	59	63	59	75	83	95	113
4	119	123	127	129	128	127	120	112	103	99	93	84	73	64	57	55	53	53	54	57	61	68	75	83	90	100	111	113	113	113	111	108	103	98	91	83	75	67	60	55	53	54	56	59	65	71	77	85
5	98	112	119	120	121	120	119	113	107	101	96	89	80	71	61	53	47	44	43	45	47	51	58	66	75	82	89	96	109	110	109	107	105	103	99	95	89	83	77	70	64	61	59	61	63	67	72	79
6	86	95	109	113	113	114	113	113	109	103	99	92	84	75	67	58	49	44	41	42	43	47	51	57	65	72	80	86	96	106	110	110	111	111	106	103	100	94	86	80	73	68	66	66	67	70	74	78
7	83	88	96	110	114	115	114	113	111	108	104	101	95	87	79	70	62	55	50	46	43	44	47	51	55	61	69	77	83	90	95	99	105	107	111	110	105	101	95	91	87	83	77	74	73	75	77	78
8	81	85	91	96	107	111	109	107	110	108	104	102	99	93	87	81	75	68	61	65		49	49	49	51	55	60	66	74	81	87	91	97	102	108	109	105	105	105	101	97	91	87	84	81	79	78	79
9	81	83	87	89	91	95	100	105	103	103	101	99	98	94	89	85	79	75	68	62	67	63	49	49	50	50	52	56	62	68	73	79	84	88	91	94	96	97	99	99	99	96	92	89	86	85	83	80
10	81	81	83	85	87	89	91	92	93	95	95	94	93	90	87	85	81	76	71	66	63	59	57	54	52	51	51	55	59	63	67	71	75	82	87	89	92	95	100	103	104	103	101	99	98	97	95	92
11	91	89	89	91	91	91	91	91	93	93	93	93	91	90	89	87	86	82	77	74	66	65	63	61	58	56	55	55	56	58	61	65	67	71	73	78	83	87	90	93	97	101	103	101	101	101	101	99
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13	107	107	104	103	101	99	97	95	93	93	91	91	91	91	91	91	91	91	92	91	91	89	88	88	85	81	77	73	72	71	69	98	67	67	69	71	73	77	80	85	89	95	105	109	113	115	117	115
14	115	115	110	107	103	103	101	97	95	91	89	88	87	86	85	85	87	90	93	93	94	94	95	95	93	89	85	81	77	75	71	63	65	65	65	65	67	69	79	78	83	87	92	106	111	117	117	117
15	115	117	117	111	107	103	101	97	94	90	86	83	81	81	81	83	84	85	57	91	95	97	98	99	99	99	97	93	90	84	80	75	74	70	67	66	66	69	71	72	77	82	88	99	114	116	121	125
16	126	126	122	116	114	108	105	102	97	91	86	83	80	78	78	78	79	82	85	88	92	95	102	107	107	105	103	101	98	93	89	83	77	71	66	63	63	62	63	64	67	73	79	80	91	106	106	119
17	123	122	123	119	115	111	105	102	97	91	85	79	75	73	72	71	71	73	76	81	85	89	93	102	111	110	107	105	104	103	101	97	91	84	77	72	68	66	65	65	67	71	76	81	86	95	114	120
18	123	125	126	124	120	116	110	104	101	95	88	81	75	71	68	67	67	68	70	74	79	83	90	103	113	112	113	115	114	110	105	102	98	93	88	80	72	66	63	63	65	67	70	73	78	85	101	115
19	116	119	121	122	12	113	108	104	100	95	87	79	70	63	58	55	55	56	57	60	64	72	77	87	91	99	105	115	115	111	107	105	103	100	95	87	81	73	68	65	65	66	67	69	73	79	85	90
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21	100	113	120	120	122	121	118	115	108	104	99	93	85	78	69	64	55	52	51	51	43	48	55	61	67	75	89	105	109	112	115	115	113	109	104	98	95	92	87	83	77	74	73	72	73	75	78	81
22	87	103	110	113	111	113	111	111	105	97	94	89	83	75	67	59	52	47	43	41	41	40	43	47	55	61	67	75	83	102	109	111	109	110	109	105	97	95	91	87	83	79	75	73	73	73	73	75
23	77	81	85	95	103	103	105	13	100	97	94	90	85	79	71	61	53	45	40	35	32	31	33	35	40	45	53	59	66	74	80	90	103	106	105	103	99	97	95	93	89	85	80	77	7	73	73	73
24	72	75	78	82	85	87	89	91	92	91	89	87	83	79	71	64	55	49	43	37	34	31	31	29	29	31	37	43	50	56	62	69	75	81	85	89	91	91	91	91	90	86	82	79	76	74	71	69
25	68	69	71	73	75	76	78	87	83	83	83	83	82	78	73	68	63	57	51	45	39	34	31	29	29	29	31	35	41	45	51	58	64	68	76	81	85	89	93	95	95	95	94	93	91	88	85	84
26	81	81	81	80	79	81	82	84	85	85	86	87	88	89	88	85	82	77	73	67	63	57	52	49	46	45	43	43	45	47	51	57	59	65	71	76	81	84	90	103	105	105	104	101	101	99	97	95
27	91	89	88	86	84	81	81	81	81	81	81	83	84	85	85	87	87	87	84	82	80	75	71	67	62	57	54	51	49	49	50	51	55	59	63	67	72	77	83	90	105	17	17	105	105	106	103	101
28	97	95	94	91	87	83	81	79	77	77	77	77	77	79	79	81	83	85	87	87	87	86	85	81	78	74	67	62	57	53	51	48	50	52	52	53	57	63	67	73	78	84	96	105	107	106	104	104
29	101	98	95	93	89	85	81	75	71	67	65	65	65	65	67	69	72	75	79	83	86	89	90	90	89	87	84	79	73	67	62	58	55	52	49	49	51	54	59	63	68	74	80	89	99	107	111	110
30	107	102	98	96	93	88	83	77	71	65	61	57	55	55	55	57	60	65	69	75	81	85	95	101	101	98	97	94	89	85	81	75	64	63	59	56	54	53	56	58	63	69	75	79	89	105	109	111
31	110	111	106	102	98	95	91	86	79	73	65	59	55	52	51	51	52	57							103	107	104	100	97	95	90	85	74	73	67	61	57	53	53	55	57	61	65	73	77	85	95	105

Chart Datum : 0.582 Below IMSL (SOURCE: CoPT)

2018 April

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1	108	111	109	103	99	97	93	87	80	71	63	56	50	47	43	41	41	44	48	53	60	67	74	83	100	107	109	108	107	101	97	96	92	97	80	73	65	61	59	57	56	57	63	69	71	76	84	105
2	108	109	107	106	105	101	97	91	87	79	70	63	55	47	42	39	39	39	41	45	51	57	65	73	83	98	110	114	112	111	111	107	99	95	90	85	79	71	65	61	61	61	62	63	67	73	79	83
3	93	103	104	107	107	101	99	95	91	85	78	71	63	54	47	41	39	37	37	39	45	51	58	65	73	80	91	106	110	114	113	112	103	101	98	94	89	83	79	73	69	66	65	65	67	70	75	80
4	85	89	99	102	102	101	99	97	94	87	83	76	67	59	51	45	39	37	35	35	36	41	47	51	63	70	78	88	107	110	110	111	110	107	104	97	93	88	83	79	73	69	66	65	67	69	72	73
5	77	83	89	95	99	98	97	95	94	91	87	79	71	63	56	49	45	39	6	35	38	41	46	51	57	64	71	79	86	97	107	110	111	113	107	105	100	97	95	90	85	81	87	75	73	73	74	76
6	79	83	86	89	93	97	101	99	97	95	91	88	84	77	69	63	57	53	49	45	42	43	45	50	55	59	65	72	79	87	91	102	109	112	113	112	105	101	99	97	95	91	87	83	79	78	78	79
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9	82	81	78	78	78	79	79	79	80	80	80	80	80	78	77	74	71	69	65	63	59	57	54	53	53	53	54	55	58	60	62	66	71	75	79	83	87	93	103	105	103	101	99	97	97	96	95	92
10	90	89	87	86	85	83	83	83	83	83	84	84	85	85	85	85	83	83	81	79	79	77	77	75	73	73	72	71	71	73	75	77	79	80	85	94	104	105	108	110	113	115	111	110	108	108	104	101
11	99	97	95	93	90	87	87	85	85	85	84	83	83	85	86	86	87	87	87	87	87	85	83		79	78	77	77	73	73	73	73	75	77	79	80	83	85	89	101	103	108	106	108	107	106	102	99
12	99	97	93	91	87	83	80	77	75	74	73	73	75	75	77	79	81	82	83	85	85	87	87	85	83	83	82	79	76	73	71	70	70	70	71	73	76	78	81	87	98	103	105	108	113	113	109	107
13	102	99	97	95	91	86	81	77	73	71	69	69	69	69	71	73	75	79	83	85	89	92	95	95	95	95	94	91	88	84	80	75	73	72	71	71	71	72	74	77	81	85	89	105	112	114	111	106
14	107	106	103	100	95	89	83	80	75	70	65	63	62	63	66	68	71	74	79	86	90	103	103		108	107	103	99	97	94	89	85	81	78	75	72	71	71	73	77	80	84	89	103	113	114	115	116
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16	118	116	111	105	100	98	95	90	84	76	69	63	59	55	52	52	54	58	61	66	73	81	102		112	115	116	116	114	108	104	99	96	93	88	84	79	74	72	71	72	75	78	81	86	98	111	114
17	113	110	108	105	101	99	97	92	86	79	74	67	59	53	49	47	47	49	52	57	64	72	83		117	121	127	126	125	122	121	116	107	101	99	97	91	87	83	81	81	82	83	85	89	97	110	43
18	117	118	119	117	110	103	99	95	91	86	77	69	62	57	52	49	46	45	47	51	57	65	73	88	111	120	125	127	127	129	127	125	120	113	103	99	97	93	90	87	85	83	83	83	85	88	93	109
19	111	115	115	115	113	107	102	99	95	91	85	78	69	58	51	47	44	42	41	43	48	55	62		80	95	119	125	126	128	131	129	130	124	116	108	103	99	97	93	91	88	87	85	85	85	90	95
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21	91	99	107	111	112	113	111	107	103	101	99	95	89	83	76	68	60	54	50	48	48	48	50	55	61	68	77	85	107	117	120	122	126	128	130	128	125	113	109	105	101	99	96	93	91	89	89	90
22	91	92	94	100	108	108	107	108	107	105	102	99	95	91	85	79	73	66	59	55	51	51	49		54	59	67	75	81	87	103	114	119	121	123	124	123	122	118	109	105	102	100	98	96	94	91	89
23	88	88	89	89	91	95	97	98	98	99	99	99	97	95	90	84	79	73	68	63	59	57	55		55	58	52	65	70	76	83	89	100	108	115	119	120	120	119	117	115	110	103	102	99	97	93	91
24	89	87	85	84	83	83	86	88	89	91	91	93	93	94	94	91	88	85	81	78	73	69	65		60	59	60	61	64	66	69	74	79	85	89	96	108	111	113	111	111	110	105	104	102	100	98	95
25	91	87	85	83	80	78	76	77	79	80	81	83	86	87	89	90	91	91	89	88	89	88	83		75	72	69	68	67	65	68	69	73	76	79	83	87	91	98	109	111	113	113	113	107	103	102	101
26	97	93	89	84	79	76	73	72	70	69	69	70	72	75	79	82	85	88	90	93	93	93	92	91	89	86	82	79	75	72	70	69	69	69	70	73	77	80	84	87	93	106	107	107	106	104	107	103
27	101	99	95	91	86	81	75	70	67	65	63	62	62	63	65	69	74	79	84	89	88	92	102		102	100	99	96	93	89	85	84	79	77	75	75	75	76	79	82	87	93	109	108	110	112	115	106
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31																																															

Chart Datum : 0.582 Below IMSL (SOURCE: CoPT)

2018 May

	0		1		2		3		4		5		6		7		8		9		10		11		12		13		14		15		16		17		18		19		20		21		22		23	
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2	93	95	96	97	97	95	93	89	84	77	70	62	55	49	45	43	41	41	43	47	52	59	67	75	86	106	114	117	121	122	117	114	110	103	101	99	97	93	88	85	81	79	79	77	77	79	81	88
3	89	91	93	95	99	97	95	93	89	84	76	68	59	52	47	44	42	41	40	41	45	51	57	56	63	73	91	100	103	107	109	109	105	101	97	94	91	89	86	81	77	75	73	71	69	69	70	73
4	75	77	79	81	82	83	81	79	77	74	67	54	51	48	45	41	37	35	34	36	40	42	45	51	58	55	73	80	85	99	105	107	105	103	100	97	95	91	88	84	80	77	74	72	70	69	69	69
5	71	73	76	77	79	81	81	79	77	75	71	68	65	59	53	47	43	41	39	38	38	39	42	45	51	58	65	71	78	87	101	101	105	105	103	100	97	95	92	89	85	82	79	75	73	71	71	71
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9	77	73	71	71	71	69	69	69	71	74	75	75	74	74	75	75	73	71	69	67	65	65	63	61	61	62	63	63	64	65	69	72	76	78	80	83	88	93	96	97	96	95	95	94	91	87	83	79
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11	85	81	77	75	71	69	65	63	63	63	63	65	67	69	71	73	75	78	80	81	83	83	82	81	81	81	80	79	77	76	76	76	77	77	77	80	82	85	87	90	96	105	105	99	100	99	97	95
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28	96	95	93	89	85	79	73	67	63	59	55	53	52	52	55	59	64	68	75	82	98	116	113	119	122	125	122	117	111	107	105	103	99	97	95	94	94	95	96	96	96	98	108	109	107	108	105	105
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30	89	89	87	85	81	74	69	62	57	51	45	40	37	38	39	41	45	48	54	61	67	85	91	97	101	115	115	113	114	114	110	104	101	97	90	86	81	77	78	73	73	75	77	81	83	85	88	91
31																									90	101	107	110	111	111	107	103	99	97	94	91	87	83	79	77	73	72	72	73	75	77	80	83

Chart Datum : 0.582 Below IMSL (SOURCE: CoPT)

2018 June

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11	99	97	95	93	90	87	87	85	85	85	84	83	83	85	86	86	87	87	87	87	87	85	83		79	78	77	77	73	73	73	73	75	77	79	80	83	85	89	101	103	108	106	108	107	106	102	99
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16	118	116	111	105	100	98	95	90	84	76	69	63	59	55	52	52	54	58	61	66	72	81	102		112	115	116	116	114	108	104	99	96	93	88	84	79	74	72	71	72	75	78	81	86	98	111	114
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22	91	92	94	100	108	108	107	108	107	105	102	99	95	91	85	79	73	66	59	55	51	51	49		54	59	67	75	81	87	103	114	119	121	123	124	123	122	118	109	105	102	100	98	96	94	91	89
23	88	88	89	89	91	95	97	98	98	99	99	99	97	95	90	84	79	73	68	63	59	57	55		55	58	62	65	70	76	83	89	100	108	115	119	120	120	119	117	115	110	103	102	99	97	93	91
24	89	87	85	84	83	83	86	88	89	91	91	93	93	94	94	91	88	85	81	78	73	69	65		60	59	60	61	64	66	69	74	79	85	89	96	108	111	113	111	111	110	105	104	102	100	98	95
25	91	87	85	83	80	78	76	77	79	80	81	83	86	87	89	90	91	91	89	88	89	88	83		75	72	69	68	67	65	68	69	73	76	79	83	87	91	98	109	111	113	113	113	107	103	102	101
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31																																															

Chart Datum : 0.582 Below IMSL (SOURCE: CoPT)

2018 July

	0		1		2		3		4		5		6		7		8		9		10		11		12		13		14		15		16		17		18		19		20		21		22		23	
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6	47	50	55	56	60	66																	57	60	63	65	66	73	77	85	88	92	92	95	99	97	93	86	83	83	77	65	57	54	48	42	44	44
7	45	41	43	46	53	57	56	60	66	69	72	73	71	78	79	75	68	63	63	61	67	63	58	60		70	74	75	78	82	86	90	91	94	97	98	94	92	93	93	78	77	70	67	56	53	49	41
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10	47	40	36	36	31	30	36	36	41	46	51	55	63	67	70	83								96	89	88	85	87	84	80	77	80	81	81	81	83	91	94	94	90	93	93	93	89	84	78	77	63
11	55	47	39	35	31	27	22	20	22	28	35	34	43	48	60	69	74	81	87	93	94	105	101	101	98	97	94	92	87	83	79	75	78	80	82	75	79	81	86	93	91	91	84	89	95	80	81	72
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13																								110	13	113	117	113	106	101	85	79	68	61	59	61	62	60	63	65	66	73	74	77	83	79	83	83
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16	89	92	91	89	92	82	77	72	63	60	50	37	28	25	14	10	15	19	28	39																													
17																					46	55	62	70	77	89	100	106	110	112	118	116	111	110	105	94	86	80	74	58	57	48	43	48	52	52	55	59
18	64	68	73	83	86	85	86	98	92	85	85	81	74	60	53	45	40	44	44	43	43	46	55	62	68	82	86	95	100	107	111	112	113	113	114	107	101	88	75	71	65	60	51	44	42	46	51	56
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23	40	41	37	36	32	30	34	38	43	48	51	56	62	67	73	78	80	84	91	94	96	93	90	89	85	85	83	79	76	76	80	83	77	83	84	85	82	85	87	81	83	85	84	86	77	65	62	59
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25	64	56	52	47	47	41	32	33	35	40	41	44	47	57	66	72	74	83	87	96	96	98	102	104	104	106	97	94	92	91	89	78	78	75	75	77	77	82	84	83	85	88	88	89	89	85	83	85
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27	74	75	72	67	58	45	45	39	35	32	28	32	33	36	39	45	53	60	66	74	82	89	97	99	100	101	105	102	99	95	89	83	79	74	70					71	73	76	79	81	82	83	84
28	84	82	79	73	67	61	56	51	41	37	30	31	31	33	39	40	47	53	60	69				101	104	106	106	106	107	103	98	91	85	81	73	69	62	64	65	68	70	72	74	77	80	83	85	86
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30	83	83	83	82	80	78	72	64	59	50	45	37	33	33	31	33	34	42	49	54	62	67	78	86	94	100	98	100	104	104	102	99	94	85	74	68	62	58	56	52	51	54	61	63	65	68	72	78
31	80	80	80	80	80	78	78	66	61	58	52	48	42	34	31	37	38	43	42	50	55	61	22	77	83	90	95	100	101	100	99	92	91	86	83	74	64	58	55	49	50	50	53	56	58	61	65	69

Chart Datum : 0.582 Below IMSL (SOURCE: CoPT)

2018 August

	0		1		2		3		4		5		6		7		8		9		10		11		12		13		14		15		16		17		18		19		20		21		22		23	
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7	24	24	25	26	31	33	36	44	50	57	59	63	72	76	81	81	81	85	80	84	84	81	74	76	77	73	72	72	73	75	78	77	80	82	83	85	81	81	84	83	79	77	70	60	55	51	43	41
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9	45	43	30	22	21	22	26	20	20	25	31	44	47	53	58	67	76	83	88	92	94	94	91	96	92	89	83	80	77	73	73	71	66	67	72	76	73	78	78	83	81	81	85	83	82	77	70	64
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13	87	93	91	92	75	73	68	56	41	33	31	23	19	16	20	31	31	35	45	60	68	77	84	93	103	106	110	108	107	104	99	91	84	73	62	60	47	52	43	41	54	53	54	62	72	75	83	88
14	85	93	94	94	94	91	90	80	87	58	51	46	39	34	30	27	33	41	45	53	64	72	78	90	95	107	107	104	114	109	106	105	95	83	72	70	67	48	55	48	47	51	50	53	56	63	82	81
15	87	92	100	102	102	95	97	103	96	84	72	72	63	55	43	39	40	47	50	53	62	69	84	93	97	105	108	116	112	114	123	107	109	101	97	77	72	72	60									
16																															124	127	123	120	108	105	100	89	82	66	56	52	42	39	45	56	48	52
17	56	62	80	94	92	100	104	112	111	113	111	113	106	101	94	89	78	77	72	77	73	75	80	92	95	98	107	117	125	126	130	128	127	126	123	116	112	105	90	82	73	68	56	50	52	58	53	53
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25	80	77	70	64	61	55	52	46	43	39	37	39	42	45	51	53	62	66	74	82	87	94	97		99	97	97	91	87	83	79	75	68	64	57	57	58	60	63	64	68	68	73	76	79	81	83	83
26	82	79	79	72	69	63	58	52	46	43	40	40	41	43	45	52	57	60	68	77	83	87	93	96	102	102	100	96	93	91	86	78	72	65	59	55	55	58	63	65	67	70	71	76	80	83	86	83
27	82	84	84	79	75	68	63	58	52	48	40	37	37	37	43	46	49	55	60	69	80	83	89	93	93	91	96	96	91	87	80	75	72	66	57	48	40	43	49	54	55	58	59	62	68	74	81	80
28	82																						84	91	97	100	102	100	100	96	94	54	51	76	65	57	50	45	45	46	55	63	61	62	67	77	82	54
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30																						66	72	76	80	88	94	98	99	94		88	85	80	73	59	50	45	42	41	38	34	35	40	53	57	58	61
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Chart Datum : 0.582 Below IMSL (SOURCE: CoPT)

2018 September

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5	25	26	29	33	37	39	44	51	54	60	63	72	75	77	81	83	83	81	80	78	77	76	75	71	71	69	67	67	68	71	70	72	73	72	73	73	74	76	73	69	64	63	60	52	46	41	36	36
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10	86	83	76	70	61	53	46	35	27	20	16	17	22	24	29	36	45	54	60	69																														
11																																																
12																					59	68	78	87	93	100	100	100	98	95	90	80	69	57	44	35	26	19	13	14	17	21	27	32	38	51	59	68
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21	50	49	44	42	41	41	42	39	34	37	51	53	55	60	67	70	77	80	84	83			87	84	82	79	74	72	65	61	59	60	56	54	56	58	60	60	62	64	69	68	69	69	69	69	65	64
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23	67	68	64	59	51	49	45	42	38	37	39	44	43	52	51	58	64	69	74	80	88	93	93	91	88	87	83	81	73	69	58	50	48	51	47	41	39	45	53	57	58	57	61	67	75	76	75	71
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25	85	81	80	75	70	67	58	51	47	39	33	33	35	37	41	47	51	57	61	69	80	86	95	97	96	93	93	89	85	79	70	61	52	45	37	33	30	31	35	39	43	51	56	61	71	79	83	87
26	90	91	91	91	87	79	69	63	59	54	47	37	37	39	40	47	48	55	62	68	74	83	91	95	101	99	97	95	90	85	74	67	59	51	41	31	30	30	33	36	39	44	52	61	71	76	83	89
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31																																															

Chart Datum : 0.582 Below IMSL (SOURCE: CoPT)

2018 October

	0		1		2		3		4		5		6		7		8		9		10		11		12		13		14		15		16		17		18		19		20		21		22		23	
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2	55	65	70	76	80	90	98	105	103	97	99	107	108	103	95	89	85	87	89	79	72	75	79		83	82	83	87	95	96	95	96	94	91	87	87	84	76	59	57	55	49	46	42	42	40	41	47
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6	75	68	64	61	60	62	60	64	70	72	78	78	85	94	100	102	105	106	112	114	113	112	109		95	93	92	86	82	77	75	73	74	75	78	82	84	85	90	95	96	100	101	103	103	101	100	97
7	88	83	81	75	73	65	60	61	67	70	72	78	84	86	89	95	101	107	110																														
8																										104	99	95	87	76	72	64	54	50	52	54	55	57	60	70	75	82	87	92	101	106	112	116
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12	100	106	118	123	119	115	112	107	103	94	84	79	70	65	65	67	71	75	70	71	79	86	91		99	101	104	105	106	90	82	80	78	66	60	48	40	32	31	30	33	36	42	48	56	64	72	81
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15																					67	73	81		86	87	91	99	94	97	94	92	90	86	84	82	79	71	63	56	53	53	51	51	52	55	59	62
16	66	69	73	92	93	94	98	103	107	109	107	101	99	96	96	90	84	83	80	77	73	74	75		78	78	78	82	84	85	86	82	80	81	82	74	74	70	66	64	56	54	53	51	44	51	53	55
17	60	61	66	68	72	78	80	86	92	93	94	96	98	94	94	93							79		75	75	77	79	84	86	87	87	84	86	84	88	83	83	80	77	77	75	70	67	65	64	69	67
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19																							96		91	85	83	85	86	87	79	79	83	87	86	85	86	88	87	93	93	89	87	84	84	86	83	83
20	82	78	77	75	75	76	78	81	73	79	85	87	93	95	96	101	103	105	105	102	99	101	101		95	90	83	82	79	77	77	76	75	77	78	80	83	81	82	86	89	93	95	94	93	90	81	89
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Chart Datum : 0.582 Below IMSL (SOURCE: CoPT)

2018 Novenber

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3																							92	88	84	77	73	69	74	73	67	70	74	78	80	85	91	90	88	96	99	103	100	95	95	91	91	87
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25																																																
26																					75	80	85			91	90	93	90	85	80	73	61	43	42	32	27	21	18	17	23	30	37	42	49	63	72	85
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31																																															

Chart Datum : 0.582 Below IMSL (SOURCE: CoPT)

2018 December

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Chart Datum: 0.582 below IMSL (source : CoPT)

2019 January

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Chart Datum: 0.582 below IMSL (source : CoPT)

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13																																															
14																					44	42	34		30	32	34	38	42	48	61	68	70	74	76	82	86	90	92	92	96	96	92	88	86	84	84	86
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Chart Datum: 0.582 below IMSL (source : CoPT)

2019 March

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22																						94	104	114	120	126	122	124	120	118	110	100	98	82	70	60	52	50	56	58	62	66	78	86	96	106	112	120
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24																																															
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29																					42	42	38	40	42	46	46	50	58	60	68	74	82	86	90	92	96	100	100	101	96	96	98	98	90	94	80	80
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2019 April																																																
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8																										100	102	110	108	107	98	96	94	95	85	74	70	65	60	58	58	60	61	67	71	77	84	91
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10																				19	25	33	45	55	63	69	83	91	96	97	100	103	105	107	100	96	89	84	79	75	72	68	61	62	66	70	73	74
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Chart Datum: 0.582 below IMSL (source : CoPT)

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24																							55	59	66	72	86	98	104	110	110	113	100	103	102	99	102	83	80	78	70							
25				72	72	70	73	62	65	68													53	56	58	66	74	84	90	96	103	108	108	108	110	107	106	99	93								
26																						46	52	53	56	61	68	73	79	86	94	97	99	99	103	106	105	104	100	97	93	85	80	70	70	68	62	
27																			56	55	52	49	51	52	55	52	57	60	69	73	75	80	85	92	94	96	92	93	94	94	89	83	80	73	71	63	59	56
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Chart Datum: 0.582 below IMSL (source : CoPT)

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Chart Datum: 0.582 below IMSL (source : CoPT)

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Chart Datum: 0.582 below IMSL (source : CoPT)

2019 August

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Chart Datum: 0.582 below IMSL (source : CoPT)

2019 September

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25	62	62	56	57	58	62	65	67	71	75	81	87	91	94	98	103	109	108	110	109		107	102	100	97	94	89	86	84	85	83	84	83	85	88	89	90	92	94	93	93	96	94	92	86	84	78	75
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31																																															

	2019 October																																															
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9	76	78	77	73	73	71	71	76	81	78	82	89	91	93	94	100	104	104	107	104	107	108	106	103	95	91	85	89	83	79	75	72	75	80	84	81	81	85	89	90	89	92	93	91	93	91	89	87
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15	110	116	114	110	106	100	98	96	87	71	67	68	68	61	66	65	72	80	79	97	95	100	105	102	106	103	102	92	94	84	80	71	60	54	48	44	36	37	39	47	49	58	66	69	79	84	95	100
16	110	114	115	115	112	112	107	98	97	89	82	77	72	73	69	67	73	74	83	83	90	96	100	105	109	110	105	107	96	93	90	83	70	62	54	52	43	40	36	34	44	53	60	62	64	82	88	93
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18	98	102																				93	100	99	104	109	110	114	112	110	101	98		90	87	78	59	52	49	47	48	48	52	56	62	68	79	92
19	94	102	111	116	122	124	126	128	126	124	119	116	109	104	96	97	94	92	89	86	93	96	102	100	102	104	110	114	112	110	104	102	100	99	98	89	78	68	59	61	56	52	44	46	54	60	66	77
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26																						124	122	118	110	104	98	90	79	74	64	62	68	61	60	61	66	74	81	82	85	96	102	112	116	118	114	116
27	116	118	111	100	90	82	79	78	74	74	72	76	80	86	88	92	100	102	108	110	119	118	114	106	108	98	88	81	72	60	52	46	36	30	32	34	44	51	52	58	66	78	91	100	104	112	114	122
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31																						110	110	118	126	130	134	130	129	120	116	112	106	90	76	66	66	58	42	36	28	32	38	56	60	70	82	100

Chart Datum: 0.582 below IMSL (source : CoPT)

2019 November

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17	97	107	115	126	123	126	125	124	127	124	118	111	102	98	90	83	79	76	78	77	81					106	104	105	106	104	100	92	84	81	72	64	54	46	40	36	40	42	44	50	52	60	72	82
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19	80	89	94	104	112	120	128	136	136	136	134	134	130	122	120	112	106	100	97	90	86	85	86	88	89	91	91	95	100	100	100	103	103	102	97	94	89	83	80	70	69	64	61	56	59	63	68	72
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21	76	77	82	88	91	97	101	111	114	117	122	125	128	127	126	125	120	115	108	103	99	94	88	86	84	80	76	72	76	82	83	86	91	94	94	100	104	100	100	104	106	98	94	90	86	88	86	82
22	78	80	81	84	86	90	94	98	102	104	114	120	122	124	124	126	124	122	119	110	100	96	92	86	78	72	64	62	64	66	65	70	72	76	82	86	88	94	96	104	106	105	100	104	102	100	96	92
23	90	86	82	80	82	80	86	90	92	98	96	102	104	116	116	119	121	119	120	114	108	102	95	89	83	75	66	60	55	52	55	57	58	60	69	73	81	85	92	100	104	110	116	119	119	116	116	114
24	109	103	99	94	91	87	87	85	89	91	93	96	102	106	110	112	118	121				107	102	99	89	81	71	63	56	48	45	42	42	45	54	60	64	71	82	90	100	108	115	122	124	129	131	
25																						108	105	103	95	86	73	62	52	95	38	32	25	23	27	35	37	47	55	68	80	90	98	105	118	130	130	126
26	124	122	121	115	105	93	85	83	80	76	76	78	79	80	84	50		93	102	106	106	105	106	105	100	90	82	73	66	52	42	34	25	20	18	21	22	26	36	50	60	70	80	92	105	110	125	127
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31																																															

2019 December

	0		1		2		3		4		5		6		7		8		9		10		11		12		13		14		15		16		17		18		19		20		21		22		23	
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2																				70	70	70	70	71	75	80	80	80	86	88	89	86	79	81	83	74	63	57	55	56	50	49	49	51	52	60	64	69
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8	96	97	96	92	84	84	84	86	90	90	92	94	92	96	102	106	102	104	98																															
9																						94	86	84	76	66	61	54	45	41	36	36	36	37	42	42	46	56	64	72	78	86	94	101	106	110	112	116
10	111	112	106	104	98	92	88	82	80	78	79	79	81	82	82	84	86	92	92	94	94	96	96	92			64	50	44	40	36	32	30	28	29	32	38	44	54	60	71	82	91	106	110	116	120	126
11	122	121	118	116	114	110	102	82	84	84	82	80	80	82	80	80	84	90	96	94	98	94	94	95	89	78	71	64	58	51	42	34	28	26	24	28	30	33	44	82	66	76	84	93	102	115	128	130
12	130	126	126	126	122	119	108	106	98	92	84	82	80	83	86	84	84	86	91	96	96	96	94	94	94	89	81	71	62	52	48	42	26	22	18	20	22	22	27	36	48	62	76	82	92	106	118	126
13	124	122	132	132	128	126	118	114	106	98	86	82	82	79	74	76	80	82	82	86	92	94	94	94	94	92	86	76	72	64	52	44	35	30	24	18	16	16	20	26	36	46	56	72	80	94	106	118
14	122	128	132	134	134	130	124	122	116	108	94	86	84	80	78	74	76	77	80	81	84	90	94	96	96	94	89	88	82	76	68	54	44	36	28	28	26	14	16	22	26	28	38	50	64	76	88	100
15	106	124	130	130	130	130	126	126	120	116	106	96	86	78	76	74	74	70	70	74	78	79	84	89	92	92	90	88	86	82	74	66	56	48	40	32	24	16	10	16	20	26	28	36	46	60	72	82
16	96	100	110	116	122	124	126	122	122	118	106	102	96	86	78	72	70	68	68	67	68	69	72	80	80	84	84	88	90	84	82	76	70	64	56	46	34	28	22	19	19	18	22	25	36	46	58	72
17	78	86	100	108	114	120	122	120	122	119	124	106	98	94	84	76	68	66	64	60	60	61	63	68	70	74	74	81	84	85	86	84	78	74	70	64	50	44	42	30	26	26	26	26	32	38	46	56
18	66	74	82	94	104	108	114	116	118	118	126	114	108	106	94	86	78	70	66	64	64	62	64	66	66	68	70	78	84	86	88	90	89	90	88	84	78	74	74	64	56	54	48	46	46	56	58	64
19	66	68	82	94	104	104	106	118	120	120	118	120	120	118	106	92	92	86	82	72	66	62	62	58	61	62	60	64	66	76	78	82	86	86	90	90	90	86	82	80	80	76	72	64	62	64	68	68
20	68	70	78	84	94	98	104	106	114	122	122	122	124	124	118	114	106	102	94	84	72	74	68	70	64	60	58	56	58	60	66	72	76	78	84	91	98	96	100	102	102	100	100	98	94	92	92	88
21	84	86	92	94	98	102	104	106	110	118	122	124	126	128	124	120	116	114	106	96	90	82	70	62	60	54	46	48	48	50	56	56	64	76	76	82	86	94	98	104	104	104	106	106	106	106	102	98
22	90	90	88	89	90	90	91	94	96	102	106	108	110	116	114	112	110	112	106	112	95	84	76	68	60	54	38	38	38	36	34	32	38	46	56	64	68	80	84	94	102	108	120	118	118	118	120	118
23	112	108	106	104	102	96	94	94	94	94	86	100	102	110	106	102	116	112	110	104		96	88	78	68	60	56	44	38	34	28	30	32	36	44	48	56	70	82	86	98	95	106	122	128	132	126	126
24	126	124	124	118	114	108	104	100	98	92	94	96	100	102	104	108	108	112	118	112	106	108	102	100	82	70	60	50	44	36	30	25	22	26	30	32	40	49	60	72	80	92	100	114	122	124	132	134
25	134	132	129	126	122	118	104	98	94	92	88	88	84	84	90	92	96	98	98	102	102	102	102	96	90	80	70	64	54	46	34								48	58	68	80	92	106	114	124	130
26	132	130	128	128	122	120	112	102	94	88	82	80	80	78	82	80	82	82	84	90	94	94	92	90	87	82	76	64	58	52	42	34	22	19	18	17	17	18	24	26	38	50	64	78	90	98	112	120
27	122	124	124	126	124	120	114	108	96	88	84	78	74	70	74	70	72	72	74	82				86	84	82	78	72	66	60	50	38	30	24	118	12	12	12	12	18	22	36	44	54	68	80	92	100
28	108	112	120	120	122	120	116	110	104	98	86	80	76	66	66	66	64	65	65	68	72	76	82	86	88	92	94	88	84	78	76	72	62	50	42	34	34	24	20	18	20	28	32	40	48	62	76	
29	98	106	114	120	122	126	124	122	120	114	106	100	90	84	76	72	64	64	64	64	65	70	76	81	86	82	81	81	82	80																		
30	88	96	104	106	116	118	116	119	112	108	106	96	90	81	72	66	62	58	60	58	62	64	70	74	76	74	76	84	82	82	78	74	66	64			42	36	32	28	26	26	32	40	46	62	76	84
31	84	90	94	106	102	114	116	114	116	114	108	104	94	84	76	72	66	60	56	58	56	58	64	66	68	74	76	78	82	82	83	78	76	74	73	67	59	53	47	42	44	38	38	44	45	54	60	70

About Antea Group

From city to countryside, from air to water: Antea Group's engineers and consultants have been contributing to our living environment in the Netherlands for years now. We design bridges and roadways, and create residential neighborhoods and water structures. But we are also involved in areas such as the environment, safety, asset management and energy. Under the name Oranjewoud, we expanded into an all-round, independent partner for companies and government bodies. As the Antea Group, we also apply this knowledge at a global level. By combining valuable knowledge, including on technical matters, with a pragmatic approach, we make solutions attainable and workable. Goal-oriented, with an eye for sustainability. In this way, we anticipate today's questions and tomorrow's answers. Just as we have been for over 60 years now.

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