

ACTION PLAN

PERUVAMBA RIVER

PRIORITY V

DISTRICT LEVEL TECHNICAL COMMITTEE

Kerala State Pollution Control Board

Irrigation Department

Kerala Water Authority

Suchithwa Mission

Revenue Department

Payannur Municipality

Kunhimangalam GP

Ramanthali GP

Kankol- Alappadamba GP

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Chapter 1

INTRODUCTION

General

Background

Water is essential for thriving of people, it is needed for domestic purposes, agricultural, industrial and energy production and these uses are highly inter-linked and sometimes in competition to each other use. Water consumption pattern in India is around 90% in agriculture, 6% in domestic and 4% for industrial use. Usage of water by industrial and domestic purposes generates wastewater that may cause pollution, however agriculture usage largely remains consumptive.

The key challenges to better management of the water quality in India are temporal and spatial variation of rainfall, improper management of surface runoff, uneven geographic distribution of surface water resources, persistent droughts, overuse of ground water and contamination, drainage & salinization and water quality problems due to treated, partially treated and untreated wastewater discharge from urban settlements, industrial establishments and runoff from irrigation sector besides poor management of municipal solid waste and animal dung in rural areas.

India, being an economy in transition from developing to developed nation, is faced with two problems. On one side, lack of infrastructure and on the other, an ever-increasing urban population. The urban population in India was about 387 million in 2011 and rose to about 420 million by 2017. This has thrown up two self-perpetuating problems viz. shortage of water and sewage overload. It is estimated that by 2050, more than 50% of the country's population estimated as 1000 million will live in cities and towns and thus the likely demand for infrastructure facilities including fresh water for drinking and resultant wastewater discharges are expected to rise sharply posing a challenge to urban planners, policy makers, environmental regulators and managers.

Public services could not keep pace with rapid urbanization. Water supply, sanitation measure, management of sewage and solid wastes could cover a fraction of total urban

population. The majority of towns and cities have no sewerage and sewage treatment services. Many cities have expanded beyond municipalities, but the new urban agglomerations remain

under rural administrations, which do not have capacity to handle the sewage. The sewage is either directly dumped into rivers or lakes or in the open field.

Availability of Water

The fresh water resources forming rivers, lakes and enriching aquifer through inflow from water sheds. Water shed retain the rain water through trees, bushes and grass land which infiltrate to subsurface and the surface water flow from the land mass by gravity action. Degradation of water shed in terms of tree cutting, cattle grazing etc. is leading to less infiltration of rain water and abstraction of surface and ground water in excess to the infiltration is reducing outflow from the water shed that ultimately reduce perennial flow in the rivers and streams in plains.

Water that supports productive activities such as; agriculture, generation of hydro power, municipal drinking water supply, industrial consumptive and non-consumptive use etc. have competitive demand that leads to no flow or very meagre flow in the rivers and streams for sustaining environmental concerns.

Pattern of Precipitation & Lean Flows

The rain fall pattern in the sub-continent of India varies widely from West to East and the average rain fall days are forty in a year. This rain fall pattern leads to flooding during monsoon season in the rivers and streams whereas lean flow period remains for nine to ten months. The lean flow period is unable to sustain the competing uses on one hand and leading to pollution in the rivers and streams on the other hand due to lack of infrastructure for handling/treating municipal as well as industrialeffluents.

In view of wide variability in rain fall pattern and few rain fall days in a year, conservation of water by application of water shed management practices will improve water retention capacity as soil moisture in the root zone of trees and grass land by building bunds across gullies and furrows to retain rain water. The water retention structures will increase infiltration, water holding capacity and prevent soil erosion. In this way an appreciable

amount of precipitation which is generally lost as a surface flow, can be harvested and stored in the water shed for beneficial purposes during non- monsoonmonths.



Fig1: Satellite Map of Peruvamba River

River and its Tributories

It originates in the Western Ghats(densely forest hill) near Wayakkara village in Kannur district. It flows along two side of the hill through the west of peringgoni,Kuttur,mathamangalam,Kakara,Pachani,Perupadavu,Panapuzha and reach Mathamagalarn from there it forms Peruvambapuzha (PerumbaPuzha)flows through KaithapramChandhapuraMeenkuzhiPeravoorPerumbaandKunchimangalam and reaches Ezhimala and divided into two-one into the Kavvayi canal and the other into the Arabian Sea.Total length of the river is 51 km.

Basin area, km ²	300
Basin area in Kerala State, km ²	300
District of Kerala in which basin are located	Kasaragod& Kannur
Origin of River	PekunnuElevation.m : 325
Length of main stream, km	51

Main tributaries	Macharuthode, Challachal, Mukkuttenkarachal	Mathamangalam, Nitaringapuzha,
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Physiography of the Basin

Basin area of the river is 300km². Navigate length of river is 16km. Origin of River is at Pekunnu at an elevation of 325m. Navigate length of river is 16 km. In the upper stretch the river is used drinking water supplies, bathing, washing and for irrigation. Paddy, Coconut and Arecanut are the main crops. Cashew, Pepper and Rubber are also cultivating in the up hills. Paddy and Coconut are the main crops in the lower stretches. No major industries are located in the basin area. The lower stretches are occupied by fish and prawn farms. Several small drains from Payyannur Municipality joins at Kandankali.

Courtesy: enviscentre:Kerala



Fig 2:Location map of Peruvamba River basin

Land Use Pattern

A majority of the population in Kannur depends on agriculture, fisheries and other related industries for their livelihood. Paddy, coconut, pepper, cashew, tapioca and Arecanut are cultivated in the district. Plantation crops like rubber can also be seen. With a coastline which sprawls over 82 km, the district also has an important place in the fisheries map of Kerala. Textiles, beedi and coir are the traditional industries here.

Climate and Rain Fall

Kannur experiences humid tropical monsoon climate in the district. Relative humidity is more during south west monsoon season from period of June to September. It is more during morning hours and is less during evening hours. Evaporation is more during summer months of March to May and low during the months of June to November. Rain fall is the only source of fresh water and it records wide spatio-temporal variations in its availability. Once the rain water reaches surface of the earth and start flowing either as surface run off or infiltrates to recharge ground water the entire process is subject to land and land use management. Based on rainfall and clouding characteristics four seasons can be identified in Kerala, the South- West monsoon (June to September), North-East monsoon (October and November), Winter (December-February) and Pre-monsoon (March-May). Kannur district receives a total annual rainfall of 3438 mm. District experiences heavy rainfall during the South West monsoon season followed by North East monsoon. South West monsoon during June to September contributes 70 % of the total rainfall of the year. The northeast monsoon contributes only about 30%.

Chapter 2

The Study Area of Peruvamba River

2.1 Study Area

Monthly monitoring of water quality of the river is conducting for years under the National Water Quality Monitoring Programme (NWMP) at Chandapura near Mathamangalamtown. Selected sampling points apart from the existing NWMP station are Kacherikadavu at Panapuzha, Mathamangalam at Peruvamba and Kandankali. Kacherikadavu and Mathamangalam are upstream of Chandapura and Kandankali is the downward location.

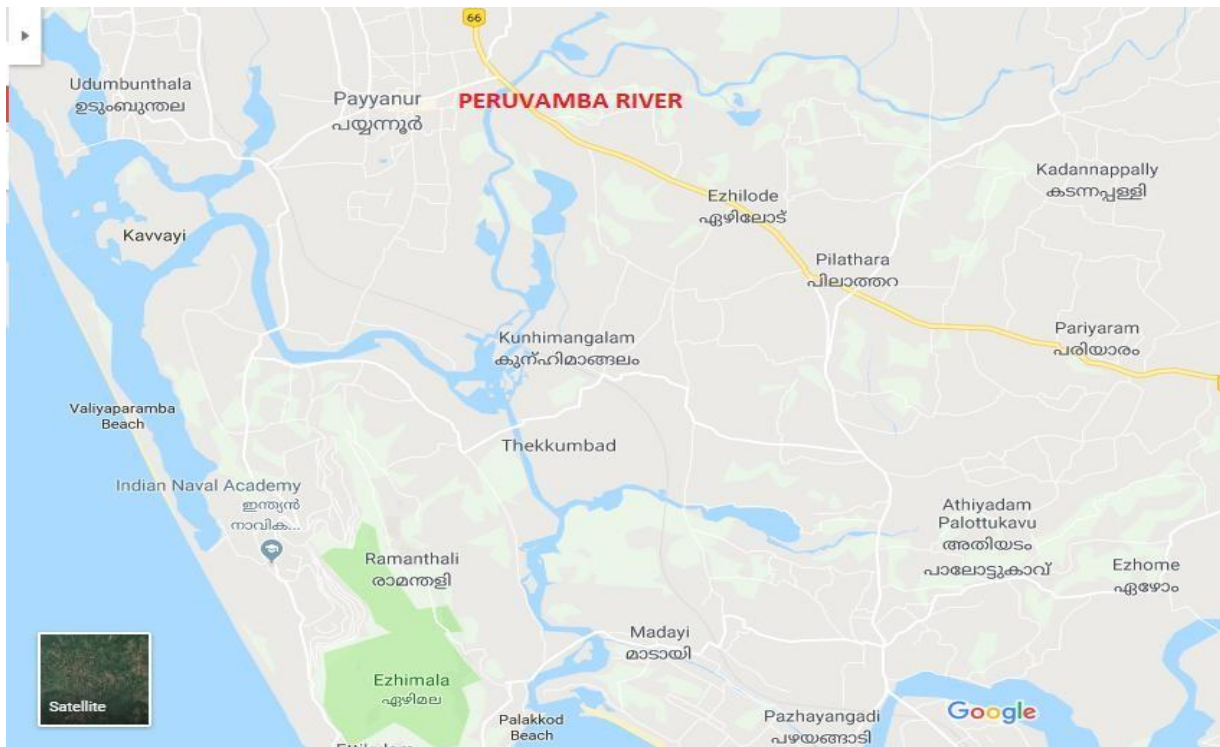
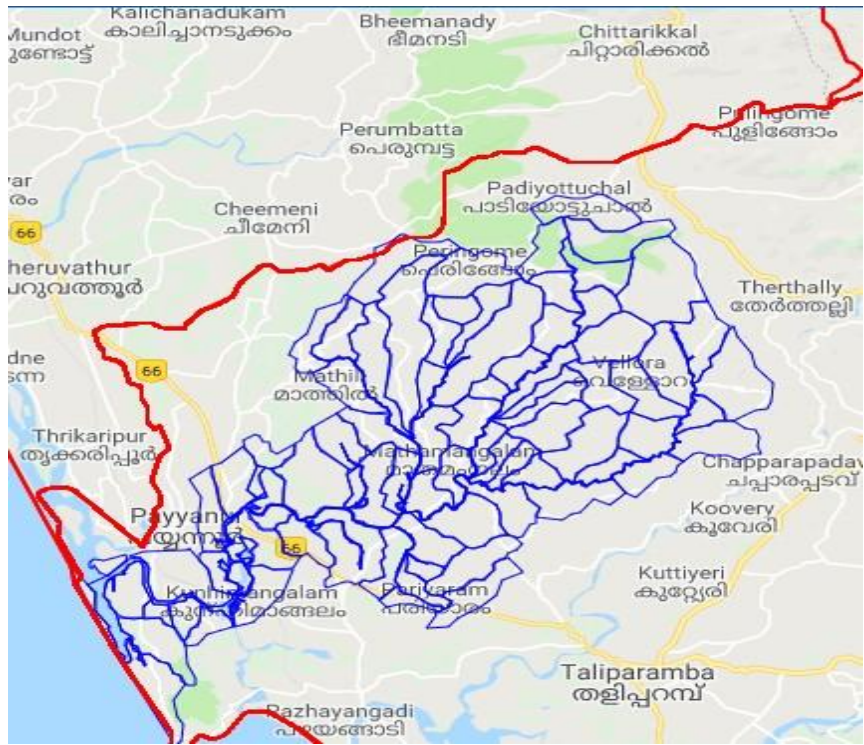
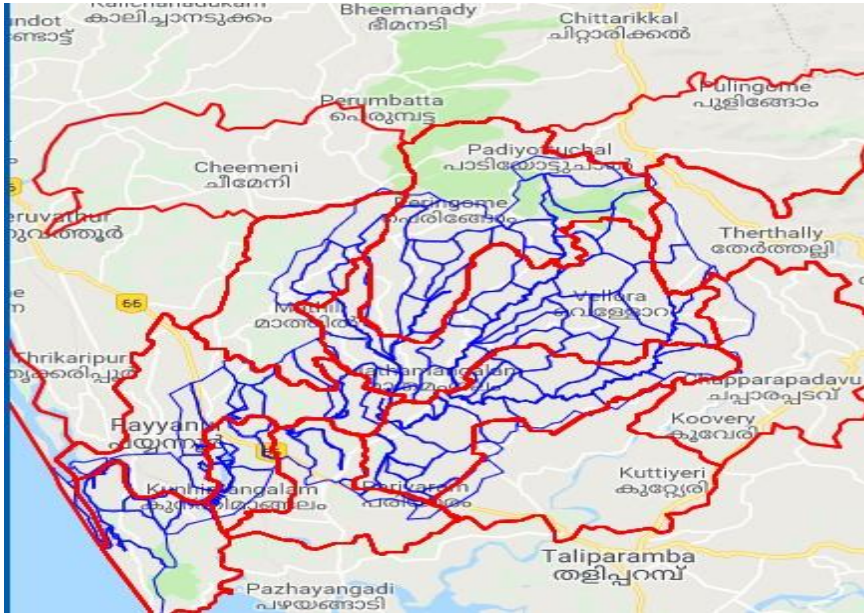


Fig 2.1: Map of the Peruvamba River



Peruvambariver in kannur district



Peruvambariver flowing through the panchayath

Sl No.	Panchayat/Municipality	Taluk	Population (as per 2011 census)
1	Eramam - Kuttur	Payyannur	9676
2	Kadannappally-Panapuzha	Payyannur	10430
3	Peringome -Vayakkara	Payyannur	16721
4	Payyannur		72424
5	Kunhimagalam	Payyannur	18965

Table 2.2: Panchayat/Municipality details

Identified points of Pollution









Causes of Pollution

The contamination of water bodies is due to disposal of untreated sewage and biodegradable and non-biodegradable wastes into the river. Besides the above, old Drains passing through the commercial area, causes the discharge of sewage into the water bodies through the pipelines, manholes and pumping/lift stations. Also unauthorized quarrying and several serious environmental impacts related to quarrying activities on and near the river, such as vibrations, land degradation, land subsidence and landslides, water pollution, occupational noise pollution, and air pollution, will lead to health-related problems and loss of biodiversity

Quarrying operations can adversely alter pre-existing ecosystems, and change hydrogeological and hydrological regimes. This adverse influence of stone and sand quarrying induces damage in property, depletion of ground water, loss of fertile topsoil, degradation of forests, deterioration in aquatic biodiversity and public health. On the other hand, haphazard quarrying of sand from riverbeds may cause a rapid change in bed configuration in response to the changes in flow. Quarrying basically destroys landscape. This can lead to downstream movement, scouring, or accumulation of sediment while provoking shoreline erosion. When riverbeds are composed of sand, this on-going pattern of erosion and deposition causes meanders to progress slowly downstream in time.

Sanitation survey of Perumba River(Polluted Stretch)by KSPCB and Local body

Based on the survey, following recommendations were made.

Sanitation survey of PayyannurMunicipality

Sanitation survey was earlier carried out by the Payyannur municipality. Based on the survey, following recommendations were made.

A. Short term recommendations to control pollution of Payyannur Municipality

Providing household latrines

1. Single pit conversion to bio toilet
2. New bio toilets for no latrine households and those which are directly connected to drains to water body

Community latrines

1. Community toilet will be provided wherever necessary with scientific septic tank

Solid waste management(Biodegradable waste)

For decomposition of biodegradable waste at its origin itself 1750 Nos pipe compost, 2440 Ring compost and 645 biogas plants are issued.

Non-Biodegradable waste management

Material Collection Facility has already been started functioning for the management of non-biodegradable waste.

Awareness programme

1. Awareness for residence association: Suchitwamission/LSGD/Corporation
2. SWM training to children, youth, Asha workers and other stake holders
3. Follow up systems: Capacity building of community groups, monitoring system and active involvement of residence association is necessary.

3 Sanitation survey of KunhimangalamPanchayath

Providing household latrines

1. Single pit conversion to bio toilet

Community latrines

1. Maintenance of existing community toilet and construction of modern septic tank.
2. Construction of new community toilet

Solid waste management(Biodegradable waste)

For decomposition of biodegradable waste at its origin itself pipe compost and biogas plants are being issued.

Non-Biodegradable waste management

Material Collection Facility has already been started functioning for the management of non-biodegradable waste.

Awareness programme

1. Awareness for residence association: Suchitwamission/LSGD/Corporation
2. SWM training to children, youth, Asha workers and other stake holders
3. Follow up systems: Capacity building of community groups, monitoring system and active involvement of residence association is necessary.

3. Sanitation survey of KadannapallypannapuzhaPanchayath

Providing household latrines

- 1 . Single pit conversion to bio toilet

Community latrines

1. Maintenance of existing community toilet and construction of modern septic tank.
2. Construction of new community toilet

Solid waste management(Biodegradable waste)

For decomposition of biodegradable waste at its origin itself pipe compost and biogas plants are being issued.

Non-Biodegradable waste management

Material Collection Facility has already been started functioning for the management of non-biodegradable waste.

Awareness programme

- a. Awareness for residence association: Suchitwamission/LSGD/Corporation
- b. SWM training to children, youth, Asha workers and other stake holders
- c. Follow up systems: Capacity building of community groups, monitoring system and active involvement of residence association is necessary.

4. Sanitation survey of EramamkutturPanchayath

Providing household latrines

1. Single pit conversion to bio toilet

Community latrines

1. Maintenance of existing community toilet and construction of modern septic tank.
2. Construction of new community toilet

Solid waste management(Biodegradable waste)

For decomposition of biodegradable waste at its origin itself pipe compost and biogas plants are being issued.

Non-Biodegradable waste management

Material Collection Facility has already been started functioning for the management of non-biodegradable waste.

Awareness programme

- a. Awareness for residence association: Suchitwamission/LSGD/Corporation
- b. SWM training to children, youth, Asha workers and other stake holders
- c. Follow up systems: Capacity building of community groups, monitoring system and active involvement of residence association is necessary.

B. Long term Recommendations

Enforcement of rules for proper designing and construction of septic tanks has to be implemented. As the MCF and RRF are not fully activated in the local bodies such types of solid wastes are depositing on the river as well as on the Drains .So MCF and RRF shall be activated and all the waste generating within the local body must be collected and disposed through MCF and RRF.To prevent pollution of River through waste dumping, strict enforcement of rules is required. Localbody has to identify suitable location for live. Monitoring facilities. . The role resident's association is crucial in monitoring the pollution abatement enforcement of rules is required .

Chapter 3

Sample Analysis and results

3.1. Restoration Plan: - Statutory Intervention

Water quality management through setting up of standards for discharge of municipal wastewater and industrial effluents are enforced through the consent to establish and consent to operate require a fresh look in view of ambient water quality requirements of aquatic resources. The prevailing standards prescribed in the consent to industrial sector and general discharge standards adopted for sewage treatment require change in approach from consumption to disposal to treat, recycle, reuse and discharge to aquatic system if matches with the norms of water quality of aquatic resources.

Polluted river stretches have been targeted for restoration of water quality through identification of sources of pollution and interventions through treatment for the municipal as well as industrial effluents.

Monitoring conducted by the Kerala State Pollution Control Board

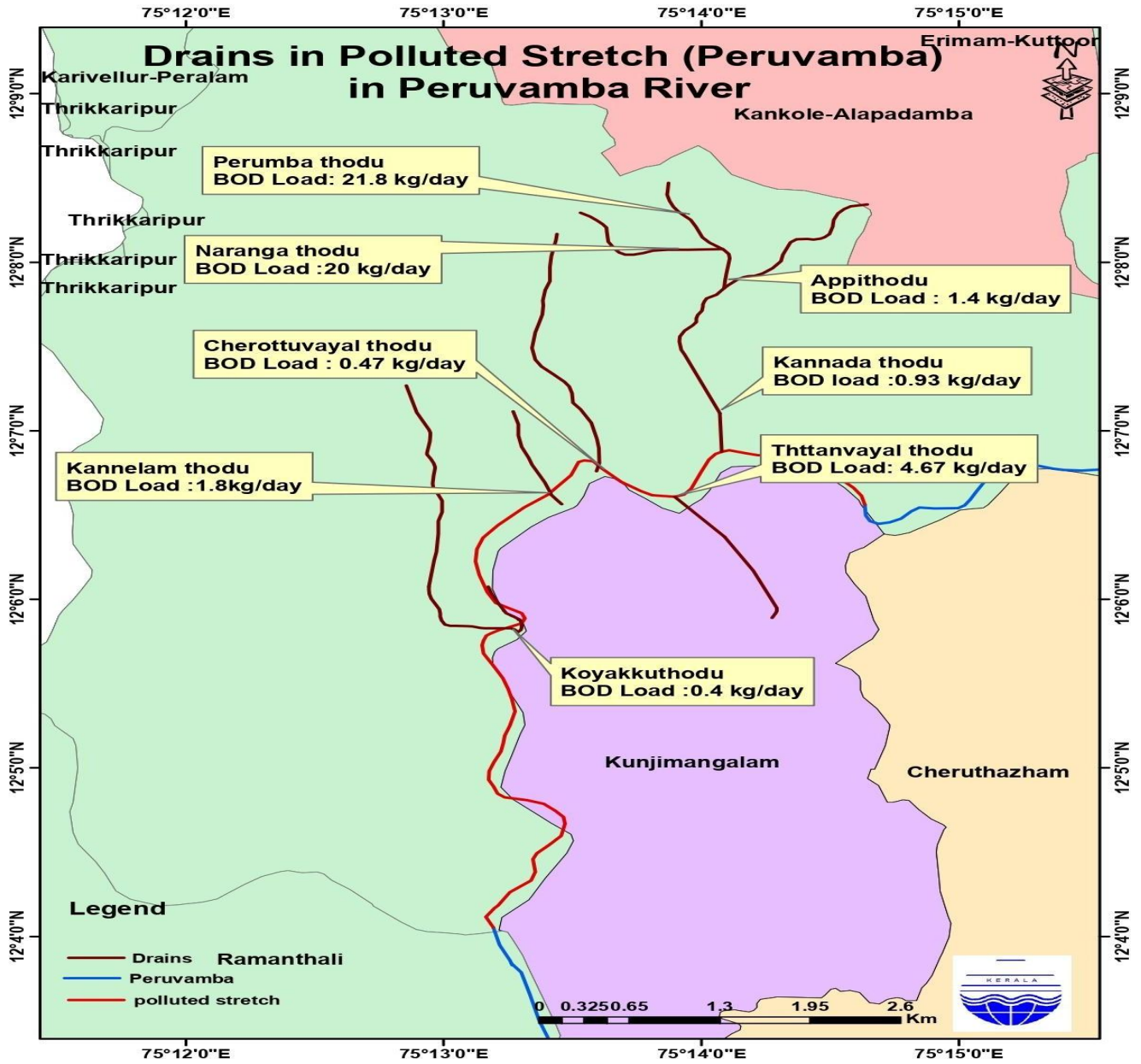
The tributaries coming under Alakode GP and Madayi GP are major causes to the polluted river identified through National Water Quality Monitoring Programme and the reconnaissance survey for river restoration. Most of the drains connecting to the Kuppam River are completely dry since it is summer season. Only from drains with flow were able to check the flow rate and take the sample. Samples were collected from available drains and tested in the lab.

Test Results

Test results obtained from KSPCB Lab were tabulated as below

Sl no	Parameters	Kacherikadavu	Mathamangalam	Chandapura	Kandakali
1	pH	7.01	7.04	7.21	7.24
2	Electrical Conductivity, $\mu\text{S}/\text{cm}$	46.2	52	48.1	11.6
3	BOD,mg/L	0.5	0.7	0.5	2.7
4	Dissolved Oxygen,mg/L	7.6	7.5	6.4	6.8
5	Total Coliform, cfu/100ml	300	300	250	160
6	Fecal Coliform , cfu/100ml	130	50	150	40
7	Turbidity	0.8	1.2	1.3	1.5
8	Calcium Hardness	7	8	10	1200
9	Total Hardness	8	20	14	6000
10	Magnesium Hardness	1	12	4	4800
11	NH ₄ -NO ₃	0.022	0.017	.01967	0.0228
12	Sulphate	6.28570	8.03895	BDL	385.194
13	Phosphate	BDL	0.05967	BDL	bdl
14	Fluoride	0.499497	0.084168	0.1002	0.281395
15	Total Alkalinity	15	10	13	36
16	Chloride	110	8	14	14100

Sl.no	Drain	Pollution load BOD in Tpd
1	Narangathodu	20
2	Perumbathodu	21.8
3	Valliohmthodu	0.8
4	Panapuzhathodu	1.6
5	PoomkottuChal	2.12
6	ManjangottuThode	0.6
7	Kannelamthodu	1.8
8	Appithodu	1.4
9	Mavullapoyilthodu	0.4
10	Kollalithodu	1.32
11	Kannada thodu	0.93
12	Koyakkotuthodu	0.4
13	Cherottuvayalthodu	0.47
14	Kollalithodu	1.07
15	Kayyilarakulamthodu	2.6
16	Tattanvayalthodu	4.67



Chapter 4

Action Plan

Action Plan of Local Body

Sl No	Ref para Item No:48as per NGT Order no 673/2018 dated20.9.2018	Local body	Activity	Implementing Agency	Unit	Fund and cost	Time of Completion
1	A(b)	PayyannurMunicipality	Sanitation Facility	Municipality	STP proposed at market place	Own fund 2 lakhs	2021
			Bio degradable waste disposal	Local Body	Bio bins (2061), Pit Compost(10992) , Bio gas Plant(687)	Suchitwa Mission fund, Plan fund (2.00 crores)	2020
	C(ii)		Non bio degradable Waste Disposal	Municipality	MCF and RRF	Rs. 40.00 is levying from each collection point	On going

	E		Awareness	youth, Asha workers and other stakeholders and HarithasahayaSamithi		Plan fund (6.00 Lakhs)	Ongoing project
2	A(b)	Kunhimangalam Panchayath	Sanitation Facility	Local Body	Scientific Septic Tank and Soak pit	Suchitwa Mission Fund(2.00 Lakhs)	2019
	C(ii)		Bio degradable waste disposal	Local Body	Bio bins, Pit Compost, Bio gas Plant	Centrally available funds, development funds(1.36 Lakhs)	Every year project
	C(ii)		Non bio degradable Waste Disposal	Haritha Karma Sena	MCF	Rs. 20.00 is levying from each collection point	Ongoing project
	E		Awareness	Youth, Asha workers and other stakeholders	Grama Sabha, Educational Institutions	Beneficiary contribution	Once in a month
	E		Side wall protection of drains	Kudumbasree	Side walls of drains	NREGS fund (1.25 Lakhs)	12/2019
	E		Installation of CCTV cameras	Local body	camera	Donation (30.00 Lakhs)	2019

		Kankol – Alappadamba GP	at major points				
	C(ii)		Bio degradable waste disposal	Local body	Bio bins, Pit Compost, Bio gas Plant (2460 Nos)	Plan Fund (24.40 Lakhs)	Ongoing
	C(ii)		Non bio degradable Waste Disposal	Haritha karma sena	MCF	Plan fund (14.00 Lakhs)	Ongoing
	E		Awareness	youth, Asha workers and other stakeholders	Gramas abha	Own Fund (2.00 lakhs)	Once in a month
4	A(b)	Ramanthali GP	Sanitation Facility		No markets and houses on the bank		
	C(ii)		Non bio degradable Waste Disposal	Haritha Karma Sena (with 15 members)	MCF and sending to RRF	Toatal Sanitation fund, Own fund, development Fund (0.05 crores)	2020
			Drain Cleaning and side	Local Body		MGNREGS fund, Total	2022

	E		protecti on			Sanitatio n fund, Beneficia ry contributi on(0.35 crores)	
	E		Awaren ess	youth, Asha workers and other stake holders	Gramas abha	Total Sanitatio n fund, Own fund (0.015 crores)	2022
	C(ii)		Bio degrada ble waste disposal	Ring Compost	1000 Nos	25 lakhs	MG NR EG S fun d,T otal San itati on fun d, Ben efic iary con trib utio n
				Compost Pit	2000 Nos	1.40 Crores	
				Bio gas plant	100 Nos	1.00 Lakhs	

Action Plan by Irrigation Department

S I N O	Ref para Item No:48 per NGT Order no 673/2018 dated20.9.2018	IRRIGATION DEPARTMENT	Local body	Activity	Imple mentin g Agenc y	Unit	Fund and cost	Time of Comp letion
1	E	Providing fencing on Perumbabridge (NH) across Perumbariver at Payyannur in Payyannur Municipality	Irrigation department	1	1	0.30	Plan Fund	2021
2	E	Desilting and reconstruction of salt water exclusion cross bar across perumbathodu in Payyannur Municipality	Irrigation Department	1	1	0.30	MI Class II Plan fund	2021
3	E	Desilting and repair of salt water exclusion cross bar across Koykottuvayal hodu in KunhimangalamPanchayath	Irrigation Department	1	1	0.02	State Disaster Response Fund	2020
4	E	Regualting activites in flood plain zone, protection and management of flood plain zone	Irrigation Department	-	-		Protection and management of flood plane zone for a period of 3 years with a fund of 0.50 crores	3 years

5	E	Greenery development- Plantation plan. Plantation on both sides of the river, setting up biodiversity parks on flood plains by removing encroachment	Irrigation Department	-	-		Planting trees on the bank of the river will be completed within 3 years from the commencement of works with a fund of 0.40 crores	3 years
6	E	Issues relating to E-flow, maintaining minimum environmental flow of river(by having watershed management provisions)	Irrigation Department	-	-		By Micro watershed management for a period of 2 years with a fund of 0.25 Crore from the available fund	2 years

Combined Action plan by KSPCB

Sl no	Project	Proposed action	Agency	Remarks
1	Sanitation	Providing of toilets to residences With treatment and disposal system for sewage and sullage	Local Body	As there are residences with single pit toilet
2	Community Toilet	Construction of new community toilets with treatment system	All local bodies Suchitwa Mission, Revenue department	Proposed Construction Of new community Toilet at satellite points on the bank of river
3	Rain water recharge	Entry of rain water and rain water recharging to all thodu and drain	All local bodies , Kerala Water Authority,	Drains are inspected before rain and all thodu , stream are cleaned once in a year
4	Solid waste management	Sanitary Facility in establishments created in the ward for the segregation, treatment and disposal of solid wastes as per Solid Wastes Management Rules, 2016	Pollution Control Board , Health authority	Check they have board consent and sanitation facility is provided
5	Household waste	Adequate number of Kitchen bins shall be provided	Municipalities and local bodies	As per the project
6	Market	Providing proper waste handling facility For wastewater And solid wastes		Six months

7	Rendering plant	Rendering plant for poultry wastes	Local body	Six months
8	Slaughter house	Slaughter house waste disposal facility	Local body	
9	Establishment like service station and workshops	Strict monitoring of disposal of waste (sewage, sullage, degradable waste, non-biodegradable waste) surveyed area and also in the catchment of the river i) Verify whether consent to operate of the Board exists	Pollution Control Board	Six months
10	Sanitation survey should be done	Sanitation survey is to be conducted for 100m on either sides of the other parts of polluted stretch if any located nearby	Pollution Control Board	Six months
11	Awareness	Awareness for residence association:	Suchitwa mission/ L SGD/Corporation	Once in a month

Action Plan by Ground Water Department

Sl.No	Ref para item nos as per NGT Order no.673/2018 dated 20.09.2018	Activity	Ground Water Department
1	B(i)	Ground Water resources and regulation of ground water extraction by industries particularly in over exploited	As per Groundwater resources of Kerala, 2017 estimate a total number of 2 blocks (Neeleswaram and Payyannur) comes under the Peruvamba river basin. All the blocks in the river stretch are safe

		as critical zones/blocks	with stage of groundwater extraction ranges from 34.85% to 69.52%
2	B(ii)	Ground water recharging / rain water harvesting	The average pre -monsoon groundwater level ranges from 7.97 mbgl - 8.81 mbgl. Department has implemented 5 no of bore well recharge structures and 3 dug well recharge at Cheemeni open prison in Neeleswaram block
3	B(iii)	Periodic ground water quality assessment and remedial actions in case of contaminated ground water tube wells/bore wells or hand pumps	Groundwater Department has 1 observation dug well and 1 piezometer for routine studies in the river stretch.
4	B(iv)	For regulating use of ground water for irrigation purpose, adopting good irrigation practices	The total irrigation draft in the area ranges from 695.64 - 1326.85 ha.m.

Other than these following are some more suggestions from the part of pollution control Board.

1. Proper awareness among the inhabitants in the area is to be given for protecting the water bodies. Basic training for the people at the grass root level is to be provided for river management. All efforts for maintaining the quality of water bodies may be done by the Panchayat/Municipal authorities only with people's participation.
2. The nearby gramapanchayath and municipalities are mainly responsible for not providing municipal waste collection and treatment facilities in the locality. So they must be instructed to provide the required facility for scientific disposal of municipal solid waste as per the MSW rules 2016. The citizens as well as the municipal/gramapanchayath authorities need to be aware of the importance of scientific disposal of waste generated. Their attitude towards handling waste has to be changed. Reducing waste, recovering recyclable materials, return of nutrients to the eco system as well as generation of energy from waste are to be practised. There has to be a valid scheme for collection, segregation, transportation, processing and safe disposal of waste by the authorities. For this affordable and viable waste to energy conversion technologies apart from conventional composting is to be implemented by the municipalities seeking technical expertise.
3. Propagation of vegetative cover in water shed will reduce soil erosion and enhance percolation of rain water into the sub surface. In downstream stretches where the river is saline, propagation of mangroves are essential.
4. Strict monitoring from the part of implementing as well as monitoring agencies is required for effective functioning of waste treatment facilities in waste generating units.
5. The practice of waste dumping into the river is to be prevented legally and strict action against this practice is to be adopted at panchayath and municipality level.
6. Re-survey of the river boundaries throughout the entire stretch is to be done urgently so as to prevent encroachment of the river.
7. The municipalities as well as the panchayaths are to be directed to provide proper waste management facilities of their own. All towns and cities must have Sewage Treatment Plants (STPs) that clean up the sewage. Facility for collection, segregation, transport, processing and scientific disposal of waste generated are to be provided by the local authorities in strict adherence to the Municipal Solid Waste Management Rules, 2016. For this, affordable and viable waste to energy conservation technologies apart from conventional composting is to be implemented seeking technical expertise.
8. Strict monitoring from the part of implementing as well as monitoring agencies is required for effective functioning of waste treatment facilities in waste generating units. The riverine stretches are to be monitored periodically at identified locations for water quality assessment.
9. Modern agricultural practices and technologies introduce the use of inorganic fertilizers with Nitrogen, Phosphorous, Potash and inorganic pesticides in farm lands and play important role in the river pollution. These may concentrate into the water body through run

off causing algal blooms by which whole stretch of water become choked. Fertilizers and chemicals application in agricultural lands are to be strictly under technical expertise.

10. Rain water recharging measures must be adopted.
11. Eco tourism and water tourism projects are to be designed giving due importance for protecting the environment. The activities are to be organized in such ways which do not induce any types of pollution to the water body. Strict monitoring from the concerned authorities are recommended in functioning of the tourism projects.
12. Implement Green Protocol effectively in local self governments. Prohibit littering of plastics in the area. Plastic wastes shall be handled as per the provisions of Plastic Waste (Management and Handling) Rules, 2018.
13. The existing waste water treatment facilities of Taliparamba Municipality shall be augmented in such a way so as to operate round the year.
14. Actions shall be taken by the local bodies to clean the storm water drains. Rejuvenation of small streams, creeks leading into the river is to be done.
15. Round the clock patrolling shall be provided so as to prevent waste dumping on public places.
16. CCTV can be installed at suitable points in order to identify the persons/ establishments dumping waste in to river. All the local bodies must establish slaughter houses with modern facilities and unauthorized slaughter houses shall be strictly enforced.
17. Strict action shall be taken against non-violating person/ agency by the authorities when noticed. Plantation of trees and plants on the bank will be highly effective in controlling the waste disposal.