



National River Conservation Directorate
Department of Water Resources,
River Development & Ganga Rejuvenation
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SOCIAL ENVIRONMENT REPORT

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National River Conservation Directorate (NRCD)

The National River Conservation Directorate, functioning under the Department of Water Resources, River Development & Ganga Rejuvenation, and Ministry of Jal Shakti providing financial assistance to the State Government for conservation of rivers under the Centrally Sponsored Schemes of ‘National River Conservation Plan (NRCP)’. National River Conservation Plan to the State Governments/ local bodies to set up infrastructure for pollution abatement of rivers in identified polluted river stretches based on proposals received from the State Governments/ local bodies. www.nrcd.nic.in

Centres for Periyar River Basin Management and Studies (cPeriyar)

The Center for Periyar River Basin Management and Studies (cPeriyar) is a Brain Trust dedicated to River Science and River Basin Management. Established in 2024 by IIT Palakkad and NIT Calicut, under the supervision of cGanga at IIT Kanpur, the center serves as a knowledge wing of the National River Conservation Directorate (NRCD). cPeriyar is committed to restoring and conserving the Periyar River and its resources through the collation of information and knowledge, research and development, planning, monitoring, education, advocacy, and stakeholder engagement. www.cPeriyar.org

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cGanga is a think tank formed under the aegis of NMCG, and one of its stated objectives is to make India a world leader in river and water science. The Centre is headquartered at IIT Kanpur and has representation from most leading science and technological institutes of the country. cGanga’s mandate is to serve as think-tank in implementation and dynamic evolution of Ganga River Basin Management Plan (GRBMP) prepared by the Consortium of 7 IITs. In addition to this, it is also responsible for introducing new technologies, innovations, and solutions into India.
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Acknowledgment

This report is a comprehensive outcome of the project jointly executed by IIT Palakkad (Lead Institute) and NIT Calicut (Fellow Institute) under the supervision of cGanga at IIT Kanpur. It was submitted to the National River Conservation Directorate (NRCD) in 2025. We gratefully acknowledge the individuals who provided information and photographs for this report.

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Preface

The Periyar River Basin, a vital artery of central Kerala, embodies the complex relationship between natural ecosystems and human communities. Flowing through the districts of Idukki, Ernakulam, and Thrissur, provides vital ecological services in addition to supporting domestic needs, industry, electricity, fisheries, and agriculture. However, rising urbanization, industry, deforestation, sand mining, pollution, and climate-related calamities are putting increasing strain on this crucial river system.

This report on the Social Environment of the Periyar River Basin is the outcome of a thorough analysis of the institutional frameworks, ongoing initiatives, and community dynamics that all work together to influence the Periyar River's sustainability and the health of the ecosystem around it. In managing land, water, forests, agriculture, garbage, and disaster response, it examines the functions of important stakeholders, including local community groups, government agencies, and non-governmental organizations. The sustainability trajectory of the river is greatly influenced by their individual and combined actions. Alongside noteworthy community-led programs like pollution control, water supply schemes, flood early warning systems, and public awareness campaigns, the report critically assesses significant Central and State Government efforts, noting their goals, successes, and implementation deficiencies. Primary stakeholders such as farmers, laborers, industries, and quarry operators are mapped, and the effects of their operations, specifically, resource extraction and land use on the river, are examined. The enabling and constraining elements in the implementation of policies are also covered, including institutional coordination, social movements, civic awareness, and legal measures. This comprehensive understanding of the social environment surrounding the Periyar River Basin highlights the urgent need for integrated, multi-stakeholder approaches to ensure the river's resilience and the well-being of the communities that depend on it.

**Centres for Periyar River Basin
Management and Studies (cPeriyar)
IIT Palakkad & NIT Calicut**

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Abbreviations and Acronyms

AMRUT	: Atal Mission for Rejuvenation and Urban Transformation
AIIB	: Asian Infrastructure Investment Bank
BHS	: Biodiversity Heritage Sites
BIS	: Bureau of Indian Standards
BMC	: Biodiversity Management Committee
BOD	: Biochemical Oxygen Demand
BPCL	: Bharat Petroleum Corporation Limited
BWUE	: Bureau of Water Use Efficiency
CBG	: Compressed Biogas
CD Block	: Community Development Block
CoS-it-FloWS	: Community Sourced Impact-Based Flood Forecast and Early Warning System
CIFT	: Central Institute of Fisheries Technology
CMLRE	: Centre for Marine Living Resources and Ecology
COVID	: Coronavirus Disease
CPHEEO	: Central Public Health and Environmental Engineering Organisation
CSR	: Corporate Social Responsibility
CT	: Census Town
CWC	: Central Water Commission
CWRDM	: Centre for Water Resources Development and Management
DHARMA	: Dam Health and Rehabilitation Monitoring Application
DMP	: Disaster Management Plan
DPRs	: Detailed Project Reports
DRIP	: Dam Rehabilitation and Improvement Project
EAPs	: Emergency Action Plans
ECRR	: European Centre for River Restoration
EDC	: Eco-Development Committee
EOC	: Emergency Operations Centre
EPR	: Extended Producer Responsibility
FACT	: Fertilizers and Chemicals Travancore Limited
FMBAP	: Flood Management and Border Areas Programme
GCDA	: Greater Cochin Development Authority
GIS	: Geographic Information System
GoK	: Govt. of Kerala

GWMR	: Ground Water Management and Regulation
HKM	: Haritha Keralam Mission
IDRB	: Irrigation Design & Research Board
IEC	: Information Education and Communication
IEDP	: India Eco-Development Project
IRE Ltd.	: Indian Rare Earths Limited
JJM	: Jal Jeevan Mission
JSA	: Jal Shakti Abhiyan
KAMCO	: Kerala Agro Machinery Corporation
KAU	: Kerala Agricultural University
KaWaCHaM	: Kerala Warnings, Crisis, and Hazard Management System
KFWD	: Kerala Forest and Wildlife Department
KILA	: Kerala Institute of Local Administration
KINFRA	: Kerala Industrial Infrastructure Development Corporation
KOMPAS	: Kerala Online Mining Permit Awarding Services
KRWSA	: Kerala Rural Water Supply and Sanitation Agency
KSDMA	: Kerala State Disaster Management Authority
KSEBL	: Kerala State Electricity Board Limited
KSPCB	: Kerala State Pollution Control Board
KSUDP	: Kerala State Urban Development Program
KSWMP	: Kerala Solid Waste Management Project
KUFOS	: Kerala University of Fisheries and Ocean Studies
KVASU	: Kerala Veterinary and Animal Sciences University
KVK	: Krishi Vigyan Kendra
KWA	: Kerala Water Authority
LRG	: Local Resource Group
LSG	: Local Self Government
LSGD	: Local Self Government Department
M ha	: Million hectares
MLD	: Million liters per day
MoEF & CC	: Ministry of Environment, Forests and Climate Change
MoHUA	: Ministry of Housing and Urban Affairs
MoJS	: Ministry of Jal Shakti
MPs	: Members of Parliaments

NAPC	: National Action Plan on Climate
NBI	: Nature Based Infrastructure
NDSA	: National Dam Safety Authority
NGO	: Non-Governmental Organization
NGRBA	: National Ganga River Basin Authority
NGT	: National Green Tribunal
NHP	: National Hydrology Project
NRCP	: National River Conservation Plan
NRW	: Non-Revenue Water
NWM	: National Water Mission
NWQMP	: National Water Quality Monitoring Program
PIL	: Public Interest Litigation
PMKSY	: Pradhan Mantri Krishi Sinchayee Yojana
PPP	: Public-Private Partnerships
PRIs	: Panchayati Raj Institutions PRIs
PTR	: Periyar Tiger Reserve
PVIP	: Periyar Valley Irrigation Project
R&D	: Research and Development
RKVY	: Rashtriya Krishi Vikas Yojana
RKI	: Rebuild Kerala Initiative
RTWQMS	: Real-Time Water Quality Monitoring Station
RWH	: Rainwater Harvesting
SAGY	: Saansad Adarsh Gram Yojana
SDMP	: State Disaster Management Plan
SBM	: Swachh Bharat Mission
SGPB	: State Geological Programming Board
SLSSC	: State Level Standing Sanitation Committee
STP	: Sewage Treatment Plant
SWQMP	: State Water Quality Monitoring Scheme
TSG	: Technical Support Group
ULB	: Urban Local Body
VPN	: Virtual Private Network
WRIS	: Water Resources Information System
WSSO	: Water and Sanitation Support Organization

1.0 Introduction

Rivers are an invaluable natural resource that offers extensive environmental, social and economic benefits (NBI, 2025). People have been interacting with rivers for ages. We have historically relied on them for food, shelter and basic survival, making them an essential component of our local ecosystem (ECRR, 2019). However, ecosystem deterioration brought on by human activity has impeded socioeconomic progress. Therefore, studying the impact of human activities on river health is essential for sustainable river basin management (Luo et al., 2018; Karr, 1999). The social environment comprising organizations, industries, agriculture, community activities, etc. substantially influences river health - either sustaining or deteriorating the ecosystem. While a socially alert environment enhances river health by enhancing sustainable water management, pollution control, conservation and community participation; unbridled anthropogenic activities such as urbanization, industrialization, pollution, deforestation, sand mining, unsustainable agriculture practices and waste management, degrade river health. This will particularly impact the utility of the river as a source of drinking water or as a freshwater ecosystem habitat. Hence it is necessary to make all out efforts to manage and safeguard our rivers (Angriani, 2018).

Periyar, the longest river in Kerala, with a length of about 244 km, originates from the Sivagiri Hills in the Southern Western Ghats. The Periyar River Basin extends over an area of about 5398 km², with about 5284 km² spread over Idukki, Ernakulam and Thrissur Districts in Kerala, and about 114 km² in Tamil Nadu. Periyar has been playing a vital role in determining the socio-economic landscape of Kerala - by supporting industries, tourism, agriculture, electricity generation, domestic water supply, fisheries etc to name a few major sectors. Rapid industrialization and urbanization, along with anthropogenic activities such as illegal sand mining, deforestation, quarrying, discharge of untreated/ improperly treated sewage, and improper waste management pose a significant threat to the Periyar River. The State and Central Governments and Non-Governmental Organizations have been putting considerable effort to support and sustain the health of the river and the river basin through various initiatives, schemes, public awareness campaigns, disaster management plans, conservation programs and policies.

Participation of the stakeholders in river basin management is gaining popularity due to its potential to improve resource management and promote the democratic processes. Three mechanisms for enhancing participation include providing space for deliberation, mobilizing human and social capital, and raising decision legitimacy (Gemma Carr, 2015). However, challenges include managing consensus building, managing asymmetrical power relationships, ensuring benefits outweigh costs and defining legitimate criteria. Strategies to address these include managing

participation process characteristics and ongoing evaluation to achieve high-quality, efficient decisions (Gemma Carr, 2015). Lack of awareness, weak law enforcement, and limited resources are some of the constraining factors that hinder policy implementation. Proper access to information, public awareness, community participation and social movements, legal actions and time-bound support from the Government will enable the implementation of policies and programmes for sustainable river management.

2.0 Key institutions in the Periyar River Basin

Government-NGO Collaboration for Sustainable River Management

Collaboration between Government organizations and NGOs is crucial for holistic river and river basin management. Governments provide the structure, resources, and legislative support, while NGOs offer innovative approaches and advocate for marginalized communities. Recognizing and nurturing this relationship is pivotal for sustainable progress, ensuring a more equitable, resilient and just future. Effective governance navigates complexities and secures the well-being of current and future generations (Chaurasiya & Gautam, 2023).

The Periyar River Basin in Kerala has faced numerous challenges in connection with the construction of various hydroelectric projects, extraction of granite, discharge of untreated/improperly treated sewage, uncontrolled sand mining etc. These factors have led to increased salinity intrusion, deteriorating water quality and ecosystem degradation. The river basin has been negatively impacted by frequent floods, and dry spells. The lack of reliable data for flood routing studies further complicates the situation. To address these issues, a river basin organization is needed to scientifically plan, monitor and manage the river basin. This requires data collection, analysis and modelling aimed at addressing various challenges related to water availability and supply and developing strategies to address the challenges posed by projected climate change. Coordinated action by various Government Departments and agencies, and NGOs is much required to address the challenges faced. A fully participatory approach is necessary for achieving the objectives of the river basin organization. Institutional autonomy, accountability and transparency are essential components for the success of organizations involved in river basin management (Kerala State Planning Board, 2022).

2.1. Government Agencies in the Periyar River Basin

Government Agencies including Departments, Public Sector Undertakings, Autonomous Bodies etc play a vital role in river basin management and conservation related activities in the Periyar River Basin. These agencies are involved at different levels in the implementation of policies and

programs aimed at ensuring sustainable resource management. The activities taken up aim to protect land, soil, and water resources, regulate water use, control pollution, and promote waste management. They also support biodiversity conservation, fisheries, agriculture, and eco-tourism, ensuring long-term environmental and socio-economic sustainability.

2.1.1. Soil and Land Management

The soil and land management sector plays a key role in safeguarding the Periyar River Basin by promoting sustainable use of natural resources like soil and water. It uses scientific tools to assess soil health and suggest the most effective land management approach. The sector also focuses on restoring ecologically stressed areas and engaging local communities in such activities through awareness building and extension activities. Kerala Soil Survey and Soil Conservation Department focuses on soil water conservation and management, preparing a database for sustainable development, and implementing state/centrally sponsored projects for agricultural advancement, environmental friendliness, and abundant water resources (Kerala Soil Survey and Soil Conservation Department, 2025). The State Geological Programming Board (SGPB) assesses geological activities by the Central and State Govt. Departments, Autonomous Bodies, Institutions and Public Sector Undertakings. The Department of Mining and Geology, Govt. of Kerala which serves as Member Secretary of the SGPB, under the Industries Department of Kerala, oversees mineral exploration, prospecting, administration, and short-term investigations, as well as geosciences projects (Department of Mining and Geology, 2025). The Kerala State Land Use Board conducts research on land utilization, gathers data, and conducts natural resource inventories. It offers technological solutions, public awareness campaigns, and consulting services for land use and spatial planning (Kerala State Land Use Board, 2025). Table 1 provides an overview of the major organisations and sectors (indicative) involved in soil and land management within the Periyar River Basin.

Table 1. Soil and Land Management Sector in the Periyar River Basin

Soil and Land Management	
Sl.No.	Institution/ Agency
1	Soil Survey and Soil Conservation Directorate - Thiruvananthapuram, Thrissur
2	District Soil Conservation Office - Ernakulam, Idukki
3	Directorate of Mining and Geology - Thiruvananthapuram, Kochi, Idukki
4	Kerala State Land Use Board - Thiruvananthapuram, Thrissur

2.1.2. Water Resource Management

Water resource management in the Periyar River Basin involves various institutions cooperating together to assure the sustainable use, conservation, and distribution of water for multiple uses such as drinking, irrigation, hydropower, and ecological balance. Centre for Water Resources Development and Management (KSCSTE-CWRDM) is a top research and development organization in the water sector that has been established by the Kerala government. CWRDM has significantly contributed to hydrologic studies and water management, addressing issues such as watershed development, wetland management, agriculture, estuarine management, groundwater development, water quality management, and environmental issues (CWRDM, 2025). The KWA provides piped water supply and implements sewerage schemes, while the Water Resources/Irrigation Department focuses on water utilization and constructing storage reservoirs for agriculture (Kerala Water Authority, 2025; Irrigation Department, Government of Kerala). The Central Water Commission (CWC) is responsible for various functions including appraisal of water resources projects, basin planning and management, dam safety, flood forecasting and hydrological observation, human resource management, hydro-mechanical design of water resources projects, hydrology, monitoring of water resources projects, river management, surveying and investigation of water resources projects and water dispute resolution (Central Water Commission, 2020). The Groundwater Department monitors, manages, and conserves groundwater resources in the Periyar River Basin and Kerala, conducting hydrogeological studies, assessing water quality, providing technical guidance, supporting drinking water supply schemes, and managing urban water (Central Ground Water Board, 2025). The Hydrology Wing of Irrigation Design & Research Board (IDRB) collects, validates, and distributes water-related data from the state's water resources. It collects, tabulates, and processes daily reservoir levels and storage volumes from irrigation projects, assesses flood discharge, and conducts water balance studies. The wing also prepares comments on State Water Policy, National Water Policy, and National Hydrology Projects (IDRB, 2025). The Dam Safety Organisation functioning under Chief Engineer (Civil- Dam Safety & DRIP) is responsible for managing dam safety and operations in KSEBL in accordance with standard protocols. By implementing timely rehabilitation measures, Dam Safety Organizations contribute significantly to the sustainability of existing dams by enhancing their life, safety, and operational performance. The organisation also coordinates inspections, provides timely information on reservoir operation, and updates emergency action plans. The integrated approach of these organizations balances drinking water supply, irrigation, sanitation and ecological sustainability in the basin (KSEB, 2023). Table 2

represents key institutions (indicative) involved in water resource management within the Periyar River Basin.

Table 2. Water Resource Management in the Periyar River Basin

Water Resource Management	
Sl. No.	Institution/ Agency
1	Kerala State Council for Science, Technology and Environment – Centre for Water Resources Development and Management (KSCSTE-CWRDM), Kozhikode
2	Kerala Water Authority - Ernakulam, Thrissur, Idukki
3	Water Resources/ Irrigation Department
4	Major Irrigation Division, Ernakulam
5	Minor Irrigation Division, Ernakulam
6	Central Water Commission
7	Central Ground Water Board (CGWB)
8	Hydrology Section, Chalakudy
9	KSEB Ltd.
10	Dams - Anayirankal, Cheruthoni, Erattayar, Idamalayar, Idukki, Kallar, Kallarkutty, Kulamavu, Kundala, Pambla, Mattupetty, Mukkudil, Mullaperiyar, Ponmudi, R.A. Headworks, Sengulam etc

2.1.3. Groundwater Department

The Groundwater Department plays a vital role in monitoring, managing and conserving groundwater resources within the Periyar River Basin and across Kerala. It conducts hydrogeological studies, groundwater exploration, groundwater quality assessments and resource evaluations to ensure sustainable use of groundwater. The Department monitors water levels and water quality in wells, analyses water quality and provides technical guidance on groundwater conservation, recharge, and pollution control. By supporting drinking water supply schemes, drought mitigation measures, and urban water management, it helps to maintain aquifer health and water security in the region (Central Ground Water Board, 2025). Table 3 provides an overview of the groundwater department (indicative) within the Periyar River Basin.

Table 3. Groundwater Department in the Periyar River Basin

Groundwater Department	
Sl. No.	Institution/ Agency
1	Central Ground Water Board (CGWB), Thiruvananthapuram
2	Ground Water Department District Office - Ernakulam, Idukki, Thrissur

2.1.4. Pollution Control and Waste Management

The Suchitwa Mission, Kerala State Pollution Control Board and Kerala Solid Waste Management Project (KSWMP) play a major role in controlling pollution and managing wastes in the Periyar River Basin. The Suchitwa Mission assists Local Self Government Institutions in waste management, whereas the KSPCB monitors and enforces pollution control measures. The KSWMP strengthens solid waste management systems by providing technical assistance, promoting awareness, and supporting infrastructure development. Together, these institutions ensure environmental sustainability, public health protection and long-term ecological balance in the Periyar River (Suchitwa Mission, 2025; Kerala State Pollution Control Board, 2025; KSWMP). Table 4 provides an overview of the waste management sectors (indicative) within the Periyar River Basin.

Table 4. Pollution Control and Waste Management Sector in the Periyar River Basin

Pollution Control and Waste Management	
Sl. No.	Institution/ Agency
1	Suchitwa Mission - Thiruvananthapuram, Idukki, Ernakulam, Thrissur
2	Kerala State Pollution Control Board (KSPCB) - Ernakulam, Idukki, Thrissur
3	Kerala Solid Waste Management Project - Thiruvananthapuram, Thrissur, Idukki

2.1.5. Forest and Biodiversity Conservation

The Department of Forests and Wildlife, Govt. of Kerala (GoK) is the an important administrative department, focusing on biodiversity conservation, forest protection, and wildlife management. Its objectives include scientifically managing forests, conserving wildlife, improving water regimes, enhancing social and cultural values, increasing productivity, promoting eco-tourism, and tree planting to address global warming threats (Kerala Forest Department, 2025). Table 5 provides an

indicative list of the key agencies under the Kerala Forest and Wildlife Department (KFWD) within the Periyar River Basin.

Table 5. Forest and Biodiversity Conservation Sector in the Periyar River Basin

Forest and Biodiversity Conservation	
Sl. No.	Institution/ Agency
1	Divisional Forest Offices - Idukki, Thrissur, Ernakulam, KFWD
2	Idukki Wildlife Sanctuary, Painavu, Idukki, KFWD
3	Mangalavanam Bird Sanctuary, Kochi, Ernakulam, KFWD
4	Thattekad Bird Sanctuary, Kothamangalam, Ernakulam, KFWD
5	Idamalayar Reserve Forest, Ernakulam, KFWD
6	Periyar National Park, Idukki, KFWD
7	Kodanad Elephant Training Centre, Malayattoor, Ernakulam, KFWD
8	Kerala Forest Department, Thiruvananthapuram

2.1.6. Department of Fisheries

The Department of Fisheries, GoK, through various agencies, serves the fisheries sector, and aims at sustainable development for nutritional security, economic growth, and socio-economic upliftment in the Periyar River Basin. Its mission is to conserve resources, ensure nutritional security through new technologies, support socio-economic development, ensure the safety and security of the fishing community, develop infrastructure, and provide effective extension services to the society. The department serves this sector through various agencies, including the Kerala State Cooperative Federation for Fisheries Development Ltd, Agency for Development of Aquaculture, Kerala, Fishermen's Welfare Fund, State Fisheries Resource Management Society, Fish Farmers Development Agency, Kerala State Coastal Area Development Corporation, National Institute of Fisheries Administration and Management, Society for Assistance to Fisherwomen, and Kerala Aqua Ventures International Limited. Through the coordinated efforts of these agencies, the department ensures the sustainable management and conservation of fisheries in the Periyar River Basin (Department of Fisheries, Govt. of Kerala). The Indian Council of Agricultural Research - Central Marine Fisheries Research Institute (ICAR - CMFRI) monitors and assesses marine fisheries resources in the Exclusive Economic Zone, develops sustainable fishery management plans, conducts mariculture research, and provides consultancy services (CMFRI, 2025). Cochin University of Science and Technology (CUSAT) aims to create a globally

competent human resource by imparting modern knowledge and training to its student community. The university aims to promote research and innovation in applied science, technology, industry, commerce, management, and social science, provide graduate and post-graduate education opportunities, develop relevant education programs, foster cooperation between academic and research communities, and organize exchange programs with other institutions to stay updated on the latest developments in teaching and research areas (CUSAT, 2021). The ICAR-CIFT conducts research in fishing and processing, designs energy-efficient systems, develops fishing implements and machinery, and supports human resource development through training and education (CIFT, 2025). Centre for Marine Living Resources and Ecology (CMLRE) coordinates ocean development activities, including mapping, inventory, ecosystem management, and R&D in marine ecology, aiming to study and optimize marine resources (Department of Science and Technology, 2025). The Kerala University of Fisheries and Ocean Studies (KUFOS) is a government-established institution specializing in fisheries and ocean sciences. Table 6 provides a list of fisheries sectors and institutions (indicative) within the Periyar River Basin.

Table 6. Department of Fishery in the Periyar River Basin

Department of Fisheries	
Sl. No.	Institution/ Agency
1	Indian Council of Agricultural Research - Central Marine Fisheries Research Institute (ICAR - CMFRI) HQ, Ernakulam
2	Office of the Joint Director of Fisheries (Central Zone), Ernakulam
3	Fisheries Complex, Kochi, Ernakulam
4	Fisheries Officer, Kerala Fishermen's Welfare Fund Board, Ernakulam
5	Fisheries Resource Management Society (FIRMA) Ernakulam
6	Department Of Fisheries and Aquaculture
7	Office of the Assistant Director of Fisheries, Idukki, Ernakulam, Thrissur
8	CUSAT Industrial Fisheries School, Pallimukku, Ernakulam
9	Indian Council of Agricultural Research - Central Institute of Fisheries Technology (ICAR-CIFT), Kochi, Ernakulam
10	Centre for Marine Living Resources and Ecology, Kochi
11	Kerala University of Fisheries and Ocean Studies (KUFOS, Kochi)
12	Fisheries Station Puduveyppu, Kochi, Ernakulam

2.1.7. Agriculture

Agriculture sector plays an important role in conserving the Periyar River Basin by promoting sustainable farming practices that protect soil health and water resources. Key institutions significantly contribute to this effort. The ICAR Krishi Vigyan Kendra (KVK), the Farm Science Centre of the Indian Council of Agricultural Research, facilitates technology assessment, on-farm testing, frontline demonstration, capacity development for farmers and extension personnel, and serves as a Knowledge and Resource Centre for agricultural technologies (ICAR-KVK, 2025). The Department of Agriculture & Farmers Welfare, Govt. of Kerala, implements eco-friendly methods, crop insurance, and strategic cropping to minimize environmental stress, support mechanization, and ensure that farmers have access to technology and credit (Department of Agriculture Development and Farmers' Welfare, 2025). The Agriculture Department in Kerala implements programs to increase food and cash crop production, promoting scientific cultivation methods, and providing high-yielding seeds, seedlings, planting materials, and plant protection chemicals to farmers, and operates through district offices led by Principal Agricultural Officers (District Administration Ernakulam, 2025). Kerala Agricultural University (KAU) aims to transform the agriculture sector into a growth engine for Kerala's economy by providing human resources, skills, and technology for sustainable development. Its research stations include Mannuthy Agricultural Research Station, which functions as a verification centre for rice research in the Central Region; and Aromatic & Medicinal Plants Research Station and Cardamom Research Station focus on aromatic, medicinal, and spice crops. (KAU, 2025). Kerala Veterinary and Animal Sciences University (KVASU) focuses on developing skilled veterinarians and dairy technologists while promoting sustainable animal production, disease control, biodiversity conservation, and socio-economic development. The Base Farm, initially part of the Indo-Swiss Project, later came under KVASU and serves as a centre for training, high-quality milk and fodder production, research, and technology transfer to support livestock and poultry farming (Kerala Veterinary and Animal Sciences University, 2018). The Directorate of Cashew nut Development, focuses on scientifically developing cashew and cocoa. It integrates with developmental agencies and research institutes, integrating technological advancements into developmental efforts. They formulate and implement development programs, promote planting, coordinate activities, monitor development programs, and serve as an advisory body. They also serve as a data bank, promote technology dissemination, and provide technical advice to farmers and entrepreneurs (Directorate of Cashew nut and Cocoa Development, 2025). Kerala Agro Machinery Corporation Ltd. (KAMCO) aims to provide sustainable, affordable farming solutions through agricultural

mechanization, sourcing and developing latest technologies, and offering ISO-Certified machinery for efficient and reliable farming operations (KAMCO, 2024). Table 7 lists indicative agricultural sectors within the Periyar River Basin.

2.1.8. Land Use Board

The Kerala State Land Use Board (KSLUB) plays an important role in conserving the Periyar River Basin. It promotes sustainable land use practices to protect soil and water resources as well as biodiversity. It is involved in ensuring rational land use, micro-level data collection, inventory preparation, and studies on natural resources. It also conducts public awareness programs and guides land use and spatial planning (Kerala State Land Use Board, 2025). Table 8 provides an overview of the land use sector (indicative) within the Periyar River Basin.

Table 7. Agriculture Sector in the Periyar River Basin

Agriculture	
Sl. No.	Institution/ Agency
1	ICAR-Krishi Vigyan Kendra, Kochi, Idukki, Thrissur
2	Department of Agriculture Development and Farmers' Welfare, Palayam, Thiruvananthapuram
3	Office of the Principal Agricultural Office, Thodupuzha, Idukki; Chembukkav, Thrissur; Kochi, Ernakulam
4	Directorate of Cashewnut and Cocoa Development, Kochi, Ernakulam
5	Agricultural Research Station - Mannuthy, Thrissur
6	Kerala Agricultural University, Vellanikkara, Thrissur
7	Aromatic & Medicinal Plants Research Station – Odakkali, Perumbavoor, Ernakulam
8	Cardamom Research Station, Pampadumpara, Idukki
9	Kerala Veterinary and Animal Sciences University, Mannuthy, Thrissur
10	Base Farm - Idukki
11	Kerala Agro Machinery Corporation. Ltd., Aluva, Ernakulam

Table 8. Land Use Sector in the Periyar River Basin

Land Use Board	
Sl. No.	Institution/ Agency
1	State Land Use Board, Thiruvananthapuram
2	Kerala State Land Use Board, Thrissur

2.1.9. Disaster Management Authority

The Kerala State Disaster Management Authority (KSDMA) plays a major role in flood forecasting, and development and deployment of systems for early warning and emergency response. Its activities during extreme weather events such as floods protect life and property along the river. The India Meteorological Department (IMD) is vital in river basin management by providing accurate weather forecasts, climate data, and early warnings for extreme weather events. It aids in water resource planning, disaster preparedness, and sustainable agricultural practices. IMD promotes research in meteorology and climate sciences, facilitating the development of long-term river conservation and adaptation strategies (KSDMA, 2025; Meteorological Department, Ministry of Earth Sciences, 2021). Table 9 provides an overview of the disaster management sector (indicative) within the Periyar River Basin.

Table 9. Disaster Management Sector in the Periyar River Basin

Disaster Management	
Sl. No.	Institution/ Agency
1	Kerala State Disaster Management Authority (KSDMA), Thiruvananthapuram
2	India Meteorological Department (IMD)

2.1.10. Urban Development and Planning

Urban development authorities are tasked with regulating sewage, and managing stormwater and solid waste in cities and towns near rivers. Sustainable urban planning helps prevent river pollution and encroachment. Table 10 provides an overview of the urban development and planning sector (indicative) within the Periyar River Basin.

Table 10. Urban Development and Planning Sector in the Periyar River Basin

Urban Development and Planning	
Sl. No.	Institution/ Agency
1	Kerala Sustainable Urban Development Project (KSUDP), Thiruvananthapuram Office of the Project Manager-Kerala Sustainable Urban Development Project, Thrissur
2	Kerala State Planning Board, Thiruvananthapuram
3	Town Planning Office, Idukki, Ernakulam, Thrissur
4	District Planning Office, Idukki, Ernakulam, Thrissur

2.1.11. Community-Based Development Programs

Community-Based Development Programs promote community engagement in water conservation, sanitation, and livelihood improvement. They support bottom-up approaches for river management through public participation and capacity building. Haritha Karmasena is an organization in Kerala that manages waste effectively. They play a crucial role in conserving the Periyar River Basin by managing solid waste and preventing it from reaching the river. The Haritha Keralam Mission aims to ensure proper waste disposal by collecting and sorting solid waste at the source, and recycling non-organic waste, and reducing the risk of plastic and other pollutants contaminating water bodies. The organization operates within the limits of Local Self-Government bodies, promoting organic waste management and waste-to-product innovation. Collaboration with other organizations like Kudumbashree and Suchithwa Mission further strengthens efforts to create a cleaner environment (Haritha Keralam Mission, 2025). Table 11 provides key Community-Based Development Programs (indicative) within the Periyar River Basin.

Table 11. Community-Based Development Programs/ Agencies in the Periyar River Basin

Community-Based Development Programs	
Sl. No.	Institution/ Agency
1	Haritha Keralam Mission and Haritha Karmasena

2.1.12. Public Health

The Department of Health & Family Welfare monitors water-borne diseases, promotes hygiene awareness and collaborates in sanitation and clean water initiatives. It plays a key role in assessing the public health impacts of river pollution. The Aardram Mission, launched by the Government of Kerala, aims to deliver comprehensive healthcare services, including disease prevention, maternal and child care, and universal immunization. It also aims to strengthen the infrastructure of family health centers, taluk hospitals, and medical colleges, and collect health data to identify and treat lifestyle diseases early. In the context of river basin management, Aardram plays a crucial role by preventing waterborne diseases, promoting sanitation, and ensuring safe waste disposal, thereby helping to reduce pollution in rivers. By raising awareness about hygiene and clean water usage, the Mission indirectly supports conservation of fresh water resources in the Periyar River Basin, ensuring better health and environmental sustainability (Nava Keralam Karma Padhathi, 2025).

Table 12. Health Sector in the Periyar River Basin

Health	
Sl. No.	Institution/ Agency
1	District Medical Office (Health), Ernakulam, Idukki, Thrissur
2	Office of The Health Inspector; Ernakulam, Idukki, Thrissur
3	National Health Mission - Arogyakeralam; Ernakulam, Idukki, Thrissur
4	Zonal Entomology Unit, Ernakulam
5	Primary Health Centre; Ernakulam, Idukki, Thrissur
6	Urban Primary Health Centre, Ernakulam, Idukki, Thrissur
7	Government Medical College; Ernakulam, Idukki, Thrissur
8	Taluk Government Hospital; Ernakulam, Idukki, Thrissur
9	Central Council for Research Unani Medicine, Aluva, Ernakulam

2.1.13. Eco-tourism

The Department of Tourism promotes sustainable tourism practices, creates awareness on river conservation, and contributes to local economic development without compromising ecological integrity. Kerala Tourism Development Corporation (KTDC) indirectly contributes to river basin management by promoting responsible tourism practices and supporting local communities. By promoting responsible tourism, KTDC ensures environmental sustainability, empowers local communities to become active stewards of their natural resources, and promotes sustainable water resource management practices through responsible water usage and wastewater treatment.

Table 13. Eco-tourism initiatives in the Periyar River Basin

Eco-tourism	
Sl. No.	Initiatives/ Agencies
1	Kottapuram Fort Walkway, Kodungallur
2	Cochin Port Walkway, Kochi, Ernakulam
3	Mangalavanam Bird Sanctuary – Mangroves
4	Vypin Walkway, Kochi, Ernakulam
5	Willingdon Island Walkway, Kochi, Ernakulam
6	Munambam Walkway, Vypin, Ernakulam
7	Marine Drive Walkway, Kochi, Ernakulam

Eco-tourism	
Sl. No.	Initiatives/ Agencies
8	Subhash Chandra Bose Park, Kochi, Ernakulam
9	Kettuvallam Bridge and Walkway Extension, Ernakulam
10	Nandanam Park, GCDA, Kadavanthra, Ernakulam
11	Panampilly Nagar Park, Ernakulam
12	APJ Abdul Kalam Park, Aluva, Ernakulam
13	Changampuzha Park, Edappally, Ernakulam
14	Kerala Tourism Development Corporation, Thiruvananthapuram

2.1.14. Government Industrial Clusters

Periyar River is one of the most polluted rivers in Kerala, with 25% of Kerala's industry located along its banks. The river is a toxic hotspot due to the discharge of toxic waste from industries in the Eloor-Edayar industrial belt. Industries in the Edayar-Eloor area consume 1,89,343 m³ of water daily and discharge 75% as used water/ effluent, causing pollution and threat to the riverine ecosystem, aquatic life and public health (Mohan et al., 2019; KSPCB, 2001). The Kerala Industrial Infrastructure Development Corporation (KINFRA) promotes industrial growth and environmental sustainability in the Periyar River Basin. It develops industry-specific infrastructure, creating eco-friendly townships and corridors. KINFRA's life-cycle approach minimizes ecological footprint, attracting investors and ensuring sustainability measures.

Table 14. Industry and Infrastructure in the Periyar River Basin
(Source - Directorate of Industries and Commerce)

Industrial Clusters	
Sl. No.	Institution/ Agency
1	Kinfra Hi-Tech Park, Kochi, Ernakulam
2	Kinfra Biotechnology and Industrial Zone, Ernakulam
3	Bharat Petroleum Corporation Ltd, Ernakulam
4	Forest Industries Travancore Ltd., Ernakulam
5	Hindustan Insecticides Ltd., Ernakulam
6	Hindustan Machine Tools, Ernakulam
7	Hindustan Tools & Hardware, Ernakulam

Industrial Clusters	
Sl. No.	Institution/ Agency
8	Indian Rare Earths Ltd., Ernakulam
9	Kerala Agro Machinery Corporation, Ernakulam
10	Kerala State Bamboo Corporation Ltd., Ernakulam
11	Kerala State Minorities Development Financial Corporation, Ernakulam
12	Kerala State Warehousing Corporation, Ernakulam
13	Meat Products of India Ltd., Ernakulam
14	Transformers and Electricals Kerala Ltd., Ernakulam
15	Travancore Cochin Chemicals Ltd., Ernakulam
16	M/s Hindustan Insecticides Ltd., Ernakulam
17	FACT Udyogamandal Division, Ernakulam
18	FACT Ltd., Petrochemical Division, Ernakulam
19	FACT Udyogamandal Complex, Ernakulam
20	Geo Surface Finishers (Edayar), Ernakulam
21	Cochin Shipyard Limited, Ernakulam

2.1.15. Local Self-Government Department

Kerala empowers Local Self-Government Institutions through resource and administrative transfers, enabling the effective implementation of developmental programs. Grama Sabhas identify and implement these programs. Decentralization of power allows the Department to formulate and implement developmental works at the grass-root level (LSGD, 2025). Periyar River Basin has 117 Grama Panchayats, 26 Block Panchayats, 5 District Panchayats, 9 Municipalities and 1 Corporation. These institutions play a critical role in environmental governance, water resource management, and disaster mitigation within the basin. They oversee the implementation of regulations related to pollution control, land-use planning and sustainable development strategies. The detailed list of LSGD is mentioned in Annexure 1.

2.2. Non-Governmental organisations in the Periyar River Basin

Private sector agencies and local community organizations are crucial in conserving and managing the Periyar River Basin. They address environmental and socio-economic challenges through

activities aimed at pollution control, waste management, social development, and maintenance of health. Industries are encouraged to adopt wastewater treatment technologies, reduce effluents, and comply with regulations. Community-driven initiatives promote sustainable livelihoods and eco-friendly practices. The health sector monitors water quality and addresses diseases. A holistic approach to management, integrating private sector initiatives with those by the Government, is essential. An indicative list of NGOs, private agencies, and industries active in the basin is provided in Annexure 2 and 3.

Role of Private Sector Agencies and Local Community Organisations in River Conservation and Management

2.2.1. Pollution Control and Waste Management Sector

Private sector agencies, particularly those working in waste management, recycling, wastewater treatment and environmental engineering, play a crucial role in conservation and management of riverine ecosystems. Companies like Green Worms, Trashco, Happy Trash and Trieco Green Private. Ltd. provide solutions for sustainable waste collection, segregation and recycling services. There are a number of other companies working on industrial waste treatment. These efforts align with environmental goals and contribute to cleaner river systems.

2.2.2. Social Development and Environmental Welfare

Kerala's social development and environmental welfare organizations play an important role in river conservation through community engagement, research, education and policy advocacy. They create awareness about clean rivers and sustainable resource use, implement community-based programs, and provide data for policy improvement. Movements like Swadeshi Science Movement and development societies in ecologically sensitive zones also contribute to river health preservation. These organizations bridge the gap between policy, science and public participation.

2.2.3. Health Sector

The private health sector plays a crucial role in river conservation and management, advocating for clean water sources, safe disposal of biomedical waste and support for water purification initiatives. Some of the private health institutions collaborate with NGOs and local bodies to monitor water quality and push for stronger pollution control regulations. By emphasizing the

health risks associated with contaminated rivers, the private health sector drives public and Governmental attention toward sustainable river management and ecosystem restoration.

2.2.4. Private Industrial Clusters

Eloor-Edayar region in Ernakulam District has about 50 large and medium industries, as well as 2500 small-scale industries. High levels of Mercury, Copper, Zinc and Cadmium are reported near the factory discharge points (KSPCB, 2001). Though these industries contribute to economic development, they have also been associated with pollution through the discharge of untreated/partially treated effluents and chemical wastes and over-extraction of water resources. These activities pose serious threats to the riverine ecosystem, aquatic life, and public health. Effective regulation, stricter enforcement of pollution control norms, and adoption of cleaner technologies are essential to mitigate the adverse environmental impacts and ensure sustainable river basin management.

3.0 Key Basin Management Programmes in the Periyar River Basin

The Periyar River is a major source of freshwater for drinking, agriculture, power generation, and industries. The river and its basin have been facing issues related to pollution, groundwater depletion and projected climate change. To address these issues, various organizations, including Central and State Governments, Local Self Government bodies, and NGOs, have undertaken water management projects. This section discusses major programs at both the Central and State levels, examining their objectives, achievements, existing gaps, and mitigation strategies adopted. Central Government initiatives include the Jal Jeevan Mission, AMRUT, Namami Gange, Swachh Bharat Mission, and the National Water Mission, while State-level efforts include Haritha Keralam Mission, and the Jalnidhi.

3.1. Central Government Initiatives

3.1.1. Schemes and Initiatives under the Ministry of Jal Shakti

To ensure sustainable water management, pollution control, and catastrophe resilience, the Ministry of Jal Shakti (MoJS) has launched a number of initiatives. The National River Conservation Plan (NRCP) aims to reduce pollution in rivers, while the Flood Management and Border Areas Programme (FMBAP) concentrates on flood management measures. The National Hydrology Project (NHP) focuses on improving flood forecasts and real-time monitoring, while

the Ground Water Management and Regulation (GWMR) program encourages sustainable groundwater use. The Water Sector Research and Development Program funds advancements in climate adaptation, water conservation, and hydrology. Other important programs include the Pradhan Mantri Krishi Sinchayee Yojana (PMKSY), which aims to increase irrigation efficiency, and the Dam Rehabilitation and Improvement Programme (DRIP), which focusses on dam safety related aspects. The Atal Bhujal Yojana (ATAL JAL) encourages community involvement in sustainable groundwater management, and the development of Water Resources Information System (India-WRIS) enhances data collection and dissemination for well-informed decision-making. This scheme improves the management of surface and groundwater resources in specific water-stressed areas of designated states like Gujarat, Haryana, Karnataka, Madhya Pradesh, Maharashtra, Rajasthan, and Uttar Pradesh. By connecting family taps, the Jal Jeevan Mission (JJM) provides clean and sufficient drinking water, while the Information Education and Communication (IEC) program spreads knowledge about water conservation. The goal of the "Jal Shakti Abhiyan: Catch the Rain" campaign is to promote sustainable water management techniques, including water conservation, and rainwater collection, and awareness building with an emphasis on community involvement and water body regeneration. Collectively, these programs facilitate the management and utilisation of the water resources in the Periyar River Basin in a sustainable manner while promoting environmental equilibrium, and effective resource use by promoting community participation.

A. Department of Drinking Water and Sanitation (DDWS) – Jal Jeevan Mission (JJM)

With the objective of supplying tap water to every rural family by 2024, Prime Minister Narendra Modi inaugurated the Jal Jeevan Mission (JJM) on August 15, 2019. The Jal Jeevan Mission (JJM) is designed to guarantee that every rural household in India has access to Functional Household Tap Connections (FHTC), delivering a dependable, safe and affordable supply of drinking water. The project focuses on areas that are particularly affected by water quality challenges, drought, deserts and Saansad Adarsh Gram Yojana (SAGY) villages. The Saansad Adarsh Gram Yojana (SAGY) is a rural development program launched in 2014 that allows Members of Parliament (MPs) to adopt communities and use local and Governmental initiatives to enhance living conditions in the villages under the scheme. The JJM aims to provide tap water access to educational institutions, Anganwadis, Gram Panchayat offices, healthcare facilities and other public entities. A vital aspect of the mission is community involvement, which encourages local support in forms of monetary contributions, materials, or voluntary labour (shramdaan) to cultivate

a sense of ownership among residents. The initiative also aims to ensure long-term viability of water supply systems by emphasizing source protection, routine upkeep and strategic financial planning. In addition, it promotes skill training in areas such as plumbing, electrical upkeep and water purification, while raising awareness about safe drinking water and hygiene practices.

Outcomes:

- Expanded household access to tap water, resulting in better public health and sanitation.
- Reinforced water supply systems, contributing to better water quality and more efficient distribution.
- Elevated community involvement in managing water resources.
- Increased collaboration among local, State and Central Government entities for water conservation initiatives.

Gaps and challenges:

- Delays in infrastructure construction impede advancement in several fields.
- Continuous supply is impacted by inadequate water sources, particularly in some areas.
- Water availability in rural areas is impacted by seasonal water scarcity.
- Difficulties in maintaining water delivery infrastructure over the long term.
- Reliable water availability is a challenge in mountainous terrain and in areas where available water sources are heavily contaminated.
- In water delivery projects, community involvement and responsibility continue to be obstacles.
- Project execution is impacted by the lack of technical skill of local workers.
- More time and money are required to resolve problems and guarantee long-term tap water connections for every rural home than what was originally envisaged. (The Hindu, 2023; Mathrubhumi, 2024).

Mitigation Measures:

- An important long-term strategy for ensuring future drinking water security is to increase aquifer storage.
- The best way to conserve water and refill aquifers in forested areas is through natural recharge.
- By absorbing and releasing water gradually, forest ecosystems serve as natural reservoirs that lower the risk of flooding.
- A consistent water supply during droughts and late monsoon seasons is ensured by increasing the amount of water available from both shallow and deep aquifers.

- Disaster management requires resilient infrastructure, particularly in regions that are vulnerable to flooding and landslides.
- In mountainous regions, pipeline placement must steer clear of landslide zones and guarantee robust anchoring to avoid flood damage.
- In order to survive earthquakes, cyclones, floods, and other natural calamities, water delivery systems including treatment plants and storage reservoirs should be positioned strategically.

B. Pradhan Mantri Krishi Sinchayee Yojana (PMKSY) – Har Khet Ko Pani (HKKP)

In order to minimize water wastage, PMKSY seeks to increase the cultivable area under guaranteed irrigation, increase on-farm water usage efficiency, and bring irrigation investments together at the field level. It aims to use water-saving technology, such as precision irrigation, under the motto "Per Drop More Crop." The plan also aims to improve aquifer recharge, implement sustainable water conservation techniques, and encourage the watershed-based integrated development of rain-fed regions. Additionally, it seeks to increase private irrigation system investments and promote the repurposing of treated municipal wastewater for peri-urban agriculture

Outcomes:

- More irrigation coverage: Irrigation infrastructure in rural areas is being expanded.
- Using micro-irrigation methods like sprinkler and drip irrigation can increase water use efficiency.
- Implementing effective water management techniques will reduce wastage of water.
- Enhancement of aquifer recharge: Aquifer management and sustainable water conservation.
- Increased crop yield: Higher agricultural production is a result of improved water availability.
- Employment creation: Increased demand for skilled and unskilled labour in irrigation infrastructure development.
- Physical accomplishments (as of 2020–2021): Of the 142 initiatives projected for 2020–2021, 153 schemes were physically completed. By March 2020, 0.84 lakh hectares of the final irrigation potential of 1.32 lakh targeted to be achieved had been reached. Furthermore, 0.15 lakh hectares of irrigation potential were targeted for 2020–2021.

Gaps and Challenges:

- PMKSY implementation is hampered by slow project execution brought on by delays in state-level money disbursement.
- There are still problems with inadequate irrigation infrastructure, such as misaligned canals and low maintenance.
- Farmers' slow adoption of precision irrigation techniques results in water wastage.
- Water scarcity is made worse by excessive groundwater extraction without appropriate recharging techniques.
- Problems with inter-ministerial coordination make it difficult for involved ministries to work together smoothly.
- Due to farmers' ignorance of the advantages of micro-irrigation systems, adoption rates are slow.

Mitigation Measures:

- Enhancing micro-irrigation coverage: Expanding the use of drip and sprinkler irrigation through subsidies
- Strengthening project execution: Ensuring timely fund disbursement and appropriate monitoring.
- Increasing groundwater storage: Implementing aquifer recharge and watershed management programs in practice.
- Technology integration: Using satellite imagery and Internet of Things (IoT) based solutions for real-time water management.
- Policy reforms and incentives: Promoting private investment in precision irrigation systems.

C. National Hydrology Project (NHP)

For efficient water management and planning, the quality, scope, and accessibility of data on water resources must be improved. Governance, policy execution, and inter-agency collaboration are all improved by fortifying water resource management organizations at the State and Central levels. Better decision-making is ensured by creating an extensive hydrologic database that incorporates real-time information on water availability, usage trends, and climatic impacts. This all-encompassing strategy promotes catastrophe resilience, sustainable water management, and data-driven policymaking for long-term resource preservation.

Outcomes:

- Improved water monitoring: Real-time, verified data is provided by new or updated stations.
- Improved Water Resources Information System (WRIS) for several sectors: Better access to information.
- Better ability to manage surface and groundwater effectively is a sign of stronger institutions.
- Improved planning and use of early warning systems can enhance our ability to manage floods and droughts.

Gaps and Challenges:

- Inadequate cross-state integration of surface and groundwater data.
- Hurdles to State and Central Organizations sharing data.
- Financial limitations for long-term viability.
- Insufficiently qualified staff to handle hydrological data.

Mitigation Measures:

- Integrate with weather systems and extend monitoring networks.
- Invest in technologies such as real-time hydrological models, satellite data, and artificial intelligence.
- Boost institutional capability by exchanging expertise and conducting training initiatives.
- Secure long-term funding through Central-State collaboration and Corporate Social Responsibility (CSR) initiatives wherein companies support sustainable water resource management projects aligned with environmental and social goals.

D. Flood Management and Border Areas Programme (FMBAP):

In India, floods are a frequent natural calamity that results in a large number of fatalities, property destruction, and infrastructure interruption. In order to safeguard property, land, and human life from floods, the Flood Management and Border Areas Programme (FMBAP) was launched by the Govt. of India. Through financial support and technical advice, the program seeks to support State Government initiatives for controlling flooding. In addition to non-structural measures like flood forecasting, early warning systems, and hydrological monitoring of rivers, it emphasizes structural measures such as embankments, anti-erosion works, drainage enhancement, as well as anti-sea erosion methods. In order to reduce the effects of flooding, the project also places a high priority on sustainable floodplain management, sediment reduction through catchment area treatment, and the incorporation of contemporary technologies for this purpose. Due to its distinct below-sea-

level farming system and proneness to frequent flood disasters, the Kuttanad is a region in Kerala where flood mitigation initiatives are important.

Outcomes:

- Enhanced flood protection: 427 projects were completed, safeguarding 53.57 million people from erosion and flooding while also benefiting 4.99 million hectares (M ha) of land.
- Financial assistance: To ensure sufficient funding for the States, the Flood Management and Border Areas Programme (FMBAP) allocated Rs. 4,100 crores for flood management between 2021 and 2026.
- Implementing embankments, anti-erosion techniques, and river restoration in susceptible areas - structural mitigation.
- Flood control initiatives: Under the FMBAP, the State Government has put forth ten new flood control projects for Kuttanad; however, detailed project reports (DPRs) are still being prepared.

Gaps and challenges:

- Low implementation & fund disbursement: Efforts to mitigate flooding are hampered by delays in project execution and fund distribution.
- Deficient infrastructure & poor maintenance: A large number of drainage systems and embankments are either unable to withstand severe flood events or are not properly maintained.
- Impact of projected climate change: Flood hazards are made worse by rising sea levels, erratic monsoons, and a rise in the frequency of extreme weather events, especially in coastal regions like Kerala.
- Limited progress on Kuttanad flood mitigation: Places close to the Vembanad backwaters are at risk of flooding. The second Kuttanad package which aims to improve flood management in this area, has not yet been approved.

Mitigation Measures:

- Enhancing the resilience of infrastructure by strengthening drainage networks, floodplains, and embankments particularly in regions like Kuttanad that are vulnerable to flooding
- Incorporating contemporary technology for improved flood management and prediction (IoT-based early warning systems, flood modelling, and satellite-based monitoring)
- Flood severity can be decreased by using sustainable water management practices such as afforestation, wetland conservation, and watershed area remediation

- In low-lying locations, floodplain zoning and risk-based land use planning are essential for reducing risk
- To successfully manage flood hazards and increase flood resilience, policy adjustments and incentives are necessary.

E. Groundwater Management and Regulation (GWMR)

The goal of the Ground Water Management and Regulation (GWMR) Scheme is to guarantee the conservation, sustainable use, and management of groundwater resources throughout India. In order to address problems associated with water scarcity and quality, it focuses on aquifer mapping, groundwater evaluation, monitoring, and control. For efficient groundwater governance, the Scheme aims to upgrade infrastructure, implement contemporary technologies, and encourage participatory management.

Outcomes:

- Aquifer mapping and characterization: Aquifers are mapped in three dimensions at a resolution of 1:50,000, and in susceptible locations, these are further detailed at a scale of 1:10,000.
- Groundwater monitoring and assessment: Piezometers and digital water level recorders are installed, and groundwater levels and quality are regularly monitored.
- Infrastructure development: To improve groundwater data collection, 1,135 wells and 7,000 piezometers are being installed in about 11 States.
- Building the capacity of grassroots workers, Panchayati Raj Institutions (PRIs), and local communities to improve groundwater governance - known as participatory management.
- Sustainable management plans: Development and implementation of aquifer management plans at regional and local levels to optimize groundwater usage.
- Regulation and control: Strengthening the regulation of groundwater extraction in critical and overexploited areas.

Gaps and Challenges:

- Data gaps and limited coverage: Although there has been a lot of progress, more thorough aquifer mapping is still needed in several areas, especially in Kerala and some other States.
- Slow management plan implementation: The efficiency of groundwater conservation initiatives is hampered by delays in the application of aquifer management techniques.
- Inadequate funding and delayed allocations: The timely implementation of important initiatives is adversely impacted by inadequate and delayed financial support.

- Overexploitation and regulatory issues: In many areas, uncontrolled extraction is still occurring, which causes water tables to drop and water quality to deteriorate.
- Limitations in technology and infrastructure: While heli-borne surveys have increased the precision of mapping, it is still difficult to integrate them with groundwater monitoring at the local level.
- Lack of community participation: Local stakeholders are not well-informed about or involved in groundwater management programs.
- Impact of climate change: Groundwater depletion is made worse by variations in rainfall and worsening drought conditions.

Mitigation Measures:

- Extension of aquifer mapping: Providing more thorough mapping to solve groundwater issues unique to a certain region by expanding coverage in susceptible areas like Kerala.
- Stricter groundwater extraction laws should be put into place, and the State and local Governments should enforce adherence to these. This will strengthen the overall regulatory mechanism.
- Adoption of advanced technologies: To improve groundwater assessment, integrate satellite-based monitoring, artificial intelligence, and real-time telemetry systems.
- Community involvement and capacity building: Encourage groundwater management that involves participation by means of awareness campaigns and skill-building projects for PRIs and nearby communities.
- Sustainable water management techniques: To efficiently replenish groundwater levels, adopt afforestation, rainwater collection, and wetland preservation.
- Climate-Resilient Groundwater Management: Develop adaptive solutions to limit the impact of projected climate change on groundwater resources, maintaining long-term sustainability.

F. Dam Rehabilitation and Improvement Project (DRIP)

Enhancing the safety, robustness, and effectiveness of dam infrastructure throughout India is the goal of the DRIP. Enhancing structural and operational safety is a primary goal in order to keep dams resilient and to be able to endure severe weather conditions, facilitating avoidance of failures and catastrophes. Building institutional capacity is also essential for boosting technical proficiency, facilitating real-time monitoring, and strengthening emergency response systems to successfully reduce hazards. In order to ensure increased operational efficiency, the project also

focuses on modernizing dam infrastructure by integrating flood control mechanisms, hydrological assessments, and cutting-edge safety instrumentation. Another crucial element is sustainable water management, which guarantees the availability of water resources for domestic use, irrigation, and power generation, thereby promoting livelihoods and economic stability. In order to ensure long-term sustainability and responsibility in dam management, DRIP also places a strong emphasis on regulatory strengthening through the establishment of standardized safety protocols and supervision of the National Dam Safety Authority (NDSA) under the Dam Safety Act, 2021.

Outcomes:

- More than 220 dams have been restored - including both structural and non-structural upgrades in several States.
- Better flood response: Controlled water discharges result from improved spillway and gate management.
- Advanced monitoring systems: Centralized dam data management through the implementation of DHARMA (Dam Health and Rehabilitation Monitoring Application).
- Capacity building: National and international training initiatives for Engineers and dam safety staff.
- Finance & global cooperation: World Bank, Asian Infrastructure Investment Bank (AIIB), and IBRD financing was obtained for long-term dam safety projects.

Gaps and Challenges:

- Unplanned water outages: Kerala floods (2018 & 2019) were aggravated due to lack of synchronized water discharge from multiple dams
- Weaknesses in the structure and aging infrastructure: Since many Indian dams are more than 50 years old, they urgently need to be rehabilitated and modified to withstand severe weather conditions
- Rainfall variability and climate change: Operation of dams is threatened by increased rainfall unpredictability, which raises the risk of flooding and water shortages
- Limited integration of real-time data: Lack of automated decision-making tools for timely actions and predictive flood modelling.
- Cost overruns and delays in implementation: Rehabilitation efforts are slowed down by lengthy approval procedures and financial shortages.

Mitigation Measures:

- Real-time decision-making and coordinated dam operations across regions are made possible by the implementation of an inter-state water release coordination mechanism.
- Emergency Action Plans (EAPs) should be emphasized in public awareness efforts in order to improve preparedness and lower risks during catastrophic disasters.
- In order to enhance infrastructure, high-risk dams should emphasize seepage management, spillway repair, and structural upgrading.
- Dam health assessments are improved by using technologies such as AI-driven predictive analytics in DHARMA.
- The efficacy of water management is increased when dam operations integrate real-time hydrological forecasting models.
- Investigating hydrological changes brought about by projected climate change and creating plans for climate adaptation should be part of climate-resilient dam management.
- Improving the National Dam Safety Authority (NDSA), guaranteeing compliance with the Dam Safety Act of 2021, and fortifying regulatory changes and governance all contribute to better policy implementation and enforcement.
- Partnerships between the public and commercial sectors can quicken dam restoration projects, guaranteeing prompt upgrades and increased dam safety all over the country.

G. National River Conservation Plan (NRCP)

The NRCP is designed to minimize pollution levels in important rivers by executing measures to mitigate pollution, which in turn enhances water quality. It offers both financial aid and technical assistance to the State Governments for projects aimed at river conservation, with the exception of the Ganga basin, which is addressed through the Namami Gange initiative. The primary areas of focus include the interception and diversion of sewage, the establishment of sewage treatment plants (STPs), affordable sanitation solutions, and initiatives for increasing public awareness.

Outcomes:

- Enhanced water quality: Monitoring reports indicate that Biochemical Oxygen Demand (BOD) levels have shown improvement at various locations when compared to the levels before intervention
- Decrease in pollution load: The establishment of Sewage Treatment Plants (STPs) and sewage systems has reduced the direct release of untreated waste into rivers.
- Project reach: The National River Conservation Plan (NRCP) has addressed polluted segments of 34 rivers across 77 towns in 16 states.

- Sewage treatment capacity: A total treatment capacity of 2677 million liters per day (MLD) has been established.
- Financial commitment: NRCP has covered polluted stretches of 34 rivers across 77 towns in 16 states to date, with a sanctioned cost of ₹5,961.75 crore.

Gaps and Challenges:

- Over time, inadequate sewage treatment system maintenance reduces the efficiency of NRCP programs
- Project delays have been caused by administrative, financial, and logistical difficulties
- Sewage treatment infrastructure development and maintenance are hampered by a lack of sufficient finance
- The sustainability of conservation efforts over the long run is impacted by low community involvement
- Untreated wastewater is released into rivers as a result of enforcement and infrastructure shortcomings

Mitigation Measures:

- Improving aquifer recharge: The passive recharge of aquifers, especially in wooded regions, can aid in the sustainable conservation of water resources over time.
- Durable infrastructure development: Sewage systems and treatment facilities should be established in locations that are not prone to disasters. Pipelines shall be safeguarded against flooding and landslides.
- Adherence to Standards: Following the guidelines set by BIS and CPHEEO guarantees the durability and effectiveness of water treatment and conservation systems.
- Increased community engagement: Local insights should be incorporated into planning efforts and awareness initiatives should be broadened to promote public participation.
- Consistent monitoring and upkeep: Implementing effective monitoring frameworks and providing adequate funding for maintenance can ensure long-term advantages.

H. National Water Mission (NWM)

The NWM, a fundamental project of change, is dedicated to sustainable water resource management through conservation, improving efficiency and equitable distribution. The mission's goals are to increase water-use efficiency by 20%, promote rainwater collection and groundwater recharge, develop legislative frameworks for sustainable use, support wastewater recycling and desalination and strengthen storage capacity while rehabilitating water bodies. These measures aim to address climate-induced water unpredictability and assure long-term water security.

Outcomes:

- Improved access to water and infrastructure
- Jal Jeevan Mission (JJM) increased tap water availability to 77.87% of rural households by August 2024
- More than 2,163 water quality testing labs were established
- Jal Shakti Abhiyan (JSA) initiatives have facilitated 1.2 crore water-related projects in water-stressed districts
- Enhanced groundwater management and rainwater harvesting
- Promotion of artificial recharge structures, borewell construction and adoption of local water saving measures
- Groundwater monitoring has been expanded, as have District Water Conservation Plans in 527 districts
- Technological and policy advancements
- The Bureau of Water Use Efficiency (BWUE) collaborated with the Indian Plumbing Association to promote domestic water efficiency
- Innovative problems for low-cost water filtration technology and portable water testing devices
- Create digital channels to raise public awareness and track progress

Gaps and Challenges:

- Disparities in state-level resources such as funding, technical expertise and implementation strategies such as how effectively the state carries out the program can lead to uneven progress in water conservation initiatives. This means that while the mission's objectives are national, their application and impact can vary significantly from state to state.
- Particularly in semi-arid and agricultural regions, pollution and groundwater depletion are serious issues
- Despite campaigns to raise awareness, there is little popular support for water conservation measures
- Water shortages are made worse by the impacts of projected climate change, such as unpredictable rainfall patterns

Mitigation Measures:

- Strengthening local water governance: Create District Rainwater Harvesting Cells to provide technical assistance and capacity building
- Expanding wastewater recycling and desalination: Adopt urban wastewater reuse solutions and promote low-cost desalination technology

- Enhancing public participation: Expand awareness campaigns such as "Catch the Rain," tying them to educational curricula and community rewards
- Integrating AI and data analytics for water management: Enhance real-time monitoring and forecasting of water levels and use trends
- Increased financial allocations: Improve collaboration between the Central and State Governments to expedite water infrastructure projects.

3.1.2 Ministry of Housing and Urban Affairs (MoHUA)

A. Atal Mission for Rejuvenation and Urban Transformation (AMRUT)

AMRUT is a centrally sponsored program run by the Ministry of Housing and Urban Development of the Govt. of India (GoI). The mission was started on June 25, 2015. The fundamental goal of AMRUT is to improve urban infrastructure by providing access to clean water, sewage treatment and non-motorized transportation. The mission aims to ensure universal access to water supply and sanitation, reduce non-revenue water losses and implement green and sustainable solutions. It also focusses on improving urban water governance through digital monitoring and fostering public-private partnerships (PPPs) in urban development (The Hindu, 2024). In Kerala, the Kerala Water Authority (KWA) is entrusted with executing water supply and sewerage projects for nine cities under the AMRUT.

Outcomes:

- Improvements to piped water supply and sewage treatment facilities in selected cities
- Increased sewer network coverage, which reduces pollutants and health risks
- Construction of urban mobility infrastructure, such as pedestrian paths and cycling lanes
- Digitalization and GIS mapping of urban services to improve governance
- Capacity building and skill development for urban local bodies (ULBs) to ensure effective project execution

Gaps and Challenges:

- Funding constraints: Many urban local Governments experience budgetary constraints, which impede project execution and upkeep
- Implementation delays: Bureaucratic roadblocks and delays in project approvals impede the timely execution of initiatives
- Technical constraints: A scarcity of competent professionals for modern water management and urban infrastructure projects
- Inequality in coverage: Smaller towns and cities have not profited as much as major urban areas, resulting in unequal growth

- Climate resilience concerns: Existing projects do not necessarily include climate adaptation and disaster resilience strategies
- Public awareness and participation: Lack of awareness of the residents and restricted public engagement impedes long-term project execution

Mitigation Measures:

- Strengthening financial assistance by increasing Federal and State Government funding, and encouraging public-private partnerships to support project execution
- Reducing bureaucratic delays, improving openness in monitoring, and establishing stricter timelines are always to manage projects effectively
- Initiatives aimed at increasing capacity should be put in place to provide urban local Governments with managerial and technical training for improved infrastructure management
- For equitable resource distribution to support balanced urban development across regions, smaller cities should be given priority
- Utilizing climate resilience techniques such as flood-resistant planning, rainwater collection, and green infrastructure to reduce environmental risks
- Increasing public involvement in urban planning and management for long-term sustainability by raising awareness and encouraging citizen participation.

3.2. State Government Initiatives

To address issues in the Periyar River Basin, the Kerala Government has launched a number of socio-environmental projects through various Departments and Agencies. These programs concentrate on many relevant themes - climate resilience, waste management, water conservation, infrastructure development, pollution control, and disaster management to name a few. To reduce the release of hazardous wastes, the Kerala State Pollution Control Board (KSPCB) keeps a close eye on industrial pollution in the Periyar River, especially in the Eloor-Edayar industrial zone. To improve flood preparedness and climate resilience, the Kerala State Disaster Management Authority (KSDMA) created the Orange Book of Disaster Management and the State Disaster Management Plan (SDMP). Infrastructure initiatives such as the Idukki Hydroelectric Project, run by the Kerala State Electricity Board Limited (KSEBL), uses water from the Periyar River to generate hydroelectric power, and the Periyar Valley Irrigation Project, overseen by the Kerala Irrigation Department, provides irrigation water to 32,800 hectares of farmland. Creation of a Periyar River Basin Authority has been suggested by the Union Ministry of Jal Shakti for sustainable management of water resources in the river basin. The Irrigation Design and Research

Board (IDRB) oversees the Dam Rehabilitation and Improvement Project (DRIP) of dams owned by the Department Irrigation/ Water Resources whereas the KSEBL does this for dams owned by it. The Local Self Government Department's Haritha Keralam Mission (HKM) supports afforestation, water conservation, and sustainable waste management in order to maintain a sustainable environment. In addition, the Swachh Bharat Mission (SBM) guarantees better sanitation and hygiene in Kerala's rural and urban areas. LSGD's Suchitwa Mission is a technical assistance organization that supports decentralized sanitation and waste management initiatives. Additionally, the State has established Jala Samithis (Water Committees) at various administrative levels to oversee and control the management of water resources as part of its "*The lineerozhukum Nava Keralam*" initiative to prevent water pollution. The India Eco-Development Project (IEDP) in the Periyar Tiger Reserve, which combines biodiversity protection with sustainable livelihoods, is one of the climate action plans and eco-development initiatives of the Department of Environment and Climate Change. The Periyar Valley Eco-Restoration Tourism Development Project was started by the Greater Cochin Development Authority (GCDA) to revitalize the Periyar River while encouraging ecotourism and conservation. Various environmental authorities developed the Periyar River Action Plan, which calls for habitat restoration, water quality monitoring, and afforestation as ways to reduce pollution.

3.2.1 Pollution Control and Environmental Monitoring - KSPCB

The Kerala State Pollution Control Board serves as the legal entity responsible for devising, overseeing and executing plans aimed at preventing and managing pollution within the State. This Board has the legal mandate to enforce the legislation and regulations related to water and air (Prevention and Control of Pollution), as well as the Environment (Protection) Act and associated rules. The ultimate goal of the pollution control initiatives is to protect and restore the quality of natural resources. Therefore, developing and putting into practice efficient pollution control management techniques requires an understanding of the ambient quality of these resources. The Board runs a network to keep an eye on the ambient quality of water resources in the State. The Board oversees two primary projects for monitoring ambient water quality:

- **National Water Quality Monitoring Programme (NWQMP):** This CPCB-sponsored initiative monitors 110 stations across ponds, lakes, rivers, and groundwater sites, with KSPCB overseeing its implementation in Kerala
- **State Water Quality Monitoring Programme (SWQMP):** The scheme covers 114 river monitoring stations that are independently monitored by the Kerala State Pollution Control Board

3.2.2. Initiatives by Local Self Government Department (LSGD)

A. Haritha Keralam Mission

The Haritha Keralam Mission, launched on December 8, 2016, focuses on water conservation, sanitation, waste management, and sustainable agriculture, with local self-governments leading implementation and various departments coordinated under its motto: Water, Hygiene, and Harvest. It aims to rehabilitate watercourses in the Western Ghats, reduce landslides and floods and ensure long-term water supplies by scientific mapping and reclamation. The Mission combines Government resources, local self-government authorities, non-Governmental organizations (NGOs) and the community in various activities. A three-tier strategy coordinates planning, resource integration and execution with technical assistance. Watershed management, afforestation, responsible tourism and sustainable agriculture are examples of key programs that aim to improve ecological balance and prevent environmental damage.

Outcomes:

- Watercourse networks totalling 46,531.63 kms have been restored throughout 230 Grama Panchayats in nine districts of Kerala
- Increased groundwater recharge and decreased surface runoff lessen the risk of landslides and flooding
- Improved water quality by scientific monitoring and waste management
- The estimated 50 lakh inhabitants of the Western Ghats benefit from long-term livelihood protection
- Better biodiversity conservation, reforestation and ecotourism development

Gaps and Challenges:

- Water stagnation, increased flooding, and landslides caused by encroachment, deforestation, and improper land use practices that disrupt natural streams
- Insufficient local knowledge of the role watercourse networks play in preventing disasters, thereby exacerbating environmental deterioration
- Insufficient finance and inadequate infrastructure impede extensive watercourse restoration initiatives, which necessitate monetary commitment, skilled labour, and technological advancements
- Restored watercourses are harmed by climate variability, which causes extreme weather events like floods, landslides, and heavy rains

- Delays and inefficiencies result from coordination issues between Government Departments, local self-governing organizations, and non-Governmental organizations; hence, restoration calls for a more organized and cooperative approach
- Project delays result from a lack of funds and resources, with bureaucratic obstacles impeding project completion.

Mitigation Measures:

Time-Bound Campaigns

- Inspired by *Ini Njanozhukatte* ("Let Me Flow Now"), the project focuses on restoring and rejuvenating water bodies
- Canals and streams are being revitalized by increasing flow, enhancing water-holding capacity and restoring network connectivity
- Kerala's stream networks are being mapped as part of the Haritha Keralam Mission's Mapathon program to aid watershed-based initiatives. Over 150 watercourses in Idukki have been mapped, and work is still ongoing in other localities
- Restoration of low-level channels in landslide-prone locations should be prioritized in order to improve water flow and reduce dangers

Major Environmental Initiatives of Haritha Keralam Mission

- Green islands and oxygen parlours (2024): By 2024, the Haritha Keralam Mission hopes to transform 1,000 garbage dumps into "Live Oxygen Parlours," which are verdant areas with a lot of vegetation that would enhance biodiversity and air quality.
- The Pachathuruth (Green Islet) project: 1,200 tree saplings were planted in Kochi. Green places were created in Lisie Hospital, Kaloor, Mundamveli and Pullepady. Greening projects such as the "*Pachathuruthu*" promote afforestation and ecological restoration (The Hindu.2024; The New Indian Express, 2024).

B. Swachh Bharat Mission

The Government of India launched the Swachh Bharat Mission (SBM) in 2014 with the goal of promoting hygiene, sanitation, and cleanliness throughout the country. SBM (Urban) for waste management and urban cleanliness, and SBM (Gramin) for rural sanitation, make up the mission. In Kerala, the Suchitwa Mission plays a vital role in the implementation of SBM as the Technical Support Group (TSG) for waste management under the Local Self Government Department (LSGD). The "*Thelineerozhukum Nava Keralam*" program was also started by the State to combat water pollution and guarantee sustainable management of water resources. The movement encourages policy changes and community involvement to lessen the worsening water shortage.

Outcome:

- Enhanced waste management and sanitation in Kerala as a result of the Haritha Keralam Mission, Suchitwa Mission, and Swachh Bharat Mission
- Reduced pollution of the environment as a result of the removal of non-biodegradable waste from homes and the implementation of scientific waste management systems
- The creation of "Jala Samithi" (Water Committees) at different administrative levels for the coordinated conservation of water bodies
- Enhanced monitoring of water quality using the 'Thelineer' Portal, created by the Suchitwa Mission, which enables authorities to map the sites of water tests, track down the sources of contamination, and provide Engineers and local entities access to real-time data

Gaps and challenges:

- Participation from the community and changes in rubbish disposal and cleanliness practices continue to be significant obstacles
- For scientific waste management systems to manage the growing waste volume, continuous monitoring and enhancements are required
- Sources of wastewater from homes and businesses must be identified and controlled, and pollution control laws must be strictly enforced
- Gap in the implementation of technological solutions since data-driven insights from the "Thelineer" portal must be converted into practical strategies on the ground

Mitigation Measures:

- Encourage eco-friendly garbage management techniques and run awareness initiatives to increase community involvement
- To effectively handle growing waste quantities, waste treatment facilities should be regularly inspected and upgraded
- Enforce stricter laws and more severe penalties for infractions pertaining to trash disposal and water contamination
- To improve real-time monitoring and decision-making, increase collaboration between scientific associations, local Government organizations, and technological platforms such as the 'Thelineer' Portal
- Create targeted solutions for sustainable water and sanitation management by integrating data analytics and AI-driven insights into policymaking.

3.2.3. Kerala Rural Water Supply and Sanitation Agency (KRWSA) - Jalnidhi

The major goal of the Jalnidhi project is to ensure that every home in Kerala has access to safe and sustainable water supply and sanitation facilities through community-driven and technology-supported efforts. The project also prioritizes water security, groundwater recharge and rainwater collection while fostering long-term operation and maintenance.

Outcomes:

- Water supply and sanitation: 5884 piped water systems, 4.52 lakh house connections and 227 Grama Panchayats served, helping 22.26 lakh people. There are 2.28 lakh sanitation structures developed
- Rainwater Harvesting (RWH) was implemented in 93 Grama Panchayats, with 21,183 RWH connections benefiting 1.05 lakh people, 9030 RWH structures (10,000L capacity), 2133 open well recharge structures, 891 rooftop RWH units and 1493 open well recharge systems funded
- Institutional and policy impact: Following the Cochin Declaration (1999), KRWSA serves as a Water and Sanitation Support Organization (WSSO) under the JJM, with the State Government acting as a facilitator. NGOs encourage community participation in sustainable water management
- Social and economic impacts: The project ensures inclusive access for marginalized households, strengthens Gram Panchayat governance, and enhances community awareness.

Gaps and challenges:

- Natural disasters (floods) and problems with environmental clearance cause delays in projects
- Despite better infrastructure, sustaining a 24-hour water supply is challenging
- There has been little development in smart water network management to lower leak-related non-revenue water (NRW) losses
- The sustainability of rainwater harvesting (RWH) systems is impacted by environmental issues such as groundwater depletion and rainfall variability brought about by climate change

Mitigation Measures:

- Accelerate the construction of the Jalnidhi Phase-II projects that have been postponed
- Examine alternative water sources such as desalination and the repurposing of processed wastewater
- Install smart water grids to distribute water more effectively

- In order to empower communities, expand capacity-building initiatives
- Provide monetary rewards for collecting rainwater
- Create Public-Private Partnerships (PPPs) to increase the effectiveness of services
- Encourage climate resilience by using unconventional energy sources, such as water pumps that run on solar power
- Boost water literacy programs to improve understanding in the community
- Planning for water resources should be integrated with disaster management techniques

3.3. NGO/ Local Community Initiatives

Addressing socio-environmental issues requires the participation of a wide range of input and stakeholders - early warning systems, big NGOs, and community projects. While NGOs offer advocacy and expertise, community initiatives combine old and modern methods. Newspapers increase awareness and guarantee accountability, while early warning systems utilize technology to forecast dangers. When combined, they improve resilience and environmental governance.

3.3.1. Community-driven flood forecasting and early warning systems

The Community-Sourced Impact-Based Flood Forecast and Early Warning System (CoS-it-FloWS), which was launched on 28th September, 2024, is a decentralized, community-driven program to improve flood preparedness in Kerala's Periyar and Chalakudy river basins. Equinot, an Indian startup dedicated to community-sourced flood detection and early warning systems, aims to provide science-based solutions and support to communities and decision makers in addressing the multiple challenges of climate change. It combines local participation, real-time data collection and technology-driven alerts to increase flood forecasting accuracy. CoS-it-FloWS empowers communities to monitor floods, facilitates early evacuation and improves coordination among panchayats, civil authorities and vulnerable populations.

Outcomes:

- Community participation - installation and maintenance of 100 rain gauges by local citizens, as well as real-time flood data reporting via the "Gather" smartphone app.
- Data is shown on an interactive dashboard; real-time alerts are disseminated through WhatsApp groups; predictive modelling focuses on impact-based flood forecasting.
- Disaster Preparedness and Response: Data is accessible to the Ernakulam District EOC for disaster planning; participatory training raises community awareness; and enhanced coordination ensures timely evacuation and response.

Gaps and challenges:

- Limited coverage: Currently only operates in specific portions of the Periyar and Chalakudy river basins, leaving other flood-prone areas unmonitored.
- Community participation: Long-term engagement is questionable; relying on volunteers may compromise data consistency.
- Data accuracy and integration: Although community input has improved data accuracy, reliability could be further increased by combining official forecasts, hydrological models, and satellite data.
- Funding & support: Reliant on external funding; long-term sustainability necessitates institutional support and better engagement with disaster management authorities.

Mitigation Measures:

- Scaling up and expansion: Install more raingauges connected to weather stations and transmit the data online to enable better and timely prediction of floods.
- Community engagement: To guarantee active participation, provide awareness campaigns, incentives, and training.
- Technology integration: To increase accuracy and create multilingual alarm systems, use satellite data, AI models, and real-time weather forecasts.
- Sustainability: Collaborate with disaster management agencies on policy integration; seek long-term funding through Government programs and CSR activities (Mongabay, India, 2024; Down to Earth, 2024; The Hindu, 2024).

3.3.2. The Nammal Namukkayi campaign

The *Nammal Namukkayi* program, a key effort of the Rebuild Kerala Initiative, aims to improve community-driven disaster management and resilience following the 2018 and 2019 floods. It enables LSG bodies to create localized DMPs, which incorporate risk-informed planning into local policy. By harnessing community knowledge, participatory decision-making and inter-agency collaboration, the effort promotes proactive catastrophe preparedness while also strengthening institutional processes to boost climate resilience.

Outcomes:

- Community participation and risk-informed planning: Local communities identified susceptible locations and created disaster preparedness plans. Data on prior catastrophes and dangers were gathered from 100 wards in Thiruvananthapuram and extrapolated to other districts. A Local Resource Group (LRG) comprising 70 professionals was established to advise planning.

- Strengthening local governance: With assistance from KILA and KSDMA under RKI financing, all Local Self Governments (LSGs) developed Disaster Management Plans (DMPs) and included them into annual development strategies.
- Institutional Capacity and Training: Training programs and capacity-building efforts were implemented for local officials. District Planning Offices were provided with specialized workers and multi-stakeholder consultations included learning from previous disasters.
- Local Governments received geographical layers to help them assess risks more effectively. Community consultations meant that scientific data was integrated with local knowledge to allow for informed decision-making.

Gaps and Challenges:

- Delays in execution: Some LSGs faced difficulties in implementing disaster plans within the given timeframe.
- Limited integration: Risk mitigation techniques were not in line with urban development plans.
- Monitoring gaps: Some places lacked real-time flood monitoring and early warnings.
- Community challenges: Participation was not uniform, with awareness gaps and little involvement from the commercial sector and non-Governmental organizations.
- Financial and capacity constraints: Long-term funding is uncertain.

Mitigation Measures:

- Strengthening disaster management: Update Disaster Management Plans on a regular basis, include them into development plans and use IoT and GIS to improve real-time flood monitoring.
- Improving community engagement: Improve training, implement local incentives, and strengthen collaboration with NGOs, colleges and private companies.
- Ensure financial sustainability: Secure long-term finance, promote PPP and CSR investments and set up specific disaster management cells in LSGs.

3.3.3. Kerala Warnings Crisis and Hazard Management System (KaWaCHaM)

The KaWaCHaM, created by the KSDMA, is an integrated disaster warning system designed to improve public safety and preparedness. It sends out real-time notification for floods, landslides, cyclones, extreme weather events, and pandemics via a network of siren-strobe light units and Emergency Operations Centres. The system improves disaster response through superior data integration and digital communication features. It also promotes community engagement by using

trained volunteers, social media alerts, and mobile-based warnings to enable timely and effective disaster response.

Outcomes:

- Early warnings are issued quickly and accurately via sirens, cell phone notifications, and social media dissemination.
- Enhanced emergency response by connecting 93 Emergency Operation Centres to central control rooms via VPN.
- Increased public awareness and education on catastrophe preparedness and safety measures.
- Effective coordination among Government Departments and Agencies, disaster response teams (NDRF, fire department, police) and local panchayats.
- Integration of surveillance technologies, such as real-time monitoring through cameras linked to control rooms.
- Shelter ready, with 20,000 verified shelters capable of housing 400,000 people during evacuation.

Gaps and Challenges:

- Incomplete installation: Although 126 sirens are planned, only 91 have been deployed so far, delaying full implementation.
- Public awareness and reaction training: The public should be educated on how to understand siren warnings and respond appropriately.
- Technical dependability: Ensuring that sirens and alarm systems operate without fail during extreme conditions such as power outages and network disruptions.
- Mobile alerts have a limited reach because not all regions have mobile network connectivity, which affects alert dissemination.
- Coordination complexity: Effective communication among multiple Government agencies, local bodies and reaction teams remains a difficulty.

Mitigation Measures:

- All 126 locations will have sirens installed by the KaWaCHaM system, which will undergo routine maintenance and reliability testing.
- Public awareness program that uses the media, LSG bodies, and schools to teach emergency response to communities.
- A backup alert system that uses community-level loudspeakers and FM radio announcements in remote areas.

- For places with poor network connectivity, satellite-based emergency alerts will be created
- To guarantee efficient crisis management, emergency responders, neighbourhood volunteers, and community organizations should get regular training and exercises.
- In accordance with the CWC recommendations, KSEBL has established rule curves for important reservoirs to control water levels throughout the monsoon season.
- Despite Kerala's natural drainage system, the 2018 floods damaged powerhouses and inflicted losses amounting to about ₹150 crore, underscoring the State's vulnerability.
- To guarantee downstream safety, an Emergency Action Plan (EAP) with a three-tiered alert system (Blue, Orange, and Red) was developed for 17 dams.
- Although EAP facilitates evacuation, it is not a flood control system.

4.0 Identifying Key Stakeholders

The Periyar River Basin is important for its ecological and economic resources, and supports a large community of humans, flora, fauna and economic activities. Various groups of people and organisations are directly connected to the river, each having an important role in the usage of water and allied resources and in its sustenance. Households near the riverbanks use it for meeting their domestic water needs. Farmers depend on it for irrigation, fishermen engage in fishing, and a section of the people engage in sand mining. Local firms and industries, including many manufacturing units and quarries also utilize the river for processing, material extraction and waste disposal. Sand mining, a significant economic activity in the river basin, affects river morphology, water flow and aquatic ecosystems, creating conflicts between economic benefits and environmental sustainability. Identifying and understanding the needs, impacts and responsibilities of various stakeholders is crucial for ensuring a balanced approach to river management and socio-environmental well-being.

4.1 Number of Households in the Periyar River Basin

Understanding the social environment of the Periyar River Basin involves examining the distribution of the population, with particular focus on the number of households that have a direct stake in the river. This section provides an overview of household data across the Grama Panchayats located within the three districts that make up the river basin.

Among the districts, Ernakulam accounts for the highest number of households within the basin, totalling 291,106, followed by Idukki with 189,937 households, and Thrissur with 144,594

households. Detailed household figures for the river basin across these districts are provided in Annexure 5.

4.2 Industries in the Periyar River Basin

Understanding the industrial presence in the Periyar River Basin is essential to assess its social and environmental impact. Industries, ranging from large-scale chemical and metal-processing plants to small enterprises, heavily depend on the river for water, transport, and waste disposal. The industrial hubs of Eloor and Edayar contribute to economic growth but also raise concerns about pollution from effluents and solid waste discharged into the river, affecting aquatic life and local communities. While industries provide jobs, they often conflict with traditional livelihoods like farming and fishing due to water contamination and resource depletion. Ensuring sustainable industrial practices, including proper waste management and community involvement, is key to balancing economic benefits with environmental conservation. The total number of industries in the Periyar River Basin, categorized district wise and the type of industry, is listed in Annexures 3.

4.3 Quarries in the Periyar River Basin

Quarrying is the process of extracting rocks, sand, gravel, or minerals from the earth for construction or industrial use. It contributes to economic growth and infrastructure development. However, due to dust and noise, rock quarrying poses air pollution, noise pollution, land degradation and deforestation. Unregulated quarrying causes biodiversity loss, changes in river flow patterns, landslides, and soil erosion. Communities living near quarry sites face many health hazards and displacement; it also affects farmers and their agriculture. Therefore, balancing quarrying activities with environmental practices is crucial for the health of the Periyar River Basin. There are a total of 50 quarries in the Periyar River Basin, all of which are granite quarries. Of these, 44 (88%) are located in Ernakulam District. 3 quarries each within the river basin are located in Thrissur and Idukki Districts (The Kerala Online Mining Permit Awarding Services (KOMPAS), Department of Mining and Geology, 2025). A list of quarries in the Periyar River basin, categorized district wise, is provided in Annexure 4.

4.4 Sand Mining

River sand is one of the most essential natural resources. It is critical for the survival of rivers, stability of riverine ecosystems, groundwater recharge etc. It has many uses – in the construction industry, manufacture of glass, sand paper, filtration systems etc. Sand is formed by mechanical forces that cause rocks to weather, and is made up of minute split rocks and mineral particles of size ranging from 150 microns to 4.75 mm (IS 383-1970). Weathered rock first turns into gravel and then sand. In Kerala, the demand for sand and gravel has grown quickly over the past ten years. Due to the shortage of natural river sand and sand from ancient riverbeds (palaeo-channels), the construction industry has started using manufactured sand (M-sand), which is made by crushing hard rocks. Using alternatives like M-sand and other artificial materials, along with eco-friendly construction methods, can help reduce the harmful impact of sand mining on the environment (District Survey Report, Revenue Department Govt. of Kerala, 2023).

4.4.1 Protection of Public and Private Infrastructure

Sand mining can pose serious risks to nearby public and private infrastructure if not properly regulated. Mining is not allowed close to sensitive areas like forests, protected zones, bridges, buildings, and residential areas. Before approving any mining lease, the Mining Department must check if there are any permanent structures like power lines, bridges, or monuments near the proposed site. According to the 2020 guidelines by the Ministry of Environment (MoEF&CC), mining is strictly restricted within certain distances: 250 meters upstream and 500 meters downstream of bridges, 200 meters from water supply or irrigation systems, 100 meters from National Highways side and railway lines, 50 meters from reservoirs, canals, or similar structures, 25 meters from State Highway's side, and 10 meters from margin of other roads (Enforcement & Monitoring Guidelines for Sand Mining, Ministry of Environment, Forest and Climate Change (MoEF&CC), 2020).

Table 15 List of Sand Mining sites in Ernakulam District within the Periyar River Basin

(Source: District Survey Report for Sand Mining and River-Bed Mining, Ernakulam District, Revenue Department, Govt. of Kerala)

Site No.	Area in ha	Total sediment available (m ³)	Mineable sand available (m ³)	Mineable sand (Tonnes)	Transportation route/Nearest access road
Periyar Stretch					
S1	2.2984	23180	13120	19,680	i) Towards Inchathotty Neriamangalam Road ii. Oonnukal-Acalichal-Neriamangalam Road
S2	3.2159	22930	4430	6,645	Towards Krariyely Kochupurackal Kadavu Road
S3	1.3056	2660	750	1,125	i) Towards Nedumbassery – Kodaikanal Road ii) Towards Vallom Panamkuzhy Road
S4	3.0896	17440	6220	9,330	Towards Kannampuzha Road
S5	2.6924	5650	560	840	i) Perumattom Road ii) Towards Kanjoor-Parappuram Road
Total	12.6019	71860	25080	37,620	
* The area of sand mining sites was calculated based on the cross-section field survey and shape files created using Google Earth and GIS in the month of Dec 2022, which gives an estimation of sand-bearing sites. However, there may be a slight shift in the sand-bearing sites during the preparation of the mine plan as the change in groundwater level is a dynamic phenomenon which delineates the exact boundary coordinates and changes in the area.					

The total number of sand mining sites in the Periyar river stretch in Ernakulam district is five and the total sand availability is 71,860 m³ in a total area of 12.6019 ha. The Panchayat-wise distribution of sand mining sites is presented in Table 16.

Table 16 Panchayat-wise Distribution of Sand Mining Sites

(Source: District Survey Report for Sand Mining and River-Bed Mining, Ernakulam District, Revenue Department, Govt. of Kerala)

Sl. No.	Sand Mining Sites	Panchayat	Approximate area (ha)
1.	S1	Kuttampuzha-Kavalangad	2.2984
2.	S2	Vengoor	3.2159
3.	S3*	Malayattoor-Neeleswaram	1.3056
4.	S4	Malayattoor-Neeleswaram	3.0896
5.	S5**	Ockal	2.6924
S3* includes both Panchayats of Kuttampuzha and Kavalangad			
S5** includes both Panchayats of Malayattoor-Neeleswaram and Koovappady			

Table 17 Mining Leases

(Source: District Survey Report for Sand Mining and River-Bed Mining, Ernakulam District, Revenue Department, Govt. of Kerala)

Lease Details	Area (ha)	Mining Leases within 500 metres	Total Excavation in Tonnes	Mineral to be Mined	Existing/ Proposed
S1	2.2	No	19680	Sand	Proposed
S2	3.22	No	6,645	Sand	Proposed
S3	1.31	No	1,125	Sand	Proposed
S4	3.09	No	9,330	Sand	Proposed
S5	2.69	No	840	Sand	Proposed



Figure 1. Representative Picture of Instream Mining

(Source: District Survey Report for Sand Mining and River-Bed Mining, Ernakulam District, Revenue Department, Govt. of Kerala)



Figure 2. Representative Picture of Manual and Mechanical Mining

(Source: District Survey Report for Sand Mining and River-Bed Mining, Ernakulam District, Revenue Department, Govt. of Kerala)

4.5. Agricultural Significance of the Periyar River in Kerala

The Periyar Basin, which spans the districts of Idukki, Ernakulam and Thrissur, plays an important role in Kerala's agricultural environment. Kerala's agricultural sector depends heavily on the Periyar River Basin. Periyar supports the production of a wide variety of crops. Along with tapioca, coconut, arecanut and tamarind, the region's main cash crops are rubber, coffee, and cardamom. The region is renowned for producing a wide variety of spices including clove, nutmeg, ginger, turmeric, and pepper. The area also produces a wide range of fruits, including cashew, pineapple, and mango. While a variety of vegetables, such as elephant foot yam, brinjal, chillies, cabbage, and tomato, add to the region's agricultural diversity, staple food crops like rice and bananas are also commonly grown (Agricultural Statistics, 2023).

In 2021-22, Idukki had a net cultivated area of 256,149.29 ha. It was the major cardamom producer, accounting for approximately 90% of Kerala's total output. The district also makes a substantial contribution to the production of coffee (41.91% of the area under coffee in the State), pepper (13.91% of the area under pepper cultivation), and rubber (16.91% of the area under rubber). However, paddy farming remains limited, accounting for only 488.29 ha or 0.25% of the total area under paddy cultivation in Kerala. Ernakulam district is an important agricultural hub, with main crops such as paddy (4,723.13 ha, 2.41% of the State's paddy area), tapioca (13,305.91 ha, 13.91% of the State's tapioca area), coconut (10.87% of the State's coconut area) and banana (5.91% of the State's banana area). Besides the above, a large area is dedicated to the cultivation of vegetables and horticulture products. In 2021-22, Thrissur District had a net cultivated area of 167,135.33 ha. It plays a significant role in paddy farming, with 23,658.66 ha under paddy cultivation, accounting for 12.09% of Kerala's total paddy area. As of 2021–22, the district also had substantial areas under the cultivation of coconut (10.87% of the state's coconut area), arecanut (13.91%), and banana (5.91%). The district also produces a vegetables, spices, and other horticultural crops (Economics and Statistics Department Kerala, 2023).

5.0 Enabling/ Constraining Elements to Implementation of Policies and Programmes in the Periyar River Basin

Numerous legislations, research projects and Governmental interventions have focused on the preservation and management of the Periyar River. The execution of these conservation initiatives was influenced by a number of enabling and restricting factors. River management has benefited

greatly from community involvement, legal frameworks such as the Environment Protection Act (1986) and real-time water quality monitoring (Government of Kerala, 2022). However, obstacles including institutional flaws, political-industrial forces and data gaps impede advancement (Room for River Project, nd). Strict environmental enforcement has been the outcome of legal actions, such as PILs against industrial pollution, and orders from the Kerala High Court and National Green Tribunal. These have strengthened pollution control measures (Verdictum, March 2025; The New Indian Express, 2024). The ecological health of the river is still under danger despite these efforts because of problems like uncontrolled sand mining, clandestine disposal of untreated/partially treated sewage, poor waste management and floods. A major step toward integrated conservation, the recent addition of Periyar to the NRCP, reflects the necessity of concerted efforts by local communities, environmental organizations and Government authorities to protect the river.

5.1. Enabling elements

- Real time water quality monitoring: On the Periyar River, specifically along the industrial corridor, the KSPCB has set up RTWQMS (Government of Kerala, 2022).
- Litigation and Public Interest Litigation: Environmental activists and Non-Governmental Organizations have successfully employed PILs to address problems such pollution in the Periyar River
- Surveillance cameras for pollution control: Nine surveillance cameras have been installed by the State along the banks of the Periyar River to keep an eye on illicit garbage/ solid waste disposal and industrial waste disposal.
- Knowledge and awareness: Digital media projects, environmental education programs such as afforestation & buffer zone creation and public awareness campaigns by Local Self-Government bodies for preventing pollution help people understand the dangers and make them abide by rules.
- Policies and legal frameworks: Environmental governance is supported by the enforcement of laws like the Environment (Protection) Act of 1986, Water (Prevention and Control of Pollution) Act of 1974, and other legislation.
- Community involvement: Decentralized environmental management is ensured through the participation of Local Self-Government bodies and the strengthening of Biodiversity Management Committees (BMC).

- Media and newspaper influence: Public pressure on authorities to act has intensified as a result of newspaper reports exposing pollution events, especially in the Eloor-Edayar region.
- Infrastructure development: Untreated waste discharge into the river has decreased as a result of the installation of sewage treatment facilities (STPs) at strategic locations. Also, creation of buffer zones with plants such Amla and Neem that absorb pollutants has also helped to restore ecosystems (Room for River Project, nd)
- Scientific investigation and information gathering: Evidence-based policy implementation is aided by GIS-based analysis and real-time water and air quality monitoring.
- Stakeholder coordination: Coordination between Departments, Agencies and Local Self-Government bodies has enhanced policy implementation and enforcement.

5.2. Constraining elements

- Data gaps: Incomplete environmental databases make decision-making difficult.
- Institutional weaknesses: Policy implementation is delayed by inadequate enforcement protocols, a lack of cooperation between Government agencies and a lack of technical personnel. Public hearings are suggested throughout the development stages of environmental policies, but in practice, impacted communities are frequently not meaningfully engaged.
- Influence from industry: Regulations are frequently resisted by industries along the Periyar River, particularly in the Eloor-Edayar belt, making execution difficult. The ability of the river to carry water is diminished by siltation brought on by industrial and municipal waste, raising the possibility of floods.
- Public opposition & financial restraints: Economic worries, especially for small enterprises and industries, can cause resistance to implementing sustainable practices.
- Encroachments & unregulated constructions: Illegal constructions along riverbanks have increased flood risks and decreased ecological resilience due to inadequate regulation of land-use regulations. Uncontrolled sand mining degrades the river over time and has a negative impact on water quality. The 60-acre Okkal Thuruthu landmass has been destroyed and made more susceptible to flooding due to excessive sand mining.
- Inadequate waste management: Lack of proper sewage treatment facilities in many municipalities, such as Aluva, Kalamassery and North Paravoor, results in pollution.

Contamination is made worse by the disposal of unsorted waste from households and markets.

- Climate change and floods: Increase in rainfall intensity and inappropriate dam releases have resulted in floods and community displacement. This problem is exacerbated by the absence of floodplain zoning. Sustainable river management is also limited by disputes between Tamil Nadu and Kerala regarding storage and water release, particularly in relation to the Mullaperiyar Dam.

5.3. Factors that work for coexistence

Coexistence between industrial development and environmental conservation in the Periyar River Basin is crucial for sustainable resource management. Due to the adverse impacts of industrial pollution, the river, in its downstream reaches, continues to encounter difficulties and endanger local livelihoods and ecosystems. However, a number of variables have helped to strike a balance between ecological preservation and economic activity. Legal actions, media advocacy, community movements and policy enforcement have played a significant role in ensuring that industries operate responsibly while preserving the health of the river. Some of the influencing factors are mentioned below.

5.3.1 PILs and Legal Actions:

In order to make industries accountable for the pollution of the Periyar river and to restrain them from polluting it further, many NGOs have filed PILs, which have resulted in more stringent enforcement of environmental regulations. Environmental protection, pollution management and public health protection have frequently been the focus of PILs pertaining to the Periyar River Basin. The main fields of litigation are:

A. Industrial pollution: Numerous PILs have been filed against industries in the Eloor-Edayar area, one of the most polluted industrial zones in India, in connection with the discharge of harmful effluents into the river. The National Green Tribunal (NGT) and the Kerala High Court have often stepped in to enforce pollution control measures.

- I. The Kerala Government has been instructed by the National Green Tribunal (NGT) to maintain preventive and corrective actions against air pollution while guaranteeing adherence to ambient air quality norms. The order, which was issued on August 24, 2022 by a Special Bench emphasized the necessity of ongoing action under environmental laws

such as the Air (Prevention and Control of Pollution) Act, 1981. Also, the Kerala High Court constituted a committee to address pollution in and around the Periyar River following a petition by Periyar Malineekarana Virudha Samithi. The Committee was instructed to visit the site, along with the petitioner's representatives and provide a report after the court noted that previous attempts by the Central and State Pollution Control Boards had failed. The NGT and High Court's interventions highlight the urgent need for stricter environmental enforcement (Verdictum, March 2025).

- II. To stop more fish kills in the Periyar River along the Eloor-Edayar industrial stretch, the Kerala High Court ordered prompt action. An order was issued dated 10.06.2024 following a petition that drew attention to pollution from industries and establishments in Aluva. Recently, thousands of dead fish were discovered in farms near Varappuzha, Kadamakkudy and Cheranalloor, the petitioner said, most likely as a result of industrial pollution. The Kerala State Pollution Control Board is still unable to pinpoint the precise cause of the recurrent instances. The river, the major source of drinking water, is nevertheless experiencing unlawful harmful discharges, the petitioner noted. The PCB was asked to provide an affidavit to the Court detailing the steps taken to reduce pollution and control the problem (The New Indian Express, 2024).
- III. The Kerala State Pollution Control Board (PCB) was ordered by Ernakulam District Collector to inspect industries in the Eloor-Edayar belt and stop effluent dumping into the Periyar. Citing the Disaster Management Act, 2005, the Collector assigned the Chief Environmental Engineer, PCB, Ernakulam, to enforce strict action. Despite PCB's claims of monitoring, pollution persists, causing fish kills and endangering drinking water supply in Kochi. The PCB has pledged strong measures while urging local bodies and the Department of Irrigation/ Water Resources to take decisive action (The New Indian Express, 2024).
- IV. In response to a PIL filed by the Periyar Malineekarana Virudha Samithi, the Kerala High Court recommended against permitting additional polluting enterprises to expand inside the Edayar industrial belt. Since its establishment in 1962, the 450-acre area has seriously contaminated the air, water and soil. Chronic disorders have struck the Thandirickal Colony residents and in the last five years, 15 cancer-related deaths have been documented. Experts warn about genotoxic and neurotoxic pollution and demand immediate action to save public health, while industries deny responsibilities (The New Indian Express, 2012).

B. Illegal Sand Mining: Overexploitation of sand has disrupted groundwater recharge, resulted in the formation of deep pits in the riverbed altering the river's natural flow and lead to erosion of riverbanks. Mining rules are being strictly enforced as a result of PILs.

- I. Environmental experts warn that unscientific and indiscriminate sand mining in the rivers of Kerala has created deep pits in the river bed, turning these rivers into death traps over the years (The Hindu, 2016). The area beneath the Sree Sankara Bridge at Kalady is notorious for illegal mining, posing a serious threat to it.
- II. Following indications of resumption of sand mining activities, the Ernakulam Rural Police have stepped up their campaign against it in Periyar. In Aluva Thuruth and Companypady, four country boats used for mining were taken into custody and destroyed as part of the operation headed by the District Police Chief. Additionally, illegally mined sand was seized and the Mining and Geology Department was notified. However, enforcement operations continue to be handicapped due to the lack of motorized boats (The Hindu, 2023).
- III. Concerns about river sand mining have been renewed by the recent huge fish mortality in the Periyar's Edayar reach. The Government's decision to recommence sand mining after almost ten years has drawn criticism from environmentalists who claim it will worsen river conditions. In order to increase water flow, activists stress that the emphasis should be on removing slush and sediments rather than mining. The State General Secretary of the Periyar Protection Council emphasized that more sand extraction will only hasten river deterioration (The Hindu, 2024).

C. Sewage pollution and garbage dumping: Uncontrolled waste disposal from cities like Aluva and Kochi has been contested in court, resulting in improved waste management.

- I. Due to shortage of land and resistance of the public to setting up treatment plants, municipalities along the Periyar River still discharge untreated sewage into the river water. The river water has significantly high levels of faecal coliforms, based on the studies conducted by the Kerala State Pollution Control Board (KSPCB). According to the KSPCB action plan, 10 drains in Kalamassery, Aluva and Eloor have high biochemical oxygen demand (BOD), a sign of serious organic pollution (The Hindu, 2019 & 2021).
- II. According to the Kerala State Pollution Control Board (KSPCB), the discoloration of water in the Periyar River on September 7, 2023, was caused by Sud-Chemie India Pvt Ltd in the Edayar industrial region. Chromium was found in the water during tests at the Central

Lab of the KSPCB in Ernakulam, proving that the industrial unit was the source of the unlawful discharge. This was a cause of major environmental concern because the pollutant was discharged through a stormwater drain. The investigation began after local activists and locals informed the authorities (The Hindu, 2023).

- III. The Kalamassery municipality was fined ₹10.30 crores by the Kerala State Pollution Control Board (KSPCB) for unlawfully releasing untreated wastewater into the Periyar River from the North Kalamassery market (The Hindu, 2023).
- IV. A used/ waste oil recycling unit in the Edayar industrial estate was ordered to be closed down by the Kerala State Pollution Control Board (KSPCB) for unlawfully releasing dark, oily effluent into the Periyar River via stormwater drain. Around 2:30 a.m on Wednesday, environmental activists spotted the violation taking place in the river during a period of intense rainfall. They promptly notified the Eloor Environment Surveillance Centre authorities. This incident occurred just after the team of Government officials visited the Edayar industrial area for the investigation of the mass fish death that was reported on May 20–21, 2024 (The Hindu, 2024).
- V. Following Mahasivratri, the Aluva Municipality removed 1.60 tonnes of garbage in an effort to avert contamination in the Periyar River. Officials set up a protective net to capture offerings and collaborated with a private trash management company to clean up in order to reduce contamination. At Manappuram, volunteers—including college students—also helped by cleaning the riverbanks. Because the collected garbage will be turned into manure, this initiative was not only a more sustainable approach but also enhanced the quality of the water (The Times of India, 2025).
- VI. Under the Disaster Management Act of 2005, the Ernakulam Collector had instructed the Kerala State Pollution Control Board (PCB) to inspect the companies in the Eloor-Edayar region. Untreated sewage discharge is still a major problem despite constant monitoring and the river's natural flow has been neglected in spite of National Green Tribunal (NGT) orders, which has increased pollution and caused fish fatalities and ecological harm (The New Indian Express, 2020). The PCB has improved regional surveillance and created an action plan to reduce industrial effluent contamination in response to the NGT's direction. Significant pollution norm violations were discovered in a prior evaluation by the Central Pollution Control Board (CPCB), which also revealed that some industries lacked adequate effluent treatment facilities. Environmentalists contend that PCB screenings are insufficient. High concentrations of heavy metals, such as copper, zinc, lead and arsenic,

were found in the water in the Periyar River by a team from the School of Marine Sciences, CUSAT, which had a negative effect on aquatic life (The New Indian Express, 2018).

- VII. In order to reduce pollution in the Periyar River, the Government proposed a project and chose to involve 20 civic organizations. By putting regular monitoring and control procedures in place, the program aims to address the escalating levels of contamination. The environment of the river has been negatively harmed by untreated sewage discharge, industrial effluents and other pollutants, which authorities are working to reduce. In order to guarantee adherence to pollution control standards, the project places a strong emphasis on cooperation between environmental agencies, local governing entities and enterprises. Given growing worries over declining water quality, this project is anticipated to be essential to re-establish the Periyar River's natural equilibrium (The Times of India, 2016).

D. Conservation of Ecosystems: Legal efforts are on to protect fish population, wetlands and the overall ecological balance of the river basin.

- I. To protect the Periyar River, a Joint Biodiversity Management Committee (BMC) has been established in 2017 as a collaborative initiative by the local bodies. It aims to address issues such as environmental hazards such as the spread of invasive species like water hyacinth, works collectively to safeguard biodiversity and advanced sustainable riverine management. In this cooperative effort, the President of the Ernakulam District Panchayat serves as chairperson and brings together civic representatives from multiple local governments and is a major step in protecting the biodiversity of Kerala's longest river (The Hindu, 2017).
- II. In response to an NGT order addressing industrial pollution, the Kerala State Pollution Control Board (KSPCB) increased surveillance in the Eloor-Edayar industrial area. The NGT discovered serious violations of pollution standards by industries and ordered authorities to create an action plan to reduce industrial effluent discharge. Environmentalists argue that monitoring is insufficient despite assertions of routine inspections, pointing to previous occurrences of fish kills and discoloured water in Periyar. High concentrations of heavy metals in the Periyar have been confirmed in a study conducted by the School of Marine Sciences, CUSAT, impacting ecosystems and marine life (The New Indian Express, 2018).
- III. To preserve and increase fish population in the river at the Periyar Tiger Reserve (PTR), the Department of Forests and Wildlife started the "*Vriksha Samridhi, Matsya Samridhi*"

project. Along the lakeside at the Periyar Tiger Reserve, six tree species will be planted, including *Pattuthalli* (*Actinodaphne malabarica*) and *Njaval* (*Syzygium cumini*). These trees assist the growth and sustainability of fish like the Mahaseer (Kuyil) by providing them food. The goal of this project is to support biodiversity conservation and improve the aquatic ecosystem within the lake at PTR (The Hindu, 2023).

- IV. An expert committee composed of representatives from the State and Central Pollution Control Boards was established by a Division Bench of the Kerala High Court to look into pollution and fish deaths in the Periyar River. This Committee was directed to examine the impacted areas and suggested action to stop similar incidents in the future (The Hindu, 2024).
- V. A Division Bench of the Kerala High Court recommended creating a special body for the preservation of the Periyar River on the lines of the National Ganga River Basin Authority (NGRBA). The recommendation was made during the hearing of petitions from the Periyar Malineekarana Virudha Samithi and some other organizations. The Court underlined that much better pollution control and long-term protection would result from a single Authority monitoring the entire Periyar River rather than fragmented supervision. The State and Central Pollution Control Boards are currently only able to advise, which restricts their capacity to take proactive action (The New Indian Express, 2025).

E. Impact of Reservoirs: Public interest lawsuits have been filed on issues related to ecological degradation, reservoir operation, and safety issues associated with dam operations.

- I. The 999-year lease agreement between Travancore and British India over the Mullaperiyar Dam, is over a century old and faces political and legal issues. Despite Kerala's objections, the Supreme Court allowed an increase in the Full Reservoir Level (FRL). Disputes persist over safety, environmental hazards, and water-sharing rights (Government of India, 2021).
- II. Kerala's hydroelectric dams, Idukki, Idamalayar, and Lower Periyar, face criticism from environmentalists over deforestation, sediment deposition, and ecosystem changes. Social concerns include displacement of the local population. Public opposition to long-term ecological harm is a major concern. Small-scale hydro projects are being investigated as a sustainable alternative (KSEBL, 2021-2023).

5.3.2 Government Monitoring Initiatives for River Health

Real-time monitoring has been given priority in order to ensure early detection of pollution events. Pollution and erosion can be decreased by the creation of buffer zones and implementation of reforestation initiatives. River conservation efforts have improved as a result of cooperation between the Departments of Revenue, and Irrigation/ Water Resources and environmental agencies.

- I. To track the water quality of the Periyar River in real time, the State Pollution Control Board (PCB) is putting up a sophisticated online monitoring system. While the primary unit will be at a mosque next to the IRE Junkar Jetty at Eloor, with a public display at FACT Junction, a sensor unit will be positioned mid-river where there is a heavy flow of water. However, as the river is still contaminated by hazardous effluents from Eloor's industrial belt, detractors contend that monitoring is insufficient on its own without strong industrial waste treatment regulations (The New Indian Express, 2012).
- II. Two surveillance boats have been launched by environmental organizations and fishermen to keep an eye on industrial pollution in the Periyar River close to the Pathalam regulator cum bridge (RCB). The program assists residents and authorities in reaching contaminated areas in the Eloor-Edayar belt under the auspices of the Janajagrata Committee and Periyar Malineekarana Virudha Samithi. The Chairman of the Eloor Municipality and the President, Kadungallur Grama Panchayat flagged off the boats. Activists assert that delayed sampling makes enforcement more difficult and that industries emit pollutants through submerged/ buried pipes, frequently on weekends to evade detection (The Times of India, 2024).
- III. To address fish deaths and water discolouration, the Ernakulam District Administration has suggested real-time water quality monitoring along the 3 km Eloor-Edayar stretch of the Periyar River. The Kerala University of Fisheries and Ocean Studies (KUFOS) recommended the installation of permanent water quality monitors for ongoing monitoring after investigating the fish kill that occurred on May 20–21, 2024. The Kerala Government has been notified of this proposal by the District Administration (The Hindu, 2024).
- IV. Wetland construction can be done by local organizations as a prototype or as a student project with the assistance of students and the youth community. The purpose of a man-made wetland is to filter and treat pollutants in the sewage. It can be built using locally accessible materials, which lowers the cost. Reported values of the efficiency of well -

maintained artificial wetlands range between 79 and 82% efficient (Earth5R 2024, December 28).

- V. Administrative and financial obstacles have impeded work on the eight long-term initiatives stated in the State Government's Periyar River Action Plan, which aims to restore and safeguard the river, leaving the long-term Periyar regeneration plans in a state of uncertainty. Significant delays in funding distribution and unclear project deadlines are affecting the implementation of proposals for monitoring and treatment. There are clear differences between the proposed projects and their actual execution, especially in the river's Aluva-Kalamassery-Edayar segment. (The Hindu, 2022).
- VI. The Govt. of India has launched the Periyar River Conservation Project in 2024. Periyar is one among the six rivers included in the National River Conservation Plan (The Hindu, 2023).

5.3.3. Role of Journalism and Media

Reports on pollution and ecological damages in newspapers and on television have created tremendous public pressure on the Government forcing it to take action.

- I. Newspaper reports: Public opinion has been mobilized and environmental infractions highlighted due in large part to newspaper reports (e.g., The Times of India, The Hindu, The New Indian Express etc on Periyar pollution). The public's desire for accountability has grown as a result of ongoing coverage of the health impacts of industrial contamination.
- II. On World Water Day, editorial teams and journalists from leading newspapers highlighted the persisting pollution problems affecting Kerala's major rivers and the ongoing restoration efforts. Despite the National Green Tribunal's (NGT) orders, the Periyar River, which has been severely harmed by industrial pollution, is still in critical condition. With over 285 industries, including more than 100 in the red category (hazardous waste), the Eloor-Edayar industrial belt is the most severely impacted. The situation is made worse by the fact that 48 industries let their effluents straight into the river and that many lack adequate wastewater treatment (The Hindu, 2024).
- III. While policymakers minimize the problem, Eloor villagers continue to struggle with industrial pollution. Agriculture and fishing have been destroyed and the river, which once supported a vibrant environment, is reeking a foul stench. 48 of the more than 285 companies — including petrochemical plants— are reportedly discharging harmful

effluents into the water. The State Pollution Control Board maintains that pollution levels are within acceptable bounds, blaming sewage rather than companies in spite of years of protests and NGT instructions. According to scientific studies, ecological degradation is taking place and locals are suffering from respiratory problems, cancer and birth deformities as a result of heavy metals, pesticides etc in their food, water and land (Al Jazeera, 2023). In 1998, KUFOS researchers found that 25 fish species disappeared and the Professor of Chemical Oceanography at CUSAT found out that contamination in crops like vegetables, eggs, meat, and tuber crops was caused by toxic heavy metals from organic fertilizers and industrial waste. While experts emphasize on-site wastewater treatment as the sole practical solution—if industries are prepared to invest—activists are stepping up surveillance and taking legal action against polluters. (Jazeer, 2024).

- IV. The Pollution Control Board's assertion that low dissolved oxygen levels were the cause of the recent mass fish mortality in the Periyar River was refuted by a report by the KUFOS (The New Indian Express, 2024). The KUFOS team discovered high levels of hydrogen sulphide and ammonia in the Periyar River, both of which are extremely harmful to aquatic life. Even though the dissolved oxygen levels in the river were low, it was improved after May 20 2024, the report is highlighting the long-term effects of pollution are still a cause for concern. KUFOS applied for permission from the Government to carry out a thorough investigation into how pollution affects native fish species, extent of chemical deposits on the riverbed and whether the riverbed has entered a 'dead' zone. In order to revitalize the river, the local community is also calling for immediate research on the ways that pollution has changed fish population (The New Indian Express, 2024).

5.3.4. Initiatives for Sustainable Development

Waste-to-energy projects, Extended Producer Responsibility (EPR) and circular economy strategies all support environmental sustainability.

- I. The Kerala Government has taken a decision to close down the large waste-to-energy (WTE) plants in Ernakulam after seven years because of technical, economical, and environmental issues. The failure to sign concessionaire agreements, land suitability challenges and financial concerns were the main factors in the decision. Due to the inability to sign the agreement, the project at Kochi (Brahmapuram) was abandoned and BPCL is currently building a Compressed Biogas (CBG) facility in that place. The WTE projects were unfeasible due to a number of issues, including inadequate waste segregation and

excessive operating expenses. The use of incineration-based techniques was made more difficult by worries about air pollution. Strong public opposition and legal disputes also contributed to delays, which made it challenging for the projects to proceed. Instead, the Government is now concentrating on biogas plants and decentralized waste management. In place of major incinerator plants, there is also a focus on encouraging composting and material recovery facilities. Another important tactic to increase the effectiveness of garbage disposal is to support local self-Government projects. Instead of depending on massive centralized plants, the Government is investigating more sustainable waste management models in the future by combining recycling, composting and small-scale energy recovery techniques. The goal of this change is to give the State a waste management system that is both more efficient and ecologically beneficial (Malayala Manorama, 2025)

5.3.5. Community-Based Conservation

Participatory wetland management, eco-restoration initiatives, and Biodiversity Heritage Sites (BHS) enhance co-habitation.

- I. Following the completion of the Eco-development Project in 2004, the Periyar Foundation was founded in 2005 as a non-profit organization (charitable society) made up of both government officials and people. By managing several programs, schemes and looking into sustainable livelihood options, the foundation prioritizes the welfare of its members (Kerala Tourism, 2025, Eco-development Project, Periyar Tiger Reserve)
- II. By offering alternate sources of income, the eco-development project in Periyar sought to lessen the tribal community's reliance on the forest. In order to engage the community in sustainable economic endeavours and drastically curtail illicit activities such as poaching and wood-cutting, Eco-Development Committees (EDCs) were established. Nowadays, a large number of ex-poachers help the Forest Department patrol and lead visitors. The financial stability of the community has increased as a result of tourism-based projects including direct pepper marketing and bamboo rafting. The Vasantha Sena and other women's Self-Help Organizations monitor the reserve and report illicit activity. Additionally, the project supports agriculture in tribal communities, helping more than 5,500 households and almost 40,000 individuals. By effectively fusing local development with conservation efforts, the project maintains the tribal community's connection to the forest while offering steady revenue streams. It is a comprehensive and dynamic strategy

that has made it a dynamic and sustainable model of success (Kerala Tourism, n.d, Benefits for the tribal communities' sections, Forest conservation efforts).

- III. To routinely check the quality of water in the Periyar, Greenpeace International has designated a Periyar River Keeper, who has dedicated the past thirty years to protecting the Periyar river safe from the effects of pollution (Earth5R 2024, December 28).
- IV. The Aluva Environmental Protection Forum was founded in 1992 by environmentalists, who also played a significant role in preventing illicit sand mining and water pollution through afforestation initiatives (Earth5R 2024, December 28).
- V. PUNARJANI, a cleanup initiative for the Periyar River and Tiger Reserves, was carried out by the local administration and communities with assistance from student organizations. 700 garbage bundles were gathered by 400 volunteers who were split up into six zones (Earth5R 2024, December 28).

5.4. Challenges for coexistence

- I. Persistent pollution problems: The Periyar River is severely polluted despite monitoring due to industrial discharges and insufficient waste treatment. Despite regulations, industrial pollution continues, making sustainable coexistence challenging. Danger of flooding is made worse by ongoing encroachments along riverbanks.
- II. Lack of wastewater treatment facilities: Industries around the Periyar continue to release untreated effluents, highlighting tardy implementation of existing laws and regulations. Repeated environmental infractions are made possible by weak punishments and inadequate monitoring mechanisms.

6.0 Concluding Remarks

Rivers have been offering a wide range of ecosystem services since the early stage of human civilization. However, due to drastic increase in population and large-scale urbanization, rivers have been severely impacted adversely. Sustainable management of rivers is a major challenge faced by humans. Periyar, the longest river in Kerala is known as the 'Lifeline of Kerala' due to its remarkable contributions to multiple domains in shaping the socio-economic regime. The river provides the basin with many essential services, including drinking water, flood control, and aesthetic and spiritual advantages. However, due to factors including sewage discharge, industrial pollution, and deforestation, the river has been steadily losing its natural purity in recent years. Governments, NGOs, and local community organizations are making efforts to manage the river

through the implementation of policies, schemes, regulatory frameworks, and by conducting awareness campaigns, thereby enhancing the well-being of communities that rely on the river for their livelihoods. However, the river and its basin continue to encounter several problems such as illegal sand mining, quarrying activities, industrial and sewage pollution, poor waste management, inadequate wastewater treatment, encroachments, and unregulated constructions. The management of river depends heavily on government efforts, social activities, and community engagement. A well-thought-out plan that takes into account the demands of all stakeholders involved, is necessary to accomplish the task of maintaining health of the river and river basin. Future implementation of ambitious projects that support economic growth and safeguard human and environmental health will require teamwork. All sections of the public in the river basin and those representing economic interests should join hands to guarantee a secure and sustainable future for the Periyar River Basin.

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Annexure - 1

Local Self Government Department in the Periyar River Basin

(Source - LSGD, Govt. of Kerala; Department of Panchayats, Government of Kerala (2025))

Sl. No.	LSGD	District
1	District Panchayat, Idukki Kattappana Municipality	Idukki
2	District Panchayat, Thrissur Irinjalakuda Municipality, Kodungallur Municipality	Thrissur
3	Kochi Municipal Corporation District Panchayath, Ernakulam Perumbavoor Municipality, Eloor Municipality Aluva Municipality, Kalamassery Municipality North Paravur Municipality, Angamaly Municipality	Ernakulam
4	District Panchayat Office	Kottayam
5	District Panchayat Office	Pathanamthitta

Grama Panchayats in the Periyar River Basin

Sl. No.	Block	Grama Panchayats	District
1	Adimaly	Adimali, Pallivasal, Bisonvalley, Vellathooval, Konnathady	Idukki
2	Devikulam	Marayoor, Kanthalloor, Munnar, Vattavada, Mankulam, Chinnakanal, Santhanpara	
3	Nedumkandam	Rajakumari, Rajakkad, Senapathi, Udumbanchola, Nedumkandam, Nedumkandam, Pampadumpara, Karunapuram	
4	Idukki	Vathikudy, Kamakshy, Mariyapuram, Idukki-Kanjikuzhy, Vazhathope, Arakulam	
5	Kattappana	Erattayar, Kanchiyar, Vandanmedu, Upputhara, Ayyappancoil, Chakkupallam	
6	Elamdesam	Vannappuram, Karimannoor, Udumbannoor	
7	Azhutha	Elappara, Kumily, Vandiperiyar, Peermade	

Sl. No.	Block	Grama Panchayats	District
8	Thalikulam	Nattika, Valappad	Thrissur
9	Anthikkad	Thanniyam	
10	Chalakudy	Athirappilly, Kadukutty, Koratty	
11	Mala	Aloor, Mala, Annamanada, Poyya, Kuzhur	
12	Mathilakam	Edathiruthy, Kaipamangalam, Perinjanam, Mathilakam, Sreenarayanapuram, Edavilangu, Eriyad	
13	Irinjalakuda	Karalam, Kattur, Muriyad	
14	Vellangallur	Padiyur, Poomangalam, Velukkara, Vellangallur, Puthenchira	
15	Kodungalloor	Methala	
16	Angamaly	Ayyampuzha, Karukutty, Manjapra, Mookkannur, Thuravoor, Kalady, Kanjoor, Malayattoor-Neeleswaram	Ernakulam
17	Kothamangalam	Kuttampuzha, Pindimana, Kottappadi, Nellikuzhi, Kavalangad, Keerampara	
18	Parakkadavu	Parakkadavu, Puthenvelikara, Nedumbassery, Kunnukara, Chengamanad, Sreemoolanagaram	
19	Koovappady	Vengoor, Koovappady, Mudakuzha, Ockal, Asamannoor, Rayamangalam	
20	Paravoor	Vadakkekara, Chendamangalam, Chittattukara, Kottuvally, Ezhikkara	
21	Vypin	Pallippuram, Kuzhuppilly, Edavanakkad, Nayarambalam, Njarakkal	
22	Alangad	Karumalloor, Alangad, Kadungallur, Varapuzha	
23	Vazhakulam	Keezhmad, Vazhakulam, Vengola, Choornikkara, Edathala	
24	Edappally	Cheranallur, Kadamakkudy, Mulavukad, Elamkunnappuzha	
25	Kanjirappally	Koottikkal	Kottayam
26	Ranni	Seethathode	Pathanamthitta

Annexure - 2
Non-Governmental Organisations in the Periyar River Basin

Pollution Control and Waste Management		
Sl. No.	Agency	Location
1	Happy Trash - Waste Management Services, Ponjassery; Green Worms Regional Office; Green Incinerator manufacturer; Hitech Biofertilizers India, Edappally; Green Engineering Systems, Edappally; Razala Hi tech Biogas plant, Edappally; Dubhe Richus Water Treatment Plant & Sewage Treatment Experts, Edappally; City Total Cleaning, Cheranallur; Aquapenta - Water and Wastewater Treatment Solutions, Perumbodath; Threear Green Pvt Ltd, Edayar	Kochi
2	Trashco Waste Management	Vazhakulam
3	Tech Mechanica Enterprises, Global Facility Management Oorjakendram; Medayil Incinerators, Eco Star Incinerators, Reco Friendly Pvt Ltd, Mahyoubha Eco Solutions Pvt Ltd, Razala Hi tech Biogas plant, Edappally; Hitech Bio Fertilisers India, Factory, Sreemoolanagaram; Aspire Greens, Gee Bee Tech Solutions for Clients	Aluva
4	Trashco Waste Management, Vazhakulam; WSR Waste and scrap Recycling, Kaloor; Ecco Solutions Waste Management System, Kaasma Plant (GET), Ceekay Green Care Agencies, Eloor; MGM Traders, Cheranallur; Plastic Bottle Collection Point, Integrated Enviroclean Systems & Solutions Pvt. Ltd, Kalamassery; Mechon Null Waste Incinerator, Angamaly; Global Labs And Consultants; Green Method Engineering Pvt Ltd, Kalamassery; TT Plastics (Tripunithura Trader's Plastic Recycling Division), Mudickal; Excel petrochemicals, Aluva; Evershine Plastic recycling granules industry, Mudickal	Ernakulam
5	E Waste Collection Centre in Kerala (THE GREEN), Clear Waste Burners, Green Worms PVT LTD, FF Plastics, Ponjassery, Choola Industries, Hamara Plastic, Medayil Incinerators, SAS Polymers	Perumbavoor
6	North Paravur Municipality Waste Disposal Unit Dubhe WasteWater Treatment Plant	North Paravur
7	Trieco Green Private Limited	Kothamangalam
8	Medayil Incinerators, Seban Electromech	Idukki
9	Ecogreen Scrap Trading & Waste Management, Mathilakam	Thrissur

Soil and Land Management	
Sl. No.	Agency
1	Sediment Soil Investigation, Mamangalam, Ernakulam

Social Development and Environmental Welfare		
Sl. No.	Agency	Location
1	Ernakulam Social Service Society, Kacheripady Centre for Socio-Economic and Environmental Studies, Edappally SCMS Institute of Bioscience and Biotechnology Research & Development, South Kalamassery	Ernakulam
2	Planatearth	Aluva
3	Kerala Social Development Society	Kattappana
4	Rajagiri out REACH, Kalamassery Swadeshi Science Movement	Kochi
5	Peermade Development Society	Peermade
6	High Range Development Society, Mariyapuram Green Valley Development Society, Thadiyampad, Mariyapuram	Idukki

Annexure – 3
List of Private Industries in the Periyar River Basin

(Source - Directorate of Industries and Commerce)

Eloor-Edayar	
Industry type	Companies
Metal & Chemical Manufacturing (41)	Binani Zinc Ltd, Premium Ferro Alloys, Kochi Castings and Manufacturing Pvt. Ltd, Hindalco Industries Ltd Extrusion Division, Steelarc Rods and Wires, Copper Blues, Minar Chemical Industries, Galilea Chemicals, Associated Rubber Chemicals(Kochi) Pvt Ltd, M.O. Philips Industries, Cochin Chemical Industries, Travancore Ammonia (P) Ltd, Sud Chemie India Private Limited, Praxair India Private Ltd, Sicgil Industrial Gases Ltd, Manorama Carbonic Private Limited (MCPL), Manakkattu Industries, Jayson Industries, Green Field Chemicals and footwears, Akshai Gases PVT LTD, Peenya Industrial Gases Pvt Ltd, Popular Carbonic Industries, Poulouse and Matthen pvt Ltd, Triveni Carbonics Pvt Ltd, Active Char Products Pvt Ltd, Damodar Industries, Deepam Engineering, Edayar Industry, Ellickal Enterprises, Fab Coats, Feromats, Inter Decor Industries, PKM Engineering, Popular Industries, Wisdom Associates & Co, Reefco Container Technologies Pvt. Ltd, Rini Engineering Works, Roof Tech, Rubber O Malabar Products Pvt. Ltd, Safe Power Industries, Sherin Hi-Fabs, Sree Krishna Engineering Works, Sri Lakshmi Timbers, Transal Wires
Packaging & Containers (6)	House of Cartons (India) Pvt Ltd, Jagadamba Containers, Dezire Packaging Manjaly, Cochin Packagings, Unipack (India) Pvt. Ltd, Prestige Laminates Private Limited
Polymer & Plastic Manufacturing (12)	Periyar Polymers (P) Ltd, Cochin Polymers PVT LTD, Bharath Polymers, Periyar Polyfilms Edayar, Polyplast Eloor, Silver Stream Polymers Manjummel, SM Industries, Green Chanel Cartons, House of Cartons India Pvt. Ltd., Cochin Packagings, Kemo Gravure, Kings Packings
Rubber Product Manufacturing (25)	Malaya Rubtech Industries, Alpha Golden Crumb Rubber (Pvt.) Ltd., Rubber O Malabar Products Pvt. Ltd., Alpharub Crumb Rubber Pvt. Ltd., Decaan Industries, Essar Enterprises, Allied Coating Industries, Excel Industries, Five Star Rubber Industries, Cee Jee Lubricants, Cochin Rubber Industries, New kerala Rubbers Udyog, Kaisons Reclaim Products, JBS Intermix & Rubber products Pvt. Ltd, Parakkal Industries, Mark Rubber Products, Merchem (India) Pvt. Ltd, Premier Industries Middle East Rubber & Engineering, Well Stuck Adhesives Orings, Oil seals, Hydraulic Pnematic Seals etc, Southern Minerals & Chemicals, Sunrise TSR Factory, Techno Rubbers, TMS Leathers
Paints & Coatings Manufacturing (4)	Ramanand Electrocoats, South Indian Fertilizers, Organo Fertilizers (India) Pvt. Ltd, Ever Shine Powder Coatings

Eloor-Edayar	
Industry type	Companies
Mineral Processing (3)	South Indian Fertilisers, Fert-Land Organic Fertilizers, Copper Blue Fertilizers
Lubricants & Petroleum Products (3)	Amcos Paints factory, Duracoat Paints Pvt. Ltd, Durastic Coatings Pvt. Ltd
Construction Materials & Cement (2)	Cochin Minerals and Rutiles Pvt Ltd, Southern Minerals & Chemicals
Food Processing & Bakery	Cee Jee Lubricants
Leather & Textile Industry	Shine Star Lubes
Electrical & Battery Industry (2)	Ultratech Cement Limited, Teccap Electronics
Natural Extracts & Herbal Products	Prism johnson Ltd Chalakka
Fibre & Textile Manufacturing	Exelon Hi-Fabs and Contractors
Animal-Based Product Processing	St.George Industries
Organic Chemical Manufacturing	Rajoh Exim Kottappady
Activated Carbon Manufacturing	TMS Leathers
Surfactants & Chemical Manufacturing	Arjuna Natural Private Limited
Powder Coating Manufacturing	National Fibre Products
Furniture, Wood & Interior Manufacturing	Yeoman bone and allied products Wood Tech Furniture
Granite & Stone Processing	Biocon Organics (P) Ltd
Composite Materials Manufacturing (7)	Indo German Carbon Ltd., Active Char Products Pvt. Ltd., Cochin Surfactants Pvt.Ltd., Bright Powder Coatings, Inter Decor Industries, National Granites, Southern Composites (P) Ltd.

Aluva	
Industry type	Companies
Polymer & Plastic Manufacturing (10)	Zodiac Plastics, United Polymers, Vajra Plastics, Diamond Polymers, Safa Polymers, K.K.Plastics, Prestige Plastics, Sun Polymers, Aluva Plastic Consortium (P) Ltd., Intimate multiplast (P) Ltd.
Rubber Product Manufacturing (9)	Alwaye Techno Rubbers(P) Ltd., Falcon Elastomers (P) Ltd., Hankook Latex (P) Ltd., Cochin Reclaims & Tread Rubber (P) Ltd., Industrial Elastomers, EVM Rubmix, High Power Treads, Crescent International Tyre Treads, Derry Foams Pvt Ltd.
Metal & Chemical Manufacturing (7)	Surya Chemicals, Al Chemie Associates, Kalliyath TMT, Jemees Starch & Chemicals (P) Ltd., STEELEX Aluva - (Iron & Steel), Crescent Metal Crusher, Cochin Minerals and Rutile Ltd.
Engineering & Manufacturing (6)	Cochin Tubes, Philvin Engineers, Aslam Industries, Vesta Engineers, Chenthara Industries, Alampilly Pressure Testing company (P) Ltd.
Wood/Furniture & Interior Manufacturing (5)	Western Veneer Industries, Peeyemmar Plywood & Timber Industries, Atlas Veneers, Sree Sashta Plywoods, Nissi
Food & Beverage / Dairy Industry (4)	Rhem a Dairy Products India (P)Ltd., Mezhukkattil Farmeto (P)Ltd., Jeevan Food & Spices, Prima beverages (P) Ltd.
Electrical & Battery Industry (5)	Resitech Electricals, Powerline Consultant, Intrans Electro Components, Global Conductors Pvt Ltd., SFO Technologies Pvt Ltd.
Coating Industry	Hitech Thermo Coatings
Lubricants & Petroleum Products	Hindustan Lubricants Pvt Ltd
Appliances / Consumer Products	Protech Appliances P.Ltd
Fertilizer & Agrochemicals Manufacturing	Indus Valley Fertilizers
Biotech / Life Sciences	J & J Biotech
Water Purification & Treatment	Aqua City
Agricultural Products & Processing	M/S Farmett Private LTD Elambakapilly

Kalamassery	
Industry type	Companies
Metal & Chemical Manufacturing (36)	Metal Craft Engineering, Metal Forms, Perfect Metal Finishers, Polywin Industries, S.R. Industries, Shri Sabari Motor, Sigma Industries, Southern Metal Industries, Sun metal colours, Techno Profiles, Yes Vees Metal Finishers, Indian Aluminium Process, Kalleppuram Metals, Manorama Oxygen (P) Ltd, Industrial & Fine Chemicals, Okay Nitrous Pvt. Ltd., Unicorn Coatings, Hindalco Industries Ltd, Hindalco Alupuram Factory & Works, Kunnath Chemicals Pvt. Ltd, Merchem Ltd., Kancor Ingredients Ltd, Periyar Metal Industries, Veliyil Fabricators, TMV Aromatics (P) Ltd, New Aluminium Syndicate, Plants India Agro Machineries(P) Ltd, Plato Solutions, Pravish Metal Tech, Raghav Ideal Craft, Shree Ganesh Scaffoldings, Techline Enterprises, T Garden Industries, Tom Industries, Muttath Engineering Corporation, Outlook Communications
Engineering & Manufacturing (22)	EMJAY Industries, Emmem gears, Hi-Tech Refrigeration Services, HRJ Refrigeration, Industrial Engg. Corporation, Leetha Industries, Link Engineering Industries, Menachery Enterprises, Metal Coats, Metal Craft, Kerala Agro Machinery Corporation Limited (KAMCO), AMP Industries, Concert Engineering Enterprises, Sagi Engg., Thayyil Industries, Decent Engineers, Bright Engineering. Works, Shine Engineering, Appully Engineers, Paramount Hydro Pneumatic Systems, Sam Packaging Innovations Pvt. Ltd., Sun Electronics
Polymer & Plastic Manufacturing (21)	Premier Poly Packs, Shepherd Plastic Extrusions (P) Ltd., Shepherd Mouldings & Components (P) Ltd, Shepherds Plastics & Chemicals, Sona Plastic Industries, Sona Polymers, Aswathy Polymers, Megha Plastics, Megha Polymers, Green Industries, Thermo Slice Industries, Southern Poly Pack (P) Ltd., Deev Gen Set (P) Ltd., Evergreen Plastics, Galaxy Polymers, Gems Pipes & Fittings (P) Ltd., Cochin plastics Esquire Multiplast, Global Polymers, Teeyem Polymers, Seven Seas Nylons Ltd
Electrical / Battery Industry (13)	Concord Batteries, Electro Panels, Electro Tech Industries, Hesel Controls, Hindustan Powerlinks, Industrial Connectors New Tech Engineers, Safa Polymers, St.Geevarghese Engineering Enterprises, Structural Fibres & Laminates (P) Ltd, Watts Electricals, Watts Electronics (P) Ltd, Indus Engineering Company
Wood and interiors (13)	Indway Interiors, Patel Veneers, Perumalil Wood Industries, Uniwood Products, Varna Designers, Mohammed Veneers Kokkadan Enterprises, Tens Rubber Company (P) Ltd., United FRP Industries, Vadakkedath Tools and Plastics, Asma Industries, Lunar Industries
Rubber (11)	Cochin Rubbers, Pottekkattu Rubbers (P) Ltd., Riyas Rubber (P) Ltd., Rubber O Dynat, Rubberind Enterprises, United Rubbers, Veliyil Engineering, Apollo Tyres Ltd, Kalamassery Plant, Nelpurayil Rubbers (P) Ltd., Kokkadan Enterprises
Paints / Coatings (9)	Crown Paints (P) Ltd., D.V. Deo Aromatic (P) Ltd., D.V.Deo Industries, Acmatex Coatings, Glitter Paints & Chemicals (P) Ltd, Rainbow Coats, Ruby Texture Industries, Colour India Paints & Inks (P) Ltd., Global Paints

Kalamassery	
Industry type	Companies
Food & Beverage Industry (6)	Asian Cakes, Athulya Foods, Bimbo Ice Cream, Economic Food Solutions, Elite Foods, JJ Roller Flour Mills
Healthcare / Pharmaceutical Industry (3)	Careon HealthCare Solutions (P) Ltd, New Glory Orthopaedics, Ortho Care
Printing (3)	My Signature, Nizeema Printers, Dupo Print pack (P) Ltd.
Containers (2)	CKK Nair Containers, AG Tech Inds
Cosmetics (2)	Vaishali Industries, Vaishali Industries
Textiles / Apparel Industry	Golden Threads
Biotechnology & Medical Research	Ubio Biotechnology Systems Pvt Ltd
Recreation Facility (Corporate) (2)	Carborundum Universal Recreation Club, Women Apparel Park
Cattle & Poultry field	Silpi Agrotech (P) Ltd.
Interlocking Bricks	Sealine Polymers (P) Ltd
Laundry	Rose Power Laundry

Angamaly	
Industry type	Companies
Engineering & Manufacturing (12)	A One Industries, Nino Brothers, Rajani Industries, K.K.Industries, Luciya Industries, ASB Roofing Inc., Cinza Hitech Engineers (P) Ltd., EDMIECS, Techno Marine Products, M/s.Paramun Engineering and Metal Crafts, Three Star Engineering, Janatha Engineering Industries
Food & Beverage Industry (10)	Neroth Agro Foods, Kathir Foods, Kansons Foods (P) Ltd., Peters Foods (P) Ltd., Peters Rice Mill, Elixir Exotic Foods & allied Products (P) Ltd., Agro Food & Spices, Mothers Agro Foods (P) Ltd., United Curry Powder, Mane Kancor Ingredients (P) Ltd.
Polymer & Plastic Manufacturing (10)	Silver Star Plastics Ltd., Pearl Plastic Industries Ltd., Soumya Industries, Blue Line Polymers, Universal Plastics, Trans Techno Polymer Products, Lab Tech Plastics, Manu Industries, Vajra Plastic Industry, Josco Plastics
Metal & Chemical Manufacturing (6)	Surya Metals, Malabar Ammonia, Kalliyath Steel Industries, Aceller Steels (P) Ltd, Manjooran Steel Industries, Accurochem Chemicals & Systems

Angamaly	
Industry type	Companies
Rubber (4)	Associated Rubber Chemicals (Kochi) (P) Ltd., Royal Rubbers, M.S.S.Rubber & Reclaims, St.George Tyres
Paints / Coatings (4)	Durolac Paints, Alpha Paints, Glitts Paints & Resins, National Paints Factories India (P) Ltd.
Wood/Furniture & Interior Manufacturing (3)	ANB Designer Wood (P) Ltd., Kachappilly Glass & Plywood, Kerala State Bamboo Corporation Ltd.
Export/Trading Industry (4)	EMME Exporters, Popular Enterprises, Evergreen Enterprises, Pynadath Agencies
Packaging Industry (3)	Popular Packaging, Puthenangady Industries, Royal Packaging.
Electrical & Battery Industry (2)	Southern Cables (P) Ltd, Hindusthan Power Links
Paper (2)	Premier Paper Products, Peacock Paper Industries
Agricultural Products & Processing (2)	Vee Jay Rice Mill, Agrotech
Power/Energy Industry	Jose Power

Vazhakulam	
Industry type	Companies
Metal & Chemical Manufacturing (7)	Alwaye Metals & Alloys, Al- Ameen Industries, Vijin Auto Works, Atlas Industries, Travancore Copper Fungicide, VKR Industries, Intechs Manufacturing (P) Ltd.
Engineering & Manufacturing (4)	Decent Engineers, Shine Engineering, Bright Engineering. Works, Appully Engineers
Polymer & Plastic Manufacturing (11)	Aswathy Polymers, Megha Plastics, Megha Polymers, Green Industries, Thermo Slice Industries, Southern Poly Pack (P) Ltd., Deev Gen Set (P) Ltd., Evergreen Plastics, Galaxy Polymers, Gems Pipes & Fittings (P) Ltd., Teeyem Polymers
Electrical / Battery Industry	Indus Engineering Company
Wood and interiors (7)	Mohammed Veneers, Kokkadan Enterprises, Tens Rubber Company (P) Ltd, Asma Industries, Lunar Industries, Modern Veneers, Shine star Industries
Rubber	Kokkadan Enterprises

Vazhakulam	
Industry type	Companies
Paints / Coatings (2)	Colour India Paints & Inks (P) Ltd., Global Paints
Food & Beverage Industry	JJ Roller Flour Mills
Packaging Industry	Yeses Wood Industries
Healthcare / Pharmaceutical Industry	New Glory Orthopaedics
Printing	Dupo Print pack (P) Ltd.
Cattle & Poultry field	Silpi Agrotech (P) Ltd.
Interlocking Bricks	Sealine Polymers (P) Ltd
Lubricants & Petroleum Products	Coconut Development Board

North Paravur	
Industry type	Companies
Food Processing & Bakery	Asia Foods Manjapa, Ennel Foods
Polymer & Plastic Manufacturing	Anna Plastics Manjali
Chemical Industry	Weenus Enterprises
Lubricants & Petroleum Products	B M Fuels Edayar

Muppathadam	
Industry type	Companies
Chemical Industry (3)	G.K. Gases and Chemicals, Suraj Chemical Company, Jyothi Chemical Industries
Packaging & Containers (2)	King's Packings Koonammavu, Rajasree Packs
Construction Materials & Cement (2)	Central Cement Products, Neptune Readymix Concrete Pvt Ltd
Rubber Product Manufacturing	Apollo Tyres
Lubricants & Petroleum Products	Excel Petrochemicals

Electrical & Battery Industry	National Battery Industries
Furniture & Interior Manufacturing	Ashan Exports and Furnishers

Other industries in the Basin		
Industry type	Companies	Place
Polymer & Plastic Manufacturing (3)	Ve Max Industries	Puthenvelikara
	Neom Industries Edayar	Alangad
	Periyar Plastics	Palarivattom
Construction Materials & Cement (2)	Essar hollow bricks	Elamakkara
	Manakkill Cement Block Manufacturing Industries	South Chittoor
Leather & Textile Industry	Cochin Leathers Pvt. Ltd, G Leathers Pvt Ltd	Edappally
Engineering & Manufacturing (4)	St. Mary's Engineering Industries	Varapuzha
	St Mary's Engineering Industries	Vengola
	Hightech Engineering Industries	Kadungalloor
	MIL Controls Ltd, Meladoor	Thrissur
Electrical & Battery Industry	Kadavil Industries	Kodungallur
Paints & Coatings Manufacturing	Amcos XL Paints (India) Pvt Ltd	Cheranallur
Agriculture & Plantations	Kanan Devan Hills Plantations Co.Pvt.Ltd.	Munnar
Export & Trading	Mahima Exports Keerampara	Neriamangalam
Ayurvedic & Traditional Medicine	Ashtavaidyan Thaikkattu Mooss Vaidyaratnam	Kodungallur
Biofuels & Renewable Energy	Akshaya Bio-fuels	Manjapra
Retail Trade	Minnu Enterprises	Cherai
Medical & Healthcare	Shree Narayana Institute of Medical Sciences Edayar	North Kuthiathode
Financial Services & Investment	Geojit Bnp Paribas Financial Services Ltd	Kaloor

Other industries in the Basin		
Industry type	Companies	Place
Natural Extracts & Herbal Products	AVT Natural Products Ltd	Kunnathunad
Beverage & Soda Production (2)	Dosth Soda	Kaitharam South
	CMM Soda Manufacturing unit	Murickassery
Power Generation & Energy	BSES Kerala Power Ltd	Pathalam
Food Processing & Bakery (9)	Navya Bakes and Confectioneries I Pvt Ltd	Karukutty
	Mas Food Products	Koottickal
	Pattern Food Industries, Poonjassery	Vengola
	Amal Foods Kuruppumpady	Ponjassery
	Ceesi Food Products	Nedumbassery
	Surya Food Products	Parappuram
	Blue Plate Food Products	Vengola
	Eastern Condiments (P) Ltd	Edappally
	Modern Food Enterprises (P) Ltd.	Edappally
Packaging & Containers (3)	Pananghat Polymer Packagings (P) Ltd	Palarivattom
	Sterling Polypacks & Chemicals	Ambalamugal
	Kavussery Pet Bottles	Manakkappady

Annexure - 4

List of Quarries in the Periyar River Basin

(Source - KOMPAS, Department of Mining and Geology)

Sl. No	Latitude	Longitude	Mineral	Owner Name	Valid Up to
District: Ernakulam					
1	10.142222	76.591666	Granite	Mary Alias	07.04.2025
2	10.033333	76.651666	Granite	P P Varghese	27.05.2024
3	10.035000	76.650833	Granite	P P Varghese	11.06.2025
4	10.263611	76.416666	Granite	Amal P Wilson	27.06.2025
5	10.174444	76.535833	Granite	Vysali Resorts Pvt Ltd	30.06.2025
6	9.997777	76.724999	Granite	Cherian K Jose	22.07.2025
7	10.060000	76.596527	Granite	P M Moithen	18.08.2025
8	10.234166	76.458333	Granite	G M Granites	03.05.2029
9	10.047499	76.482222	Granite	St Marys Super Granites	14.02.2031
10	10.012499	76.643611	Granite	P K Prasad	14.02.2029
11	10.263611	76.417500	Granite	Gigi Mathew	28.07.2027
12	10.276388	76.418888	Granite	Saji Vadakkekara	24.11.2031
13	10.241944	76.459444	Granite	Star Granites	02.06.2025
14	10.040277	76.649444	Granite	Four Star Granites	05.05.2030
15	10.045000	76.478888	Granite	Cochin Granites Pulickal Associates	19.06.2033
16	10.044166	76.475555	Granite	Eldho Kuruvila	07.04.2031
17	9.993611	76.486111	Granite	Kadakanad Aggregates Pvt Ltd	26.09.2029
18	10.042500	76.478611	Granite	P K Prasad	22.09.2034
19	10.034166	76.492500	Granite	P K Prasad	04.10.2029
20	10.279444	76.439444	Granite	P K P Granites	17.08.2029
21	10.130277	76.643611	Granite	Annamma Antony	16.02.2030
22	10.044444	76.473333	Granite	P V Santhosh	16.02.2029
23	10.216628	76.493342	Granite	T P Sabu	NA
24	10.222657	76.356679	Granite	T M Joy	NA
25	10.266607	76.460362	Granite	Star Rock Products pvt ltd	NA
26	10.281484	76.441014	Granite	P K P Granites	NA
27	10.236290	76.453564	Granite	Crystal Granite Ltd	NA
28	10.209009	76.541032	Granite	Anugraha Metals and Sands Pvt Ltd	NA
29	10.136136	76.619118	Granite	N A Thomas	NA
30	10.142505	76.648498	Granite	Vettampara Nobel Granites Pvt ltd	NA
31	10.094170	76.673441	Granite	Kumary Joy	NA
32	10.093503	76.673330	Granite	Rema Rajeev	NA
33	10.092413	76.690580	Granite	Reji Kuriakose	NA
34	10.083518	76.586314	Granite	Kothamangalam Aggregates	NA

Sl. No	Latitude	Longitude	Mineral	Owner Name	Valid Up to
District: Ernakulam					
35	10.054649	76.715766	Granite	Denson K S	NA
36	10.033989	76.724547	Granite	Ever One Properties India Pvt Ltd	NA
37	10.090316	76.428552	Granite	Anu J Kadavan	NA
38	10.086715	76.454279	Granite	Cochin Granites	NA
39	10.150624	76.519603	Granite	Saju GeorgeE	NA
40	10.176501	76.532635	Granite	P C Baby	NA
41	10.060060	76.411096	Granite	K T Paul	NA
42	10.060302	76.471613	Granite	N V Kuriakose	NA
43	10.052470	76.552493	Granite	M K Salim	NA
44	10.036686	76.576989	Granite	A H Sheriff	NA
District: Idukki					
45	9.596944	77.037777	Granite	Raji Mathew	07.03.2035
46	9.619166	77.142777	Granite	Kizhakkethalackal Rocks	26.05.2027
47	9.619166	77.142777	Granite	Kizhakkethalackal Rocks	26.05.2027
District: Thrissur					
48	10.341666	76.435555	Granite	Pynadath Granites Ltd	15.01.2028
49	10.289722	76.413611	Granite	Ashokan M V	26.12.2029
50	10.093055	76.693333	Granite	Three Star Granites Pvt. Ltd.	26.12.2027

Annexure 5

Number of Households in the Periyar River Basin

(Source - Census of India 2011, District Census Handbook, Kerala, Ernakulam district)

Ernakulam district			
Name of Gram Panchayat	Name of Village	Name of Taluk	No. of households
C.D.Block: Vypin			
Pallippuram	Kuzhuppilly Pallippuram	Kochi	10838
Kuzhuppilly	Kuzhuppilly		3015
Edavanakkad	Edavanakkad		5293
Nayarambalam	Nayarambalam		5910
Njarackal	Njarackal(CT)		5848
Elamkunnappuzha	Elamkunnappuzha (CT)		12231
Mulavukad	Mulavukad (CT)	Kanayannur	5315
C.D.Block: Paravur			
Ezhikkara	Ezhikkara,Kedamangalam (OG) Kottuvally (CT)	Paravur	4536
Chendamangalam	Chendamangalam (CT)		7635
Vadakkekara	Moothakunnam (CT) Vadakkekara (CT)		8266
Chittattukara	Moothakunnam (CT,Vadakkekara		7830
Kottuvally	Kedamangalam (OG), Kottuvally (CT)		10652
C.D.Block: Kothamangalam			
Pindimana	Thrikkariyoor (P), Pindimana	Kothamangalam	4217
Pallarimangalam	Neriamangalam, Kuttamangalam, Varappetty, Pothanikkad		3387
C.D.Block: Edappally			
Cheranallur	Cheranallur (CT)	Kanayannur	7619
Kadamakkudy	Kadamakkudy (CT)	Kanayannur	4017

Ernakulam district			
Name of Gram Panchayat	Name of Village	Name of Taluk	No. of households
C.D.Block: Alangad			
Karumalloor	Choornikkara (CT) (Part)	Aluva	2713
Kadungalloor	Choornikkara (CT) (Part)		958
Karumalloor	Karumalloor (CT)	Paravur	5948
Kadungalloor	Kadungalloor (CT) (Part), Alangad (CT)		9167
Eloor	Kadungalloor (CT) (Part), Eloor (CT)		9159
Alangad	Alangad (CT)		10197
Varappuzha	Varappuzha (CT)		6667
C.D.Block: Angamaly			
Thuravoor		Aluva	
Ayyampuzha	Ayyampuzha		3639
Malayattoor-Neeleswaram	Malayattoor,Kalady (CT)		6460
Manjapra	Manjapra,Thuravoor		4061
Kalady	Kalady (CT) Mattoor (CT)		7088
Kanjoor	Vadakkumbhagom (CT), Kizhakkumbhagom (CT), Thekkumbhagom (CT)		5582
Sreemoolanagaram	Chowwara (CT) Thekkumbhagom (CT)		6146
C.D.Block: Parakkadavu			
Nedumbassery	Nedumbassery (CT), Chengamanad (CT)	Aluva	7956
Chengamanad	Chengamanad (CT)		6879
Kunnukara	Parakkadavu		521
Kunnukara	Kunnukara, Puthenvelikkara (CT)	Paravur	4898
Puthenvelikkara	Puthenvelikkara (CT)		28054

Ernakulam district			
Name of Gram Panchayat	Name of Village	Name of Taluk	No. of households
C.D.Block : Koovappady			
Koovappady	Kodanad , Koovappady (CT)	Kunnathunad	9056
Vengoor	Kombanad,Vengoor		5607
Mudakuzha	Vengoor West		4448
Asamannoor	Asamannoor		4714
Rayamangalam	Rayamangalam		9219
Okkal	Koovappady (CT), Chelamattom (CT)		5916
C.D.Block : Vazhakulam			
Vazhakulam	Marampilly (CT), Vazhakulam (CT)	Kunnathunad	9722
			291106

(Source - Census of India 2011, District Census Handbook, Kerala, Thrissur district)

Thrissur district			
Name of Gram Panchayat	Name of Village	Name of Taluk	No. of households
C.D.Block : Anthikkad			
Thanniyam	Vadakkummuri (CT), Kizhakkummuri(CT), Kizhuppillikkara (CT), Thanniyam (CT)	Thrissur	7396
C.D.Block : Irinjalakkuda			
Karalam	Karalam (P), Manavalassery (CT) (Part)	Mukundapuram	5496
Kattur	Kattur (CT)	Mukundapuram	4480
C.D.Block : Mala			
Mala	Vadakkumbhagam, Annallur ,Kuruvilassery,Vadama (CT)	Mukundapuram	8751
Kuzhur	Kakkulissery,Thirumukkulam	Mukundapuram	5060
Poyya	Pallippuram (CT), Poyya (CT), Madathumpady (CT)	Kodungallur	5690

Thrissur district			
Name of Gram Panchayat	Name of Village	Name of Taluk	No. of households
C.D.Block : Mathilakam			
Mathilakam	Koolimuttam ,Pappinivattom (CT)	Kodungallur	6967
S. N. Puram	Pandinjare Vemballur, Panangad (CT), Ala (CT)	Kodungallur	9350
Edathiruthy	Edathiruthy (CT), Chendrapinni (CT)	Kodungallur	7231
Kaipamangalam	Kaipamangalam (CT)	Kodungallur	8495
Perinjanam	Perinjanam (CT)	Kodungallur	5342
C.D.Block : Kodungallur			
Valappad	Valappad	Kodungallur	8852
C.D.Block : Vellangallur			
Vellokkara	Kaduppassery (Part), Kottanellur,Manavalassery (CT) (Part), Vellokkara (CT)	Mukundapuram	7608
Vellangallur	Vallivattom, Karumathra, Vadakkumkara (CT) ,Thekkumkara (CT)	Mukundapuram	9542
Puthenchira	Puthenchira	Mukundapuram	5531
Poomangalam	Poomangalam (CT) , Manavalassery (CT) (Part)	Mukundapuram	3261
Padiyur	Padiyur (CT), Edathirinji (CT) , Manavalassery (CT) (Part)	Mukundapuram	4800
			144594

(Source - Census of India 2011, District Census Handbook, Kerala, Idukki district)

Idukki District			
Name of Gram Panchayat	Name of Village	Name of Taluk	No. of households
C.D.Block : Adimali			
Vellathooval	Mannamkandam, Kunjithanny, Vellathooval	Devikulam	6437
Adimali	Mannamkandam	Devikulam	10336
Pallivasal	Anaviratty, Pallivasal, Kunjithanny	Devikulam	4269
Konnathady	Konnathady	Udumbanchola	7398
Baisonvally	Rajakkad (Part), Baisonvally	Udumbanchola	3474

Idukki District			
Name of Gram Panchayat	Name of Village	Name of Taluk	No. of households
C.D.Block Devikulam			
Munnar	Kannan Devan Hills	Devikulam	7968
Devikulam	Kannan Devan Hills	Devikulam	6166
Mankulam	Mankulam	Devikulam	2513
Chinnakanal	Chinnakanal	Udumbanchola	3099
Santhanpara	Chinnakanal, Poopara (Part), Rajakumari (Part), Santhanpara	Udumbanchola	4408
C.D.Block : Azhutha			
Elappara	Anavilasam (Part)	Udumbanchola	472
Kumily	Anavilasam (Part)	Udumbanchola	440
C.D.Block : Idukki			
Idukki- Kanjikuzhy	Kanjikuzhi	Thodupuzha	6838
Vazhathope	Idukki	Thodupuzha	4933
C.D.Block : Kattappana			
Erattayar	Kalkoonthal (Part), Kattappana	Udumbanchola	4539
Vandanmedu	Vandanmedu, Anavilasam (Part), Anakkara, Chakkupallam	Udumbanchola	8115
Kattappana	Kattappana	Udumbanchola	10394
Kanchiyar	Ayyappancoil	Udumbanchola	5642
Ayyappancoil	Ayyappancoil , Anavilasam (Part)	Udumbanchola	4046
Chakkupallam	Anavilasam (Part), Chakkupallam, Anakkara	Udumbanchola	5642
Upputhara	Vagamon (Part), poothara, Elappara (Part)	Peermade	6842
C.D.Block Nedumkandam			
Rajakkad	Rajakkad (Part)	Udumbanchola	3783
Rajakumari	Rajakumari (Part), Poopara (Part)	Udumbanchola	4188
Senapathy	Kanthippara, Chathurangapara	Udumbanchola	3228
Udumbanchola	Chathurangapara, Udumbanchola, Parathodu	Udumbanchola	4118
Nedumkandam	Kalkoonthal (Part), Parathodu	Udumbanchola	10744
Pampadumpara	Pampadumpara, Karunapuram	Udumbanchola	5332
Karunapuram	Karunapuram	Udumbanchola	6590
			189937
**Here, Kuttamangalam, Varappetty, Pothanikkad, Thuravoor, Vazhakulam (CT), Vadakkummu (CT), Kizhakkummuri (CT), Karalam (P), Annallur, Pallippuram (CT), Kaduppassery (Part), Edathirinji (CT), Anakkara, villages that are located outside the basin (Census of India 2011, District Census Handbook, Kerala)			

