



National River Conservation Directorate
Ministry of Jal Shakti,
Department of Water Resources,
River Development & Ganga Rejuvenation
Government of India

Industrial profile Report

Periyar

December 2025



cPeriyar



IIT PALAKKAD



താമരക്കുളം യാ ഹിന്ദുവിദ്യാലയം



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Industrial Profile Report

Periyar



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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.

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The Center for Periyar River Basin Management 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.

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cGanga is a think tank formed under the aegis of National Mission for Clean Ganga (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.

www.cganga.org

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. IIT Palakkad carried out the collection and analysis of secondary industrial data for the Idukki district, while NIT Calicut undertook the corresponding work for the Ernakulam and Thrissur regions of the Periyar River Basin. 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 is one of Kerala's most significant river systems, supporting diverse ecosystems, thriving urban centres, extensive agricultural landscapes, and a wide spectrum of industrial activities. While industrial development has played a pivotal role in the socio-economic growth of the basin, it has also intensified the need for sustainable management of water resources and environmental quality. Balancing industrial growth with the ecological health of the river is therefore fundamental to achieving long-term basin sustainability.

This Industrial Profile Report is a comprehensive compilation of industrial information across the basin and serves as a baseline reference for understanding the industrial landscape and its interaction with riverine ecosystems. The report consolidates district-wise information on industrial distribution, classification, products, water demand, wastewater generation, industrial estates, pollution potential, and environmental compliance. By integrating these datasets with river basin management objectives, the report assists in the identification of pollution hotspots, estimation of industrial pollution loads, and prioritization of interventions required for protecting water quality.

The information presented herein is intended to support government departments, regulatory agencies, local self-government institutions, planners, researchers, and other stakeholders engaged in river conservation and sustainable industrial development. In particular, the report provides a valuable knowledge base for preparing District River Management Plans (DRMPs), strengthening environmental regulation, planning wastewater infrastructure, and advancing the objectives of the 'Nirmal Dhara' initiative towards cleaner and healthier rivers.

It is expected that this Industrial Profile Report will serve not only as a repository of industrial information but also as a decision-support document for promoting evidence-based planning, interdepartmental coordination, and environmentally responsible industrial growth within the Periyar River Basin.

Centres for Periyar River Basin
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List of Abbreviations

ASI	Annual Survey of Industries
BOD	Biochemical Oxygen Demand
CETP	Common Effluent Treatment Plant
COD	Chemical Oxygen Demand
CPCB	Central Pollution Control Board
CTE	Consent to Establish
CTO	Consent to Operate
DA	Development Area
DIC	District Industries Centre
DP	Development Plot
EIA	Environmental Impact Assessment
EMP	Environmental Management Plan
GoI	Government of India
GoK	Government of Kerala
IDA	Industrial Development Area
KAMCO	Kerala Agro Machinery Corporation
KSPCB	Kerala State Pollution Control Board
MCM	Million Cubic Metre
MLD	Million Litres per Day

MSME	Micro, Small and Medium Enterprises
NIC	National Industrial Classification
P&M/c	Plant and Machinery cost
PAHs	Polycyclic Aromatic Hydrocarbons
PCB	Pollution Control Board
PMKSY	Pradhan Mantri Krishi Sinchayee Yojana
PSU	Public Sector Undertaking
STP	Sewage Treatment Plant
SWM	Solid Waste Management
TSS	Total Suspended Solids
ULB	Urban Local Body

1. Introduction

The Industrial Profile Report of the Periyar River Basin is conceived as a structured baseline assessment of the industrial landscape within the basin, encompassing spatial distribution, scale of operations (Micro, Small and Medium Enterprises - MSME), sectoral composition, investment patterns, employment generation, infrastructure availability, and environmental implications. An industrial profile serves as a diagnostic and planning instrument that systematically compiles district- and basin-level industrial data to support evidence-based policy formulation, infrastructure planning, and environmental regulation. In river basins such as Periyar, where ecological sensitivity coexists with concentrated industrial growth, particularly in downstream stretches, industrial profiling becomes essential for identifying industrial clusters, evaluating resource utilization (especially land and water), and assessing potential pollution sources. The scope of this report therefore extends beyond a mere inventory of industrial units; it integrates industrial statistics with basin-level environmental considerations to support sustainable industrial development and river basin management. This report focuses on pollution load assessment, drain management, wastewater treatment and ecological restoration. It also contains detailed information about Industrial categorization based on:

1. Pollution potential (Red, Orange, Green, White), category (MSME & Large), nature (manufacturing/service) and, item (product/service);
2. KINFRA park and mini-industrial estates created by DIC, SIDCO for decentralized industrial growth;
3. Spatial distribution of industries in 3 types: block-level, taluk-level and local body-level;
4. Sector-wise distribution;
5. Industrial water demand and
6. Wastewater generation

The Industrial Profile of the Periyar Basin is directly linked to the objectives of the *Nirmal Dhara* initiative, which is one of the missions in the CAMP (Condition Assessment & Management Plan) project that aims for pollution free rivers. Water consumption and effluent discharge data are fundamental to estimating industrial pollution loads entering the river. Industrial inventory data integrated with water quality and drain outfall mapping, serves as a foundational dataset for calculating pollutant contributions and prioritizing regulatory interventions under Nirmal Dhara.

Periyar is the longest river (~260.7 km) in the state of Kerala which originates from the Chokkampatti malai of Sivagiri Hills, Western Ghats in the Idukki district and eventually drains into the Arabian Sea. The Periyar River Basin (shown in Figure 1) has a total area of 5216 km², which extends over two states, Kerala and Tamil Nadu. The Periyar Tiger Reserve (PTR) is a biodiversity hotspot of the Periyar River Basin, supporting various flora and fauna. The basin includes 17 dams, with Idukki and Idamalayar being the most significant due to their role in irrigation and power generation.

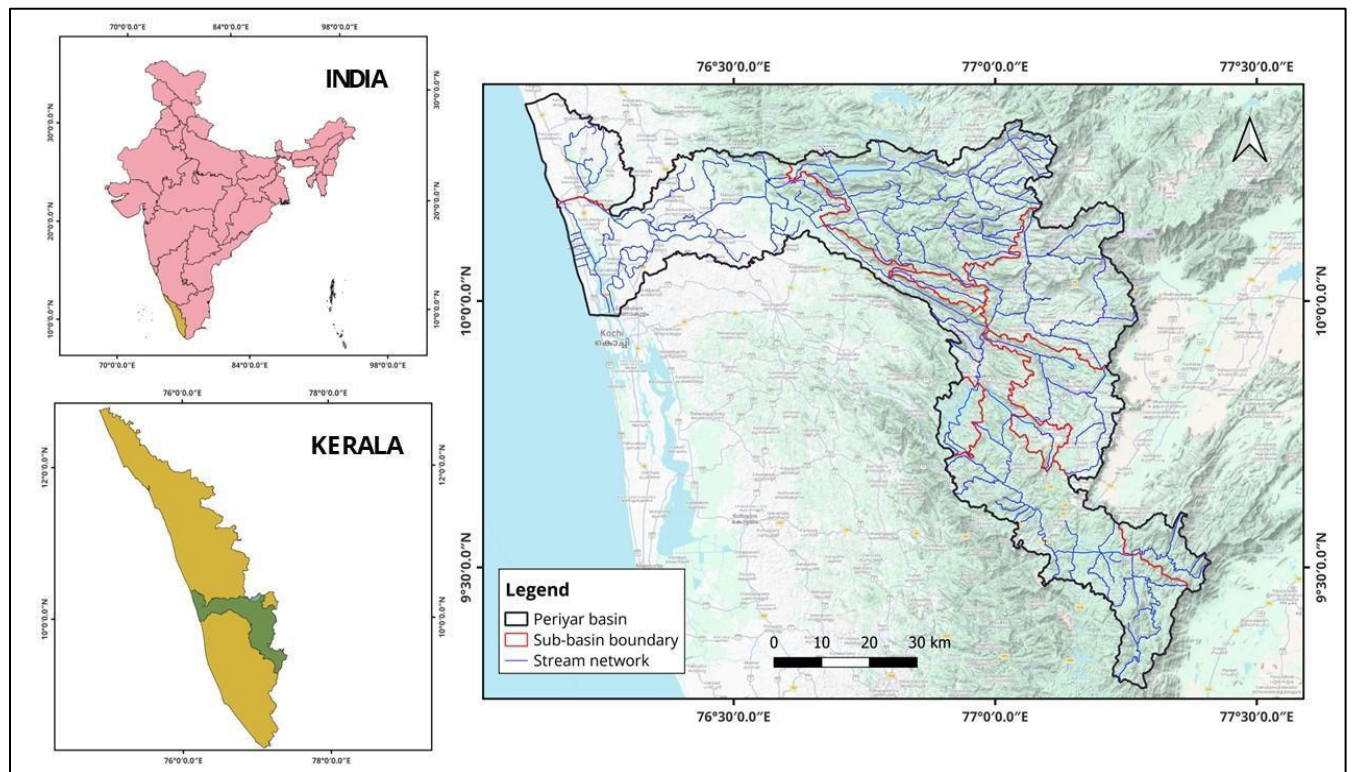


Figure 1 Periyar river basin

Industrial activities constitute a critical component of regional economic development within the Periyar River Basin, contributing significantly to employment generation, capital formation, value addition, and linkages with agriculture, trade, and service sectors. For example, major industrial establishments such as Fertilisers and Chemicals Travancore (FACT), Bharat Petroleum Corporation Limited (BPCL) Kochi Refinery, Cochin Shipyard Limited, and the industrial clusters

of Eloor–Edayar have played a vital role in supporting manufacturing, logistics, trade, and ancillary service industries within the basin, providing local employment and contributing to economy (Shah et.al., 2013). The presence of micro and small-scale industries in upstream districts such as Idukki and larger industrial concentrations in downstream districts such as Ernakulam reflects varying stages of industrialization within the basin. Industrial growth stimulates infrastructure development such as roads, power supply, water systems which further enhances local livelihoods through direct and indirect employment. However, industries are also major consumers of water resources and potential generators of wastewater, effluents, emissions, and solid or hazardous waste. Therefore, while industrialization strengthens the economic base of the basin, it simultaneously necessitates systematic monitoring and regulatory oversight to ensure that economic gains do not compromise the ecological integrity and water quality.

1.1. Overview of Industrial Sectors in the Periyar River Basin

The Periyar river, which traverses the districts of Idukki, Ernakulam, and Thrissur, forms a vital hydrological and ecological system supporting domestic water supply, industrial activities, hydropower generation, fisheries, and agricultural production. However, rapid industrialization within the Aluva–Kochi Industrial Belt particularly along the Angamaly to Kochi stretch has imposed substantial pressure on the river system and its connected groundwater resources. This region hosts more than 50 large and medium industries and over 2,500 small-scale industrial units, encompassing fertilizer, pesticide, chemical, petroleum refining, metal processing, radioactive mineral processing, rubber, battery manufacturing, and allied sectors. Industries in the Eloor–Edayar region alone abstract approximately 189,343 m³ of water per day from the river, and discharging nearly 75% of the abstracted volume as wastewater along with significant pollutant loads (Earth5R). It is estimated that around 260 million litres of industrial effluents enter the Periyar River daily from the Kochi industrial belt. Overall, in Kerala, the Periyar River Basin represents a critical example of industrially induced surface and groundwater degradation.

Although the major geographical extent of the Periyar River Basin lies within Idukki district, the presence of industries in Idukki is comparatively low when compared to Ernakulam and Thrissur districts. Industries in Ernakulam district, particularly within the Eloor–Edayar industrial belt along the Periyar River, comprise a dense cluster of chemical and manufacturing units that depend on the

river for water and disposal, contributing significantly to industrial pollution and groundwater contamination. Idukki is classified as an industrially backward district due to physiographic and land availability constraints (District Survey Report of Minor Minerals, 2016). Approximately 97% of the district comprises rugged mountains and forested terrain (Slope > 15°), with only about 3% categorized as middle land in the western part. Lowland areas are virtually absent, and more than 50% of the total district area is under forest cover. The limited availability of developable land for industrial infrastructure is one of the primary constraints restricting large-scale industrial establishment, thereby influencing the industrial density and spatial distribution within the basin.

As per the MSME-Development Institute under the Ministry of MSME, Thrissur district has 28,290 registered industrial units out of a total of 29,940 industrial units, indicating a high degree of industrial formalization. The district comprises 11 Medium and Large-Scale units, reflecting a relatively limited presence of large industries. Employment in the organized industrial sector is notable, with 5,892 persons employed in Medium and Large-Scale industries. The district's industrial infrastructure includes 5 Development Areas / Development Plots (DA/DP) and 8 Mini Industrial Estates (MIEs), demonstrating institutional support for industrial development (Government of India, Ministry of MSME, MSME-Development Institute, Thrissur).

As per the District Industries Centre (DIC), Idukki (January 2022 data), the district has 5,580 registered industrial units with a total investment of ₹133,551.03 lakhs and total employment of 22,454 persons. Of these, 11 are Medium Scale units, 315 are Small Scale units, and 5,254 are Micro Scale units, indicating a predominance of micro-enterprises within the district industrial structure (industry.kerala.gov.in).

According to the KSPCB, 2023 report, a total of 93,340 units across the State were issued Consent to Operate (CTO) for discharge / emission and disposal of hazardous / biomedical waste. Of these, 4,646 units are located in Idukki district. For pollution load estimation and regulatory prioritization within the Periyar Basin, Industries have been categorized in 4 categories based on the CPCB pollution categorization guidelines (2016), as shown in Table 1. In this classification, “White” category industries are those which are practically non-polluting such as Scientific instrument manufacturing, Solar power generation through photovoltaic cell, etc. Recently, New Industrial categorization has been introduced based on Cumulative Pollution Index score in February, 2025.

This Cumulative PI is calculated from Water Pollutant Score (PIW), Air Pollutant Score (PIA) and Waste Pollutant Score (PIH). According to this 2025 classification, Industries has been categorized in five categories as following:

- Red ($PI > 80$)
- Orange ($55 \leq PI < 80$)
- Green ($25 \leq PI < 55$)
- White ($PI < 25$)
- Blue (Additional category for essential environmental services, such as Waste Management. However, Industrial data for the Idukki district based on 2025 classification is not available currently)

Table 1 Industrial Categorization based on Pollution Index Score (2016 methodology)

Sl. No	Category	Pollution Potential	Pollution Index Score	Idukki CTO units
1	Red	High	≥ 60	464
2	Orange	Moderate	41 to 59	1845
3	Green	Low	21 to 40	2302
4	White	None	≤ 20	35
Total				4646

Table 2 Details of Mini Industrial Estates under DIC

Sl. No.	Name of Mini Industrial Estates	No. of Sheds	Area (sqft)
1	Manakkad	10	7,200
2	Udumbanoor	10	6,900
3	Rajakumari	10	6,000
4	Kattappana	10	7,200

The DIC has developed four Mini Industrial Estates within Idukki district to promote decentralized industrial growth as given in Table 2. In addition, Mini Industrial Estates have been established by the Kerala Small Industries Development Corporation Limited (SIDCO), which provides infrastructure support, raw material supply, and marketing assistance to MSMEs. In Idukki district, SIDCO Mini Industrial Estates are located at Olamattom, Kodikulam, and Adimali. Out of which, two are located outside and only one - Adimali is located inside of the Periyar basin as shown in Figure 2. Furthermore, Kerala Industrial Infrastructure Development Corporation (KINFRA) has

developed specialized industrial infrastructure within the basin. A KINFRA Park is located in Rajakumari Grama Panchayat with an area of 55,000 sq.ft, providing sector-specific infrastructure support including power, water, roads, and built-up space to facilitate industrial growth (industry.kerala.gov.in).

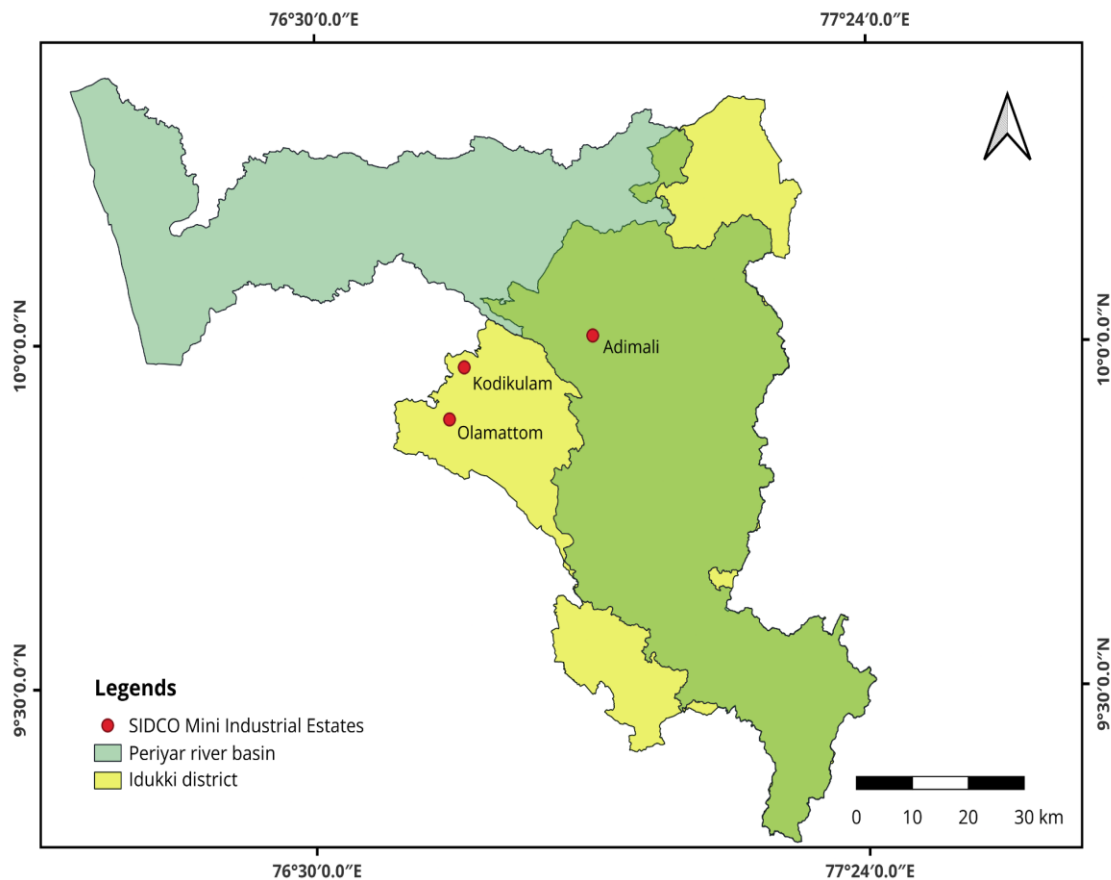


Figure 2 Details of Mini Industrial Estates formed by SIDCO in Idukki district

The data for this Industrial Profile Report of the Periyar River Basin was primarily collected from the Directorate of Industries and Commerce, Kerala. For detailed information regarding raw material consumption, by-products, waste generation, and industrial water consumption, requisitions were submitted to the Kerala State Pollution Control Board (KSPCB); however, detailed unit-level data for Idukki district are yet to be received. Table 3 gives a summary of data collected for the preparation of Industrial profile of Periyar river basin and their respective sources. These datasets collectively form the analytical basis for assessing industrial structure, environmental implications, and pollution load dynamics within the Periyar River Basin.

Table 3. Summary of data collected from various sources

Sl. No.	Type of data	Source
1.	All primary data	Directorate of Industries and Commerce (DIC), Kerala
2.	District level industrial data including location details, MSME categorization and sector-wise classification	DIC
3.	Raw material consumption, by-products, waste generation, and industrial water consumption*	KSPCB
4.	Annual and Monthly reports	KSPCB
5.	District Industrial profile reports	MSME-Development Institute
6.	Economic review reports	Kerala State Planning Board

** Indicates that the data has not been received from the source*

2. Industrial profile inventory

2.1. Total Industrial Units

2.1.1.Total Industrial Units in Ernakulam District

As a part of the industrial inventory preparation for the Periyar River Basin, an initial understanding of the industrial base of Ernakulam was established using data from the Annual Survey of Industries (2021–22). The district accounts for 1590 registered operating factories, contributing approximately 19.9% of the total factories in Kerala, indicating its position as the most industrially advanced district in the state (Directorate of Economics and Statistics Kerala, 2022).

To further understand the spatial distribution of industries, data on industrial estates and development areas were analyzed. As per records from MSME Development Institute Thrissur, a total of six major industrial areas including Development Areas (DA) and Development Plots (DP) are present within the district. These include key industrial hubs such as Edayar, Aluva, Angamaly, Vazhakulam, and Kalamassery. Notably, all six industrial areas fall within the hydrological boundary of the Periyar River Basin, making them highly relevant for basin-level industrial assessment (MSME Development Institute Thrissur, 2019). Together, these industrial areas comprise 761 developed plots, out of which 698 units are currently in production, indicating a high level of industrial occupancy and activity within the Periyar River Basin in Ernakulam district. This

refined dataset forms the basis for subsequent analysis, including category-wise, sector-wise, spatial, and nature-wise distribution of industries in the study area.

2.1.2.Total Industrial Units in Thrissur District

As part of the industrial inventory preparation for the Periyar River Basin, an initial understanding of the industrial base of Thrissur was established using data from the Annual Survey of Industries (2021–22). The district accounts for 912 registered industries, contributing approximately 11.8% of the total factories in Kerala, indicating its position as the most industrially advanced district in the state (Directorate of Economics and Statistics Kerala, 2022). To further understand the spatial distribution of industries, data on industrial estates and development plots were analyzed. As per records from MSME Development Institute Thrissur, a total of six Development Plots (DP) are present within Thrissur district, namely Athani, Ayyankunnu, Kunnankulam, Puzhakkalpadam, Velakode, and Varavoor. Together, these industrial areas account for a total land acquisition of 124.65 hectares, out of which 104.69 hectares have been developed. The dataset indicates the presence of 237 industrial plots, all of which have been allotted, reflecting full occupancy of the available industrial space. Out of these, 210 units are currently in production, indicating a high level of industrial activity within the district. However, certain industrial areas such as Puzhakkalpadam and Varavoor show no developed land or active industrial units, suggesting that these locations are either in the initial stages of development or yet to become operational.

2.1.3.Total Industrial Units in Idukki District

As part of the industrial inventory preparation for the Periyar River Basin, a comprehensive dataset comprising 6001 industrial units in Idukki district was initially obtained. A primary screening and spatial validation were undertaken to delineate only those industrial units falling within the hydrological boundary of the Periyar River Basin. Industrial establishments located outside the basin limits, particularly those concentrated in Thodupuzha Municipality, were excluded from the analysis. Further data cleaning involved the removal of closed units and duplicate entries to ensure accuracy and relevance of the industrial database. Following this basin-specific filtration and operational status verification, a total of 2164 currently functioning industrial units were identified within the Periyar River Basin in the Idukki district. This refined dataset forms the analytical base for category-wise, sector-wise, and nature-wise assessment of industries.

2.2. Category-wise Distribution (Micro / Small / Medium / Large)

Industrial units within the basin are classified into micro, small, medium, and large categories based on investment in plant & machinery/equipment and annual turnover (Classification of 2020). This categorization is critical for understanding the scale of capital investment, employment intensity, infrastructure demand, and potential environmental footprint of industrial activities.

2.2.1. Category-wise Distribution (Micro / Small / Medium / Large) - Ernakulam

Large Scale Industries in Ernakulam

A total of 34 large-scale private sector industries are identified within the Periyar River Basin in Ernakulam as indicated in Table 4. These industries are mainly involved in sectors such as food processing, rubber and tyre manufacturing, chemicals, paper and packaging, and engineering. Food and agro-based industries form a major share, including rice mills, spice processing, and seafood units. Rubber and tyre industries are also important, with units like tread and tyre manufacturing. Other sectors include chemical extraction, printing, paper products, and machinery manufacturing. A major power generation unit is also present in the basin. Overall, the large-scale industries show a mix of agro-based and industrial activities, contributing to employment and economic development in the region.

A total of 10 large-scale public sector industries is located within the Periyar River Basin in Ernakulam as indicated in Table 5. These include major units in sectors such as fertilizers, petrochemicals, chemicals, heavy engineering, and mineral processing. Key industries include FACT, Travancore Cochin Chemicals, HMT, and Hindalco, which are important for large-scale production and employment. These industries have high investment and play a major role in the industrial economy of the region.

Table 4 Large Scale Private Industries in Periyar River Basin - Ernakulam

Source: MSME Development Institute Thrissur (2019)

Sl.no	Name of Enterprise	Latitude	Longitude	Product	Value of P&M/c (Rs in Crore)	Employees (Nos)
1	Hi-Build Coatings(P)Ltd, D.P. Kalamassery	10° 5'48.12"N	76°20'29.80"E	Paint manufacturing	16	1476
2	Appollo Tyres.Pvt Ltd, Kalamassery	10° 3'40.30"N	76°19'25.16"E	Tyre & Precured tread rubber manufacturing	145	950
3	Kancor Ingredients, IDA, Angamaly	10°10'43.98"N	76°22'15.01"E	Oleo resin, Spice extracts	18	270
4	Cochin Kagaz Ltd., Karukutty, Angamaly	10°12'46.42"N	76°22'50.16"E	Craft Paper, White Liner, Craft liner Etc	40	200
5	BSES Kerala Power Ltd, Udyogamandal	10° 4'27.45"N	76°19'8.63"E	Electricity	564.68	126
6	RCS Cartons (P) Ltd., Vettickal.P.O	9°55'1.80"N	76°25'8.96"E	Carton box	96	16
7	Manalil Industries, Vettickal.P.O	9°54'39.04"N	76°24'52.78"E	Moulded Plastic Industrial accessories	196	9
8	Namiattukudy rice mill	10° 9'9.63"N	76°28'26.79"E	Rice, Flour etc	1260	196
9	K.K.R Rice mills	10° 9'2.41"N	76°27'9.88"E	Rice, Flour etc	779	96
10	AKAY spices	10° 9'40.28"N	76°30'4.14"E	Spices	25	51
11	CAP SEA foods	9°58'38.67"N	76°14'30.73"E	Food process	500	90
12	Cochin Security Press	10° 3'29.12"N	76°17'8.07"E	Printing	500	12
13	FINPACK Market Road, Mini Harbor, Palliport PO	10°10'0.35"N	76°10'53.57"E	Paper cup	40	6
14	Samuel Ice Factory, Mini Harbor, Palliport PO, Ernakulam	NA	NA	Ice	76	4
15	Chrismaria Food Packers,Narakkal	10° 2'20.48"N	76°13'4.00"E	Sauce, jam, pickles	42	9

16	Photone	10° 6'45.66"N	76°21'8.35"E	Printing	56	6
17	Vithayathil , Digital Lab	10° 6'22.45"N	76°21'24.92"E	Printing	32	5
18	Inks Creative	10° 5'51.46"N	76°21'31.72"E	Flex printing	30	3
19	Cherupushpam, Offset	10° 5'48.79"N	76°21'33.14"E	Offset printing	46	7
20	Pazhupparambath Foods, Valluvally, Koonammavu-PO	10° 6'53.14"N	76°15'44.29"E	Food products	81	9
21	Mariam Paper Containers Pvt.Ltd, Chendamangalam PO	10° 9'55.03"N	76°14'52.40"E	Manufacture of paper containers	268	26
22	L B Business Forms, No.13/200a, Kaitharam- PO	10° 7'0.61"N	76°14'30.77"E	Paper products	31	6
23	Carborundum Universal Ltd, K D Plot P.o South kalamassery	10° 2'47.37"N	76°18'29.25"E	Minerals	14495	336
24	M/s.paravur Engineers,peruvaram	10° 8'22.60"N	76°14'16.08"E	Chapatti making machine	15	2
25	DNA Automation,perumpadanna	10° 8'37.83"N	76°12'56.33"E	Wooden furniture	24	2
26	M/s.Khanu& sons,N.paravur	10° 9'4.44"N	76°14'33.43"E	Hollow bricks	12	4
27	M/s.Adhil signs,N.Parur	10° 8'56.57"N	76°14'11.34"E	Flex,sign board,momentos	25	5
28	M/s.Kerala Ayurveda Ltd,	10°13'31.11"N	76°11'58.03"E	Ayurvedic medicine	385	120
29	Arjuna Natural Extracts Ltd. D A Edayar	10° 5'6.88"N	76°18'19.61"E	Processed spices	2236	94
30	Prima Agro Ltd, Edayar	10° 4'57.29"N	76°18'43.74"E	Cattle feed	818.98	52
31	SriSreenivasa Roller Flour Mill Pvt Ltd	10° 5'16.43"N	76°18'21.45"E	Flour milling	457.96	26
32	Eastern Treads	10° 1'12.86"N	76°18'36.53"E	Tyre treads	900	130
33	Rado Tyres	9°59'46.50"N	76°16'49.16"E	Tyres	1880	250
34	Palappillil Crub Rubbers	10° 8'38.33"N	76°41'56.62"E	Rubber products	600	130

Table 5 Large Scale PSU Industries in Periyar River Basin - Ernakulam

Source: MSME Development Institute Thrissur (2019)

Sl.No	Name of Enterprise	Latitude	Longitude	Product	Value of P&M/c (Rs in Crore)	Employees (Nos)
1	KAMCO,Athani	10° 9'25.07"N	76°21'17.40"E	Agro Machineries	16.15	235
2	Transformers & Electrical Kerala (TELK) Ltd, Angamaly	10°10'54.24"N	76°22'39.93"E	Power Transformers	43.42	605
3	Kerala State Bamboo Corporation Ltd., Angamaly	10°11'9.22"N	76°22'25.83"E	Bamboo Products	15.40	242
4	HMT, Kalamasserry	10° 2'54.01"N	76°20'22.69"E	Machine Tool Manufacturing	110	329
5	Forest Industries Travancore (FIT) Ltd., Aluva	10° 5'26.13"N	76°20'39.69"E	Wooden Furniture	3.52	86
6	Hindalco Industries Ltd, Eloor	10° 4'45.12"N	76°19'38.92"E	Alluminium,Alloys	64.44	340
7	HIL Ltd, Udyogamandal	10° 4'39.03"N	76°17'50.45"E	DDT,Dicofol	44.98	242
8	Travancore Cochin Chemicals Ltd PB No. 4, Udyogamandal	10° 4'27.13"N	76°18'12.91"E	Caustic soda, Liquid Chlorine, HCl acid, soda bleach	246.16	344
9	FACT LTd, Eloor, Udyogamandal	10° 4'19.64"N	76°18'21.03"E	Fertilizer& Petrochemicals, Engg. Consultancy Service	1374.29	2708
10	Indian Rare Earths Ltd, Eloor	10° 4'49.31"N	76°17'48.16"E	Minerals	NA	NA

Table 6 Medium Scale Industries in Periyar River Basin – Ernakulam (Source: MSME Development Institute Thrissur, 2019)

Sl. No	Name of Enterprise	Product	Latitude	Longitude	Value of P&M/c (Rs in Crores)	Employees (No)
1	M/s.Social Saw Mills,Kalamassery	Wooden chair Window	10°3'22.01"N	76°19'14.68E	5.5	115
2	National Paints Factories, Angamaly	Paint	10°10'39.38"N	76°22'19.23"E	5	55
3	Hankook Latex Pvt.Ltd. Irapuram	Condoms, Other dipped Latex products, Rubber Hose	10° 4'0.20"N	76°29'37.99"E	5.9	51
4	Win Ply And Boards, Kothamangalam	Plywood, Blocks Wooden	10° 6'8.45"N	76°34'35.26"E	5.35	12
5	Malaya Rub Tech Industries, IDA, Edayar	Insulation Sheets & Board Rubber	10°4'50.99"N	76°18'56.63"E	5.45	60
6	Diamond Food Products, Koovapady	Broken Rice, Rice Bran, Paddy Husk	10°9'12.48"N	76°28'28.71"E	7.55	16
7	Resitech Electricals, IDA, Aluva East	Transformers 11kv except for captive consumption	10°5'10.36"N	76°24'9.82"E	6.25	12
8	Geeyem Agro Mills, Koovapady	Rice Milling	10°9'57.12"N	76°29'41.66"E	8.16	13
9	Pai &Company Printing Division Jew Street, EKM	Offset printing, Books Binding, Computer Designing	9°58'38.36"N	76°16'41.19"E	1	08
10	Siggil Indstl. Gases, Eloor	Carbon Dioxide solid, Carbon Dioxide Gas	10° 4'3.82"N	76°17'50.66"E	5.17	08
11	J &A Foundations Pvt.Ltd, Vennala, Kochi	Piling	10°0'41.09"N	76°18'44.76"E	4.52	137
12	Choice Blocks, Kalamassery	Cement Product Others	10°1'26.97"N	76°18'53.90"E	5.8	10
13	Leetha Industries, IDA, Kalamassery	Paper cups	10°2'59.33"N	76°18'48.36"E	6	80
14	Beena Apparels, Perumbavoor	Shirts	10°6'52.65"N	76°28'45.54"E	6.64	60
15	Microtrol Sterilization Service, IDA,	Sterilization Service	10°4'58.53"N	76°18'57.13"E	5	10

16	Thulabhavan, Ernakulam	Electronic components	9°59'4.53"N	76°16'38.44"E	5.03	6
17	Alpha Paints, DP, Angamaly	Paints, Varnish	10°10'47.42"N	76°22'10.99"E	6.18	8
18	Logic bond Technologies Pvt Ltd, Aluva	Software development	10°6'21.59"N	76°21'41.64"E	8.8	8
19	V C Pharmaceutic als, N paravur	Veterinary Preparations	10°9'10.43"N	76°13'42.54"E	3	11
20	Print N Unity, Kochi	Printing and other activities	10°0'34.57"N	76°18'14.61"E	5.9	5
21	Silpi Agrotech Pvt Ltd, Vazhakulam	Cattle feed	10°5'28.22"N	76°25'5.92"E	5	36
22	Meh Roof Polymers Rayonpuram	Other Plastic Product	10°7'31.52"N	76°27'57.55"E	5	12
23	Resitech Electricals, Vazhakulam	Transformer	10°5'10.32"N	76°24'9.81"E	7.25	10
24	Premier Aluminium Industries, Angamaly(S)	Aluminium based products	9°58'41.90"N	76°16'47.87"E	6.5	18
25	Lucia Industries, Vazhakulam	Paper containers and boxes	10°10'47.71"N	76°22'6.66"E	7.5	26
26	Grove Limited, 45aDPA Kalamassery	Banana Chips, Cashew nut Fried	10°2'51.00"N	76°18'35.16"E	5.47	50
27	Delta Wood Panels Perumbavoor	Treated Rubber Wood Products	10°6'30.95"N	76°29'38.79"E	5	20
28	Sea Blue Shipyard Kochi	Ship Building	9°58'29.49"N	76°14'34.62"E	9	60
29	Sea Blue Shipyard Kochi	Ship Repairing	9°58'29.64"N	76°14'34.54"E	5	60
30	Mercham Limited	Rubber Chemicals	9°58'31.44"N	76°16'44.89"E	7.45	141
31	Kalady Rice Millers, Kalady	Refined Rice Bran Oil	10°10'19.97"N	76°26'0.85"E	6.598	33
32	Eastern Condiments, Edappaly	Spices Spices mixes	10°1'13.04"N	76°18'36.81"E	9.2	307
33	Metro m Sand Inds.Kalady	M Sand, M Sand Fine	10°10'28.62"N	76°26'8.27"E	5.57	12
34	PDP Central Society, Kalady	Milk Products Icecream	10°10'33.72"N	76°24'40.47"E	5.005	119
35	Jrunique Printers	Paper Products	10°11'47.18"N	76°23'20.59"E	7.5	40

Medium-Scale Industries in Ernakulam

A total of 35 medium-scale industrial units are identified within the Periyar River Basin in Ernakulam district. These industries include both manufacturing and service activities. Table 6 showed the details of medium-scale industries within the Periyar River Basin.

Most of the units are related to agro-based and food processing sectors such as rice milling, spice processing, cattle feed production, and dairy products. There are also industries related to rubber, plastic, chemicals, aluminium products, and engineering works, including transformer manufacturing. Some units are involved in printing, packaging, paper products, and software development, showing the presence of service-based industries. These industries are mainly located in areas such as Kalamassery, Eloor, Angamaly, Aluva, Perumbavoor, and Kalady, which are known industrial regions in the basin.

Micro and Small Units in Ernakulam

The industrial structure of Ernakulam is predominantly driven by micro and small enterprises, as indicated by the presence of 27,413 operational units as of 31.03.2019, based on data from the DIC, Table 7 shows the details of existing micro and small enterprises and artisan units in Ernakulam district.

A sector-wise analysis shows that agro and food-based industries form the largest segment with 5,225 units, highlighting the importance of agro-processing activities in the district. This is followed by repairing and servicing units (4,959) and other miscellaneous industries (4,852), indicating a strong presence of service-oriented activities. Among manufacturing sectors, engineering units (3,612) and wood-based industries (2,268) contribute significantly, reflecting industrial diversity. The presence of rubber, plastic, and chemical-based industries also indicates linkages with traditional and petrochemical-based industrial activities, especially in major industrial regions. In terms of investment, metal-based industries and garment sectors show relatively higher capital involvement. Employment generation is notably high in the ‘others’ category and agro-based industries, indicating their importance in livelihood support (MSME Development Institute Thrissur, 2019).

Table 7 Details of existing Micro and Small enterprises and artisan units in Ernakulam*(Source: MSME Development Institute Thrissur, 2019)*

Sl. No	NIC Code	Type Of Industry	No. of Units	Investment (Lakh Rs.)	Employment
1	11	Agro & Food based	5225	89710.76	43085
2	11	Soda water/Packaged drinking water	169	6259	1105
3	13	Woolen, silk & artificial thread based clothes	16	194	191
4	14	Ready-made garments & embroidery	1764	103214.32	13545
5	31	Wood/wooden based furniture	2268	9526.6	19027
6	17	Paper & Paper products	502	4458.14	4304
7	15	Leather based	167	16728.15	1433
8	20	Chemical/Chemical based	874	19133.45	13389
9	22	Rubber, Plastic & Petro based	924	22877	7863
10	23	Mineral based	155	34248	1438
11	25	Metal based (Steel Fab.)	810	102481.11	7473
12	24	Engineering units	3612	36730.18	28798
13	27	Electrical machinery and transport equipment	1017	48230.74	10009
14	95	Repairing & servicing	4959	43009.92	23288
15	96	Others	4852	85158.63	56468
16	--	Artisan Units	99	509	202
Total			27413	622469	231618

2.2.2. Category-wise Distribution (Micro / Small / Medium / Large) - Thrissur**Large Scale Industries in Thrissur**

Several large-scale industries are present in Thrissur district, including both private sector and public sector units. Major industries in the district are related to textiles, cattle feed, steel products, tyres, pharmaceuticals, and industrial tools. Important industrial units include Kerala Feeds, Apollo Tyres, Kerala Lakshmi Mills, Oushadhi, and Steel Industrials Kerala Limited. However, spatial analysis carried out using the Periyar River Basin boundary shows that these industries are located outside the basin area as indicated in Table 8.

Table 8 Large Scale Industries in Thrissur District (*Source: MSME Development Institute Thrissur, 2019*)

Sl. No	Name of Enterprise	Latitude	Longitude	Product	Ownership and control
1	KCPL (Nitta Gelatine India Ltd) Kadukutty	10°15'30.91"N	76°19'32.64"E	Gelatine	PVT
2	Kerala Solvent Extraction Ltd., Irinjalakuda & Koratty	10°15'53.71"N	76°20'55.37"E	Cattle feed, solvent extract & Dairy products	PVT
3	Thrissur Co-operative Spinning Mill, Vadakkanchery	10°38'46.81"N	76°17'2.46"E	Textiles	Co-operative
4	Kerala Feeds, Kallettumkara	10°21'7.41"N	76°16'22.42"E	Cattle Feeds	PSU
5	Kerala Lakshmi Mills, Pullazhy	10°31'17.94"N	76°10'18.53"E	Yarn	PVT
6	Alagappa Textiles, Alagappa Nagar	10°25'58.11"N	76°16'20.69"E	Textiles	PVT
7	Steel & Industries Foreign (SIFL), Athani	10°37'4.11"N	76°12'45.34"E	Steel	PSU
8	Apollo Tyres, Perambra	10°20'52.13"N	76°19'3.43"E	Tyres	PVT
9	Carborandum Universal, Koratty	10°16'38.48"N	76°23'15.09"E	Tools	PVT
10	The Pharmaceutical Corporation of Kerala (Oushadhi), Kuttanellur	10°29'33.68"N	76°15'19.22"E	Ayurvedic Medicines	PSU
11	Sitaram Mills, Poonkunnam, Thrissur	10°32'6.71"N	76°12'5.37"E	Textiles	PSU
12	Steel Industrials Kerala Limited, Athani	10°36'59.19"N	76°12'46.67"E	Steel	PSU

PSU-Public sector; PVT-Private Sector

Medium-Scale Industries in Thrissur

Data regarding medium-scale industries in Thrissur were not available at the time of analysis

Micro and Small Units in Thrissur

As per the available data, a total of 16,272 micro and small industrial units are present in Thrissur district, with a total investment of 158,150 lakh rupees and employment of 90,365 persons. The sector is dominated by “others” category and agro-based industries, which together account for a large share of total units and employment. Agro-based industries alone contribute significantly with 2,866 units and employ a large workforce. Traditional sectors such as textile, jute, garments, and leather industries also have a strong presence, indicating the importance of small-scale and labour - intensive industries in the district. In addition, mineral-based, engineering, and metal-based industries form a considerable share of the industrial structure. Industries related to rubber, plastic, and petro-based products, as well as electrical machinery and transport equipment, also contribute to the industrial base, though in smaller proportions. Repairing and servicing units further add to the service-oriented segment of the sector. Table 9 shows the details of existing micro and small enterprises and artisan units in Thrissur district.

Table 9 Details of Existing Micro and Small Enterprises and Artisan Units in the Thrissur District
(Source: MSME Development Institute Thrissur 2019)

Sl. No	NIC Code	Type of Industry	No of Units	Investment (Lakhs Rs.)	Employment
1	01	Agro Based	2866	24639	16826
2	22	Soda Water	35	268	84
3	23	Cotton Textile	21	30	234
4	24	Woolen, silk and artificial thread-based clothes	1754	9125	8918
5	25	Jute & Jute based	1144	10611	7552
6	26	Ready-made garments & embroidery	843	7719	5081
7	27	Wood/wooden based furniture	46	267	254
8	28	Paper & Paper products	212	2152	942
9	29	Leather based	690	15942	4206
10	31	Chemical/Chemical based	2	28	16
11	30	Rubber, Plastic & petro based	275	3809	1208
12	32	Mineral Based	1789	15494	9117
13	33	Metal based (Steel Fab.)	523	5034	3868
14	35	Engineering units	1686	8028	7604
15	36	Electrical machinery and transport equipment	761	14712	3100
16	97	Repairing & Servicing	275	2196	971
17	01	Others	3350	38096	20384
Total			16272	158150	90365

2.2.3. Category-wise Distribution (Micro / Small / Medium / Large) - Idukki

Table 10 indicates the classification of industries in Idukki district. Only 7 units (0.32%) are classified under the large-scale category in Idukki. Table 11 provides the list of large-scale industries located within the basin. The relatively low presence of large-scale industries in Idukki can be mainly attributed to land scarcity, challenging topography, extensive forest cover, and the limited availability of developed industrial infrastructure. A total of 4 units (0.18%) fall under the medium-scale category, as indicated in Table 12.

Table 10 Classification of enterprises in Idukki district*(Source: Kerala Industrial Policy, 2023)*

Sl. No.	Category	Investment in P & M/c (Crores)	Turnover (Crores)	Operational industrial units
1	Micro	≤1	≤5	2,114 units (97.69%)
2	Small	≤10	≤50	39 units (1.80%)
3	Medium	≤50	≤250	4 units (0.18%)
4	Large	Between 50-300	250-300	7 units (0.32%)
Total				2,164 units

Table 11 List of Large-Scale Industries in Idukki District

Sl. No.	Name of Industry	Location (LSGI)	Industry Type (Nature)	Industrial Sector
1	Masala Powder Division Eastern Condiments Private Limited	Adimali	Manufacture	Agro food, Beverage, Meat/ Fish Product and Processsing
2	Eastern Condiments Pvt Ltd	Adimali	Manufacture	Agro food, Beverage, Meat/ Fish Product and Processsing
3	Flavors	Munnar	Manufacture	Agro food, Beverage, Meat/ Fish Product and Processsing
4	Meenakshi Engineering Works, Rajakumary	Rajakumary	Manufacture	General Engineering & Precision Engineering (Steel, Iron etc Products / fabrication)
5	St George Water Service Station	Ayyappan covil	Service	Other Service Activities
6	Shiva Furniture	Vathikudy	Manufacture	Wood Products
7	Ponnu Constructions	Munnar	Manufacture	Other manufacturing activities

Table 12 List of Medium-Scale Industries in Idukki District

Sl. No.	Name of Industry	Location (LSGI)	Industry Type (Nature)	Industrial Sector
1	Kadalaar Tea Factory	Munnar	Manufacture	Agro food, Beverage, Meat/ Fish Product and Processsing
2	Kanniamallay Tea Factory	Munnar	Manufacture	Agro food, Beverage, Meat/ Fish Product and Processsing
3	Tata Global Beverages Limited Packeting Centre	Pallivasal	Manufacture	Agro food, Beverage, Meat/ Fish Product and Processsing
4	Kattappana Dairy	Kattappana (M)	Manufacture	Other Service Activities

Table 13 List of Small-Scale Industries in Idukki District

Sl. No.	Name of Industry	Location (LSGI)	Industry Type (Nature)	Industrial Sector
1	Periakanal Tea Factory	Chinnakkanal	Manufacture	Agro food, Beverage, Meat/ Fish Product and Processsing
2	Upper Surianalle Factory	Chinnakkanal	Manufacture	Agro food, Beverage, Meat/ Fish Product and Processsing
3	Aromatic Distillation Unit Kdhp Company Pvt Ltd	Devikulam	Manufacture	Agro food, Beverage, Meat/ Fish Product and Processsing
4	Devikulam Tea Factory	Devikulam	Manufacture	Agro food, Beverage, Meat/ Fish Product and Processsing
5	Arivikad Tea Factory	Devikulam	Manufacture	Agro food, Beverage, Meat/ Fish Product and Processsing
6	Gudera Tea Factory	Devikulam	Manufacture	Agro food, Beverage, Meat/ Fish Product and Processsing
7	Chittavurrai Tea Factory	Devikulam	Manufacture	Agro food, Beverage, Meat/ Fish Product and Processsing
8	Harrisons Malayalam Ltd Lockhart Factory	Devikulam	Manufacture	Agro food, Beverage, Meat/ Fish Product and Processsing
9	Periyar Plantations Pvt Ltd Semnivally	Elappara	Manufacture	Agro food, Beverage, Meat/ Fish Product and Processsing
10	Co-operative Tea Factory Ambalamedu	Kamakshy	Manufacture	Agro food, Beverage, Meat/ Fish Product and Processsing
11	High range Spices	Kumily	Manufacture	Agro food, Beverage, Meat/ Fish Product and Processsing
12	Spice More Trading Co.	Kumily	Manufacture	Agro food, Beverage, Meat/ Fish Product and Processsing
13	Kalaar Tea Factory	Munnar	Manufacture	Agro food, Beverage, Meat/ Fish Product and Processsing
14	Chokanad Tea Factory	Munnar	Manufacture	Agro food, Beverage, Meat/ Fish Product and Processsing
15	Letchmi Tea Factory	Munnar	Manufacture	Agro food, Beverage, Meat/ Fish Product and Processsing
16	Periavurrai Tea Factory	Munnar	Manufacture	Agro food, Beverage, Meat/ Fish Product and Processsing
17	Tata Global Beverages Limited Pullivasal Factory	Pallivasal	Manufacture	Agro food, Beverage, Meat/ Fish Product and Processsing
18	High Land Produce Co. Ltd.	Peerumade	Manufacture	Agro food, Beverage, Meat/ Fish Product and Processsing
19	Periyar Connemara tea factory	Vandiperiyar	Manufacture	Agro food, Beverage, Meat/ Fish Product and Processsing

20	Thengakal Tea Factory	Vandiperiyar	Manufacture	Agro food, Beverage, Meat/ Fish Product and Processing
21	Granby Tea Factory	Vandiperiyar	Manufacture	Agro food, Beverage, Meat/ Fish Product and Processing
22	Wallardie Tea Factory	Vandiperiyar	Manufacture	Agro food, Beverage, Meat/ Fish Product and Processing
23	High range Coco Products Pandipara	Kamakshy	Service	Agro food, Beverage, Meat/ Fish Product and Processing
24	Abitha Food Products	Munnar	Service	Agro food, Beverage, Meat/ Fish Product and Processing
25	Poabs Enterprises Private Limited	Vandiperiyar	Service	Agro food, Beverage, Meat/ Fish Product and Processing
26	Plathottam Automobiles	Munnar	Service	Automobile Service / Repair
27	Munnar Workshop and Engineering Department	Munnar	Service	Automobile Service / Repair
28	Mar Basil Granites & Metals	Udumbanchola	Manufacture	Building Materials, Construction, Architecture, Structural Designing
29	Thannikkott Metals and Granites	Udumbanchola	Manufacture	Building Materials, Construction, Architecture, Structural Designing
30	K H A Constructions	Adimali	Service	Building Materials, Construction, Architecture, Structural Designing
31	Surya Tools and Electricals	Munnar	Service	Electrical & Electronics Products and Services, IT and Mobile Hardware, Cable TV, Internet
32	Vee Jay Fish Net Industries	Adimali	Manufacture	Garments and Textiles, Tailoring, Boutique, Apparel Designing, Ornaments
33	Chundavurrai Tea Factory	Devikulam	Manufacture	Other manufacturing activities
34	Madupatty Tea Factory	Devikulam	Manufacture	Other manufacturing activities
35	Yellapatty Tea Factory	Devikulam	Manufacture	Other manufacturing activities
36	Gundumallay Tea Factory	Devikulam	Manufacture	Other manufacturing activities
37	Kizhakkethalackal Rocks	Kumily	Manufacture	Other manufacturing activities
38	Blue Flame Gas Service	Munnar	Service	Other Service Activities
39	Bright Offset Printers	Adimali	Manufacture	Video/ Photo Processing, Media & Entertainment, Event Management, Printing & Publishing, DTP

Micro enterprises constitute the dominant share of the industrial base, with 2,114 units accounting for 97.69% of the total industries within the basin. The high concentration of micro units is primarily due to lower investment requirements, their suitability to smaller land holdings, and their compatibility with locally available resource-based and agro-based activities in Idukki. In addition, there are 39 small-scale industries, representing 1.80% of the total industrial units, as listed in Table 13 for Idukki district. Overall, the industrial composition of the Idukki region is strongly oriented toward micro enterprises, reflecting a decentralized industrial pattern with low to moderate industrial intensity.

2.3. Distribution of industries based on nature of activity (Manufacturing vs Service) in Idukki district

Beyond scale-based classification, industrial units are further categorized based on the nature of activity into Manufacturing and Service sectors. Manufacturing industries are engaged in the physical transformation of raw materials into finished or semi-finished goods, involving production processes, machinery use, and material handling. Service industries, on the other hand, provide maintenance, repair, processing support, logistics, or other non-manufacturing economic services without substantial material transformation.

Within the 2,164 operational units:

- Manufacturing Industries: 1,008 units
- Service Industries: 1,156 units

Service industries constitute a slightly higher share (53.42%) compared to manufacturing industries (46.58%). This trend reflects the district's economic orientation towards small workshops, repair units, and support-based enterprises that require lower capital investment and minimal land area. Among the 7 large-scale industries, 6 belong to the manufacturing sector, while 1 unit (St. George Water Service Station) falls under the service category. All 4 medium-scale industries are manufacturing units. Within the small-scale segment, 31 units are manufacturing industries and 8 units fall under the service sector. This indicates that higher-scale enterprises within the basin are predominantly production-oriented, whereas service dominance is primarily observed in the micro-scale category.

2.3.1.Item-wise / Product & Service Profile of Idukki’s Industries

The industrial activities exhibit a diversified product and service portfolio, largely influenced by agro-based resources, local consumption demand, and small-scale entrepreneurship. The range of products manufactured, and services provided spans from agro-processing and food-based industries to engineering workshops and craft-based enterprises. Large-scale industries include condiment manufacturing units. Medium-scale industries include tea factories and packaging-related units. Small-scale industries are engaged in tea manufacturing and allied agro-processing activities. Micro-scale industries, which form the bulk of the industrial base, include automobile workshops, aluminium fabrication and engineering works, bakery and food product manufacturing, spice and cardamom processing, coffee processing, furniture manufacturing, brick manufacturing, bamboo craft production, bag manufacturing, candle manufacturing, soda manufacturing, cloth manufacturing, animal feed production, and related small engineering units. Overall, the industrial product spectrum in the Idukki ranges from primary agro-based processing (tea, coffee, spices) to light manufacturing (bakery products, furniture, bricks) and service-oriented workshops (automobile and fabrication works), reflecting a predominantly resource-linked, small-scale, and decentralized industrial ecosystem within the basin.

2.4. Spatial Distribution of Industries

2.4.1.Spatial Distribution of Industries - Ernakulam

The spatial distribution of industries within the Ernakulam portions of the Periyar River Basin was analyzed at the panchayat and block levels using administrative boundary data. The dataset includes operational micro and small, medium, and large-scale industrial units located within the basin. This LSGI-level assessment helps in understanding the distribution pattern of industries across different parts of the districts and in identifying major industrial concentration zones.

Local Body-Level Distribution

Out of 96 local bodies in the Ernakulam district (including 1 corporation, 13 municipalities, and the remaining Grama Panchayats), 55 local bodies are within the Periyar Basin, and 26 local bodies contain operational industrial units.

Among the local bodies, Kochi Corporation recorded the highest number of large-scale industries with 11 units, followed by Eloor (7 units) and Angamaly, Kadungalloor, and Kanjoor with 6 units each. Moderate industrial presence was observed in Aluva and North Paravur, while most other local bodies recorded comparatively fewer industries. Figure 3 illustrates the LSGI-wise distribution of industrial units within the study area.

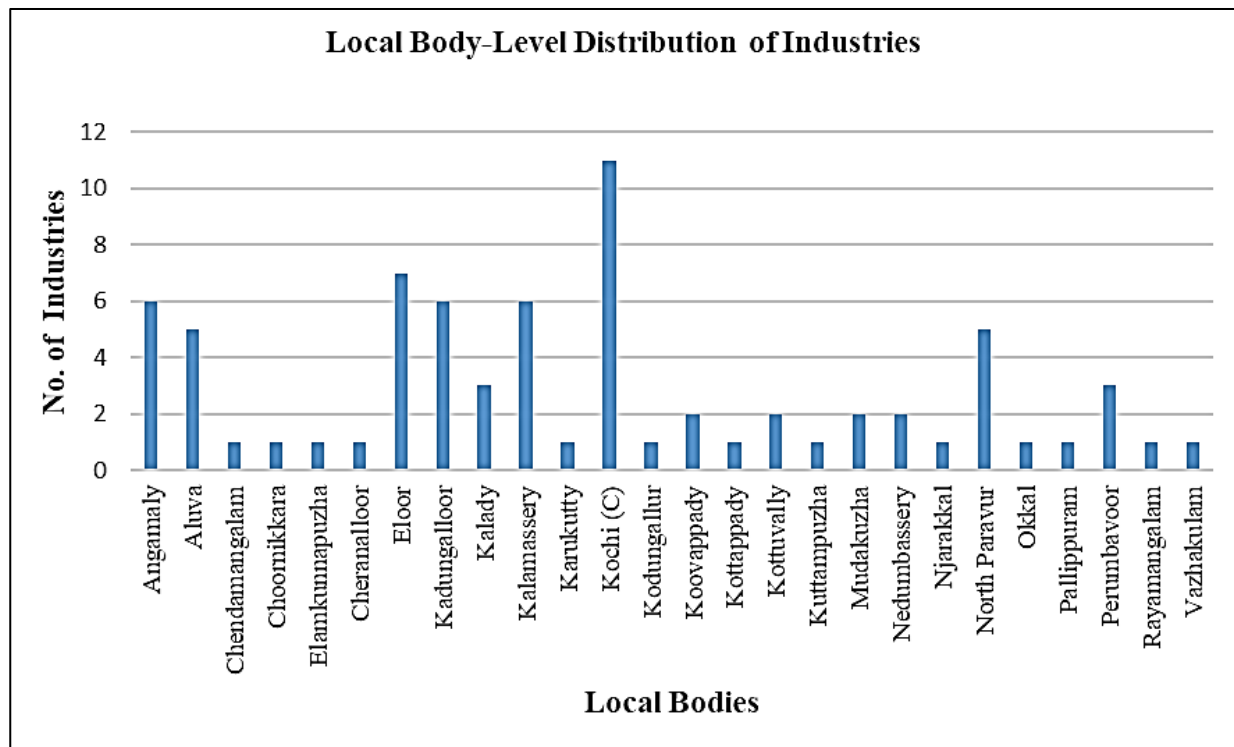


Figure 3 LSGI-wise distribution of large-scale industrial units in Ernakulam

Detailed LSGI-wise spatial distribution analysis for the Thrissur district portion of the Periyar River Basin could not be incorporated in the present study due to limitations in obtaining consistent industrial information from the available secondary sources and reports.

2.4.2. Spatial Distribution of Industries - Idukki

The spatial distribution of industries within the Idukki district has been analyzed using administrative boundary data at Block, Taluk, and Local Body (Grama Panchayat/Municipality) levels. The dataset includes Micro, Small, Medium, and Large-scale industrial units that are currently operational within the basin. This multi-tier administrative assessment enables identification of industrial concentration zones, distribution patterns, and scale-wise clustering,

which are essential for regional industrial planning and basin-level environmental management.

Block-Level Distribution

Idukki district comprises 8 blocks, of which 7 blocks fall within the Periyar River Basin boundary. Thodupuzha Block has been excluded from the analysis as it lies outside the basin. Nedumkandam Block records the highest number of industrial units (567), followed by Adimali (515) and Azhutha (476), indicating significant industrial clustering in these regions. In contrast, Elamdesom (3 units) and Idukki Block (35 units) exhibit very low industrial presence, reflecting spatial disparities in industrial development. This variation is largely influenced by accessibility, land availability, market connectivity, and terrain conditions.

Large-scale industries are distributed across 5 of the 7 basin blocks. Adimali and Devikulam Blocks each host 2 large-scale industries, while Idukki, Kattappana, and Nedumkandam Blocks each have 1 large-scale unit. Medium-scale industries are present in 3 blocks: Devikulam (2 units), Adimali (1 unit), and Kattappana (1 unit). Small-scale industries show a higher concentration in Devikulam Block (21 units), followed by Azhutha (10 units).

Taluk-Level Distribution

Udumbanchola Taluk records the highest number of industrial units (1,048), accounting for nearly half of the basin's industries, followed by Devikulam (639) and Peerumade (477). Large-scale industries are present only in Devikulam and Udumbanchola Taluks. Devikulam hosts 4 large-scale industries, while Udumbanchola has 3. Medium-scale industries are primarily concentrated in Devikulam (3 units) and Udumbanchola (1 unit). Unlike large and medium industries, small-scale industries are distributed across all three taluks, with the highest number in Devikulam (25 units), followed by Peerumade (10 units) and Udumbanchola (4 units). This indicates that Devikulam Taluk functions as a relatively important industrial node within the basin, particularly for medium and small-scale operations.

Local Body-Level Distribution

Out of 54 local bodies in Idukki district (including 2 Municipalities and the remaining Grama Panchayats), 31 local bodies within the Periyar Basin contain operational industrial units. Figure 4

illustrates distribution of industries in Idukki's local bodies. The local bodies given below incorporates the highest number of industries.

- Adimali Grama Panchayat – 301 units (highest)
- Udumbanchola Grama Panchayat – 237 units
- Kattappana Municipality – 234 units

The least number of industries is observed in:

- Mariyapuram Grama Panchayat – 4 units
- Chinnakkanal Grama Panchayat – 6 units
- Mankulam Grama Panchayat – 10 units

The higher industrial concentration in Adimali, Udumbanchola, and Kattappana is attributed to better road connectivity, commercial activity centers and relatively favorable land conditions compared to high-altitude or forest-dominated panchayats. From the spatial distribution analysis, Adimali, Udumbanchola, and Kattappana Municipality emerge as key Industrial Concentration Zones within the Periyar Basin. The identification of such clusters is critical for infrastructure planning, pollution load assessment, and environmental monitoring.

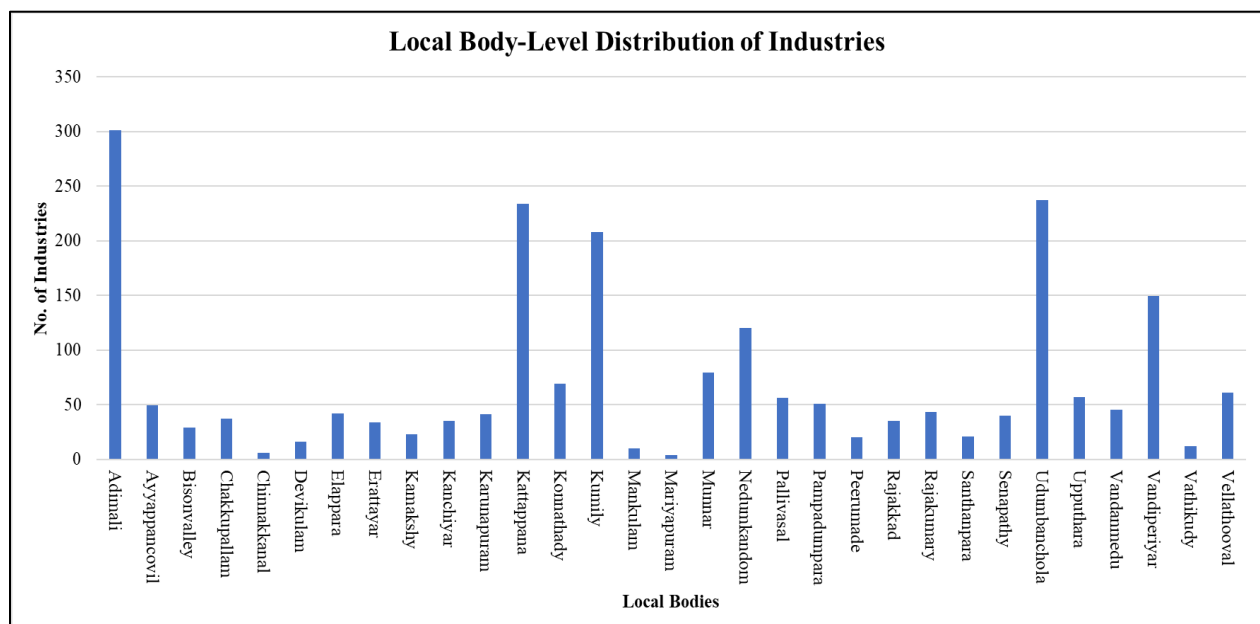


Figure 4 LSGI-wise distribution of industrial units in Idukki

2.4.3. Spatial Mapping of Industries in Ernakulam and Thrissur District

Figure 5 and Figure 6 depicts the spatial distribution of large-scale (public and private) and medium-scale industries in Ernakulam district with respect to local body boundaries within the Periyar River Basin, respectively. Figure 7 gives an overview of large-Scale Industries in Thrissur district.

A high concentration of industrial units is observed in the central part of Ernakulam district, with multiple units located in closely spaced adjoining local bodies. Additional concentrations are visible along the coastal belt, including areas near North Paravur and Kodungallur. Localized clusters are also present in parts of the midland region, including Angamaly and nearby local bodies. In contrast, the eastern and southeastern regions of the basin, including Kothamangalam, Perumbavoor, and Kuttampuzha, show a sparse distribution with only a few isolated units. Public sector industries are fewer in number and are mainly confined to the central cluster, whereas private sector industries are more numerous and more widely distributed across the study area.

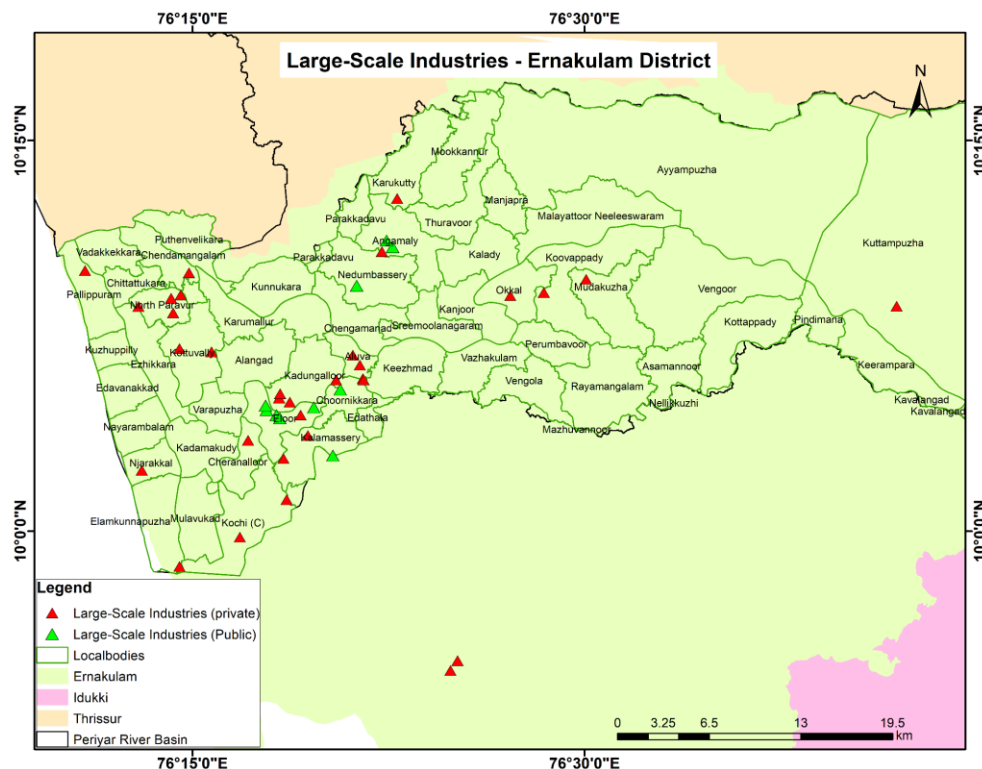


Figure 5 Spatial Distribution of Large-Scale Industries Across LSGI Boundaries in Ernakulam

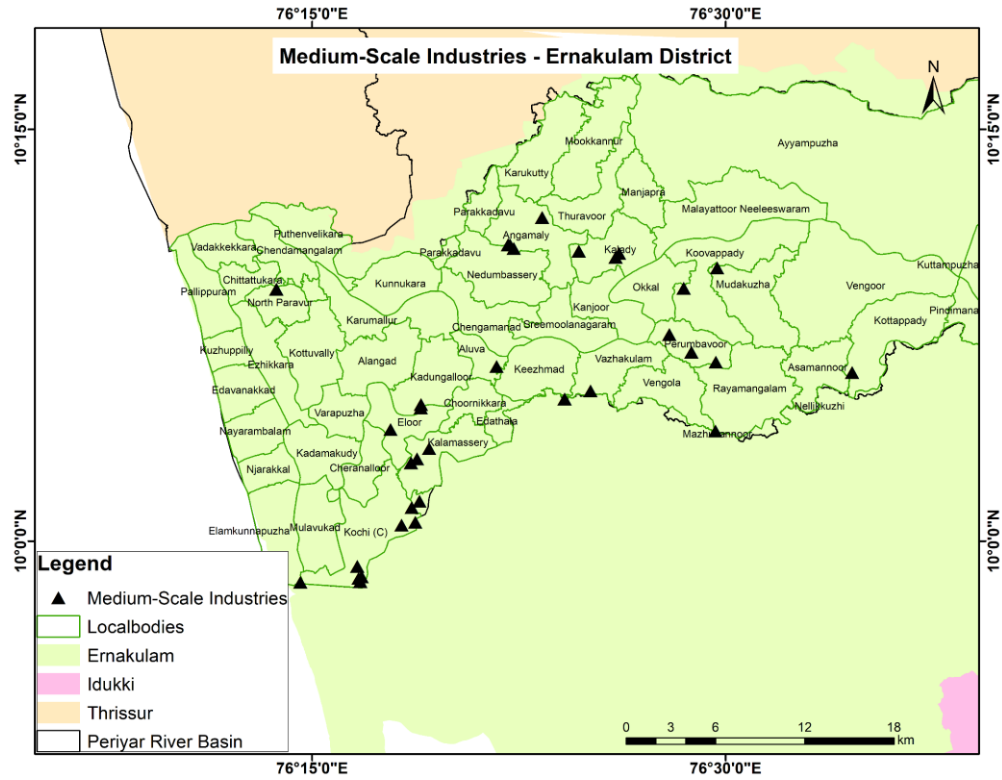


Figure 6 Spatial Distribution of Medium-Scale Industries Across LSGI Boundaries in Ernakulam

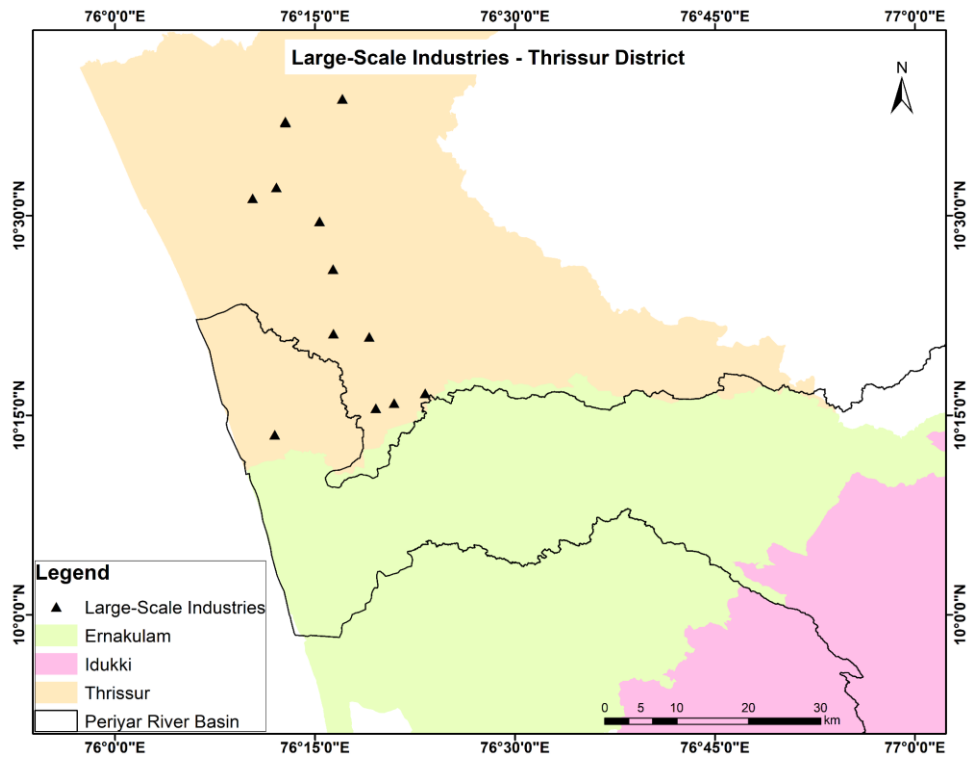


Figure 7 Spatial Distribution of Large-Scale Industries in Thrissur

2.4.4. Spatial Mapping of Industries - Idukki

Figure 8 depicts the distribution of large-scale industries with respect to local body boundaries in Idukki district. There are,

- 2 units are located in Adimali Grama Panchayat
- 2 units in Munnar Grama Panchayat
- 1 unit each in Vathikudy, Ayyappancovil, and Rajakumary Grama Panchayats

Figure 9 shows the distribution of medium-scale industries with respect to local body boundaries in Idukki. There are,

- 2 units in Munnar Grama Panchayat
- 1 unit in Pallivasal Grama Panchayat
- 1 unit in Kattappana Municipality

The locations of small-scale industries with respect to local body boundaries are given in Figure 10. Devikulam Grama Panchayat records the highest number of small-scale industries (10 units), followed by Munnar (9 units). Small-scale industries are also distributed across Adimali, Chinnakkanal, Elappara, Kamakshy, Kumily, Pallivasal, Peerumade, Udumbanchola, and Vandiperiyar Grama Panchayats.

Micro-scale industries in local bodies of Idukki are illustrated in Figure 11. The spatial distribution shows widespread dispersion across the basin's local bodies, with significant clustering in Adimali, Udumbanchola, and Kattappana regions. The spatial assessment provides a critical foundation for targeted infrastructure development, regulatory monitoring, and basin-level industrial impact evaluation.

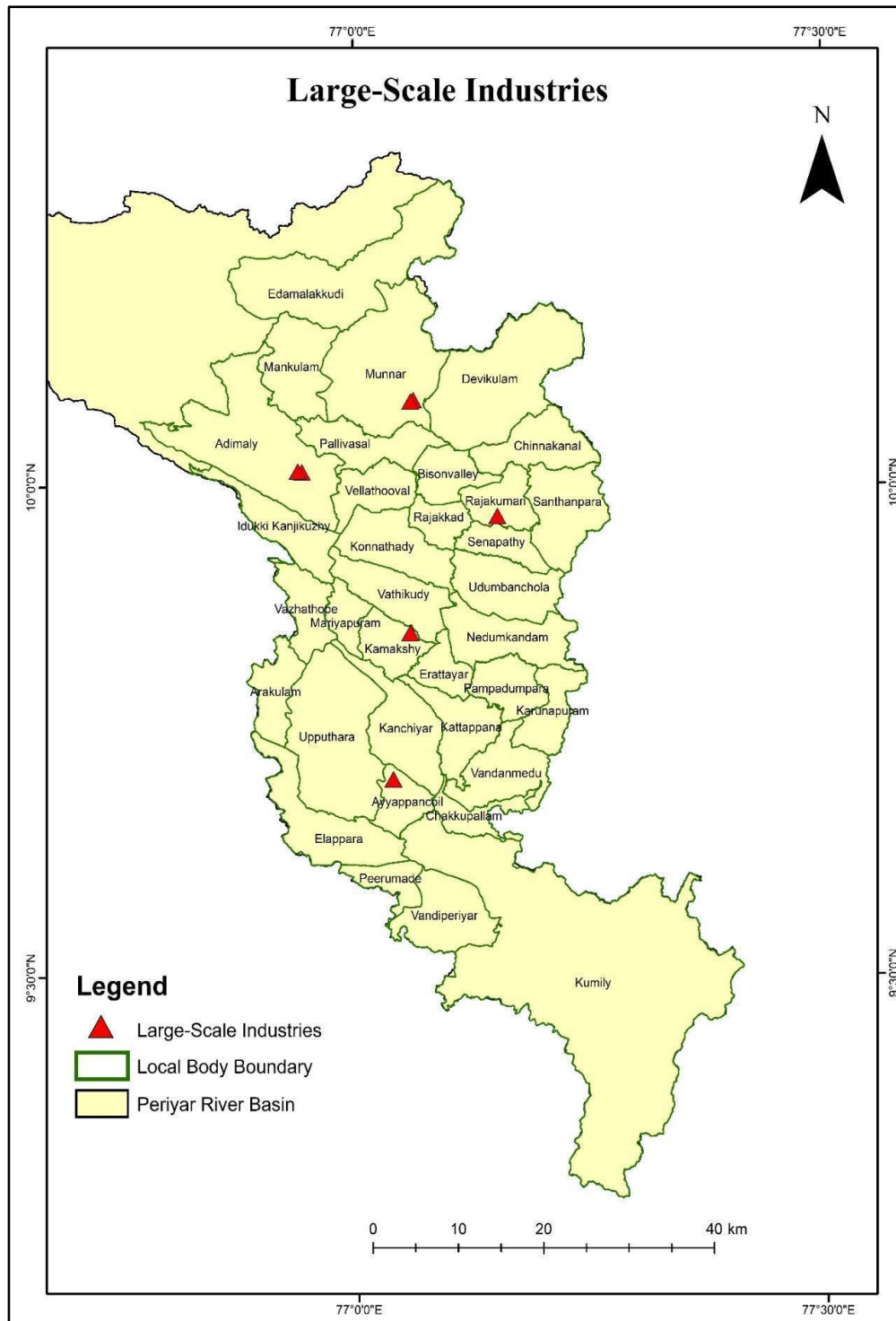


Figure 8 Spatial Distribution of Large-Scale Industries Across LSGI Boundaries in Idukki



Figure 9 Spatial Distribution of Medium-Scale Industries Across LSGI Boundaries in Idukki

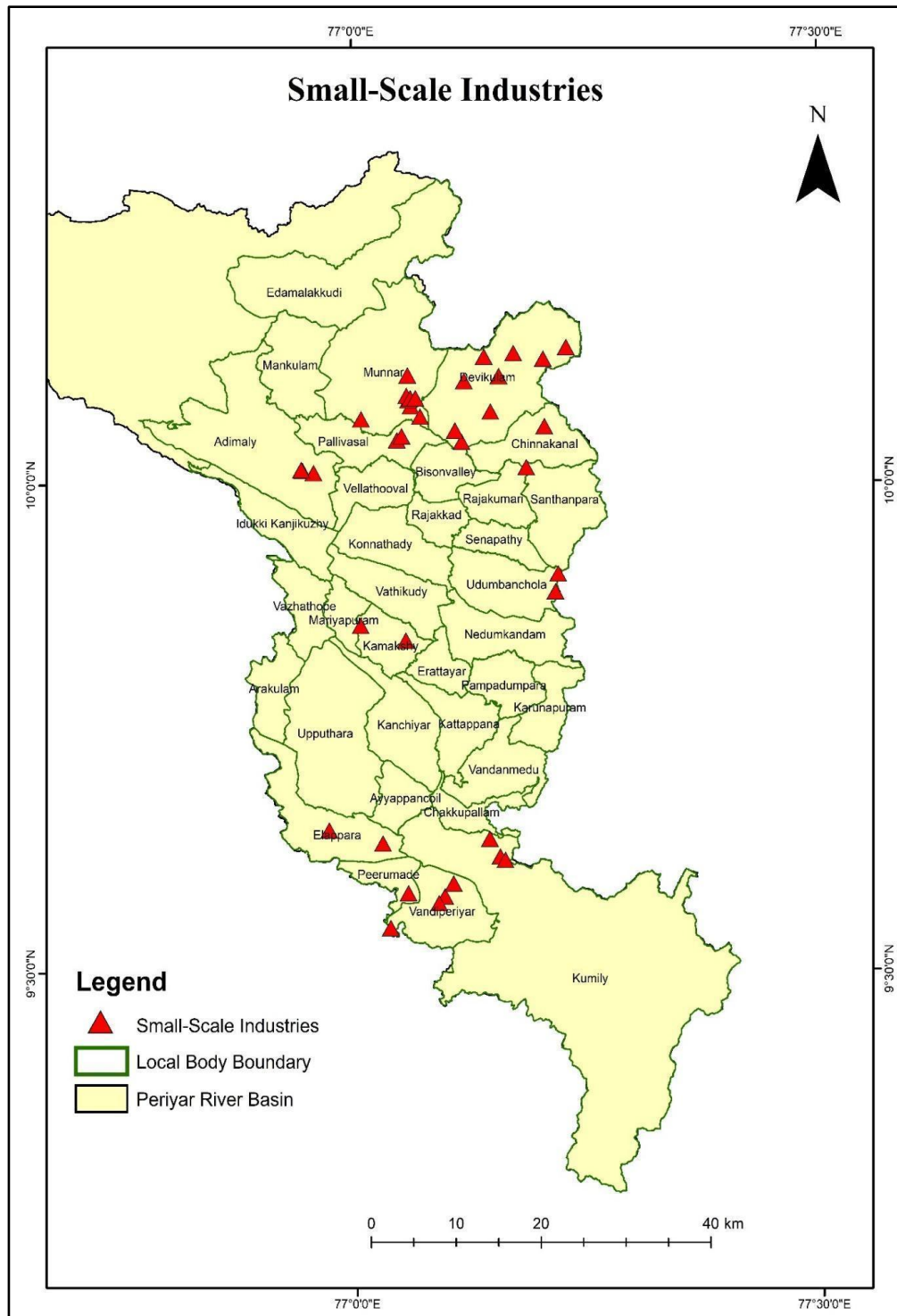


Figure 10 Spatial Distribution of Small-Scale Industries Across LSGI Boundaries in Idukki

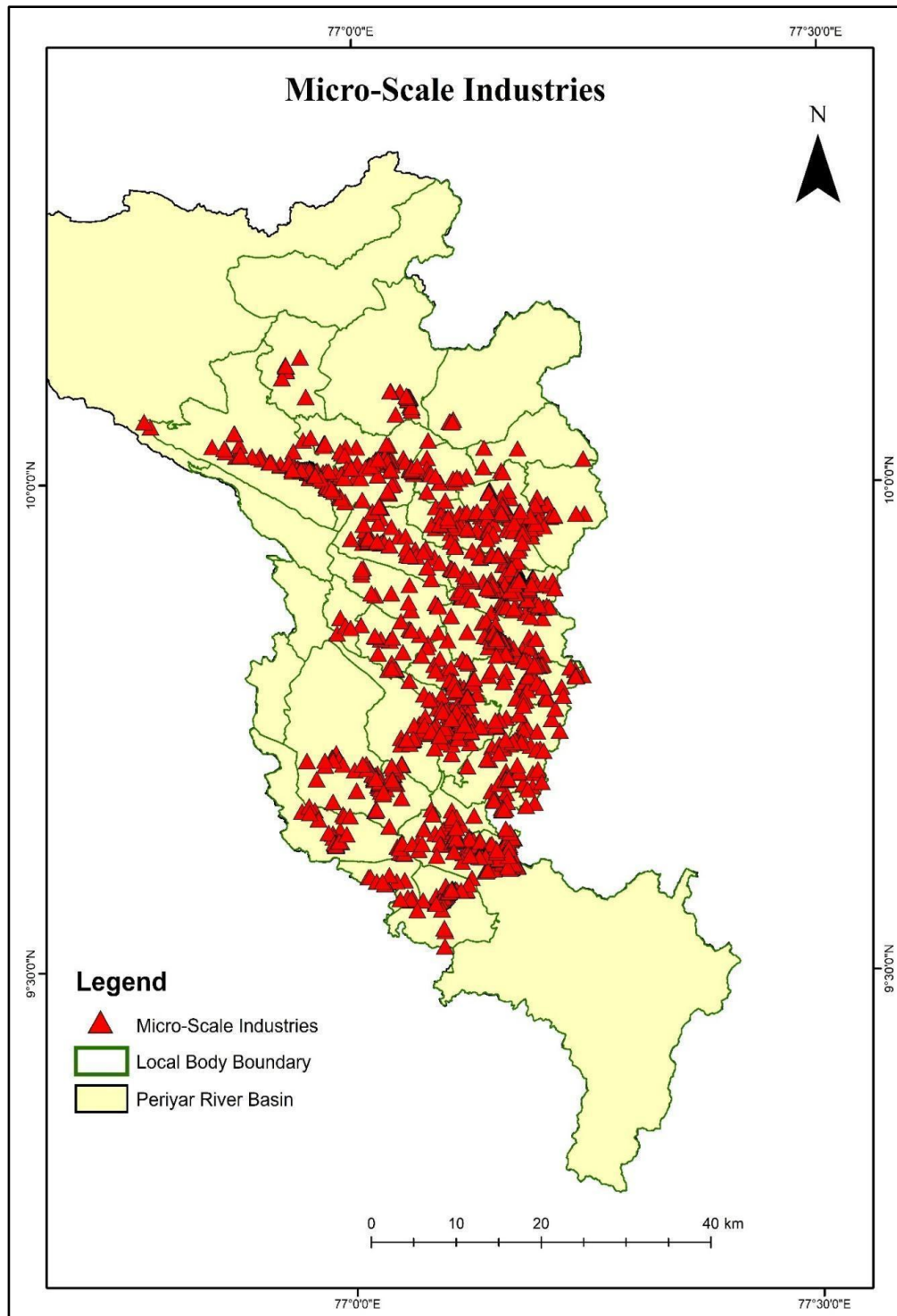


Figure 11 Spatial Distribution of Micro-Scale Industries Across LSGI Boundaries in Idukki

2.5. Sector-Wise Distribution of Industries

2.5.1. Sector-Wise Distribution of Industries in Idukki

A total of 50 industrial units from large, medium, and small scales have been identified and classified across 10 broad sectors, encompassing both manufacturing and service activities. The distribution reveals a highly concentrated industrial structure, with the Agro-Food and Beverage Processing sector alone accounting for nearly two-thirds of all registered units.

Table 14 Sector-Wise Distribution of Industrial Units in Idukki District

Sector	Units	Share	Large	Medium	Small	Key Items
Agro Food, Beverage, Meat/Fish Processing	31	62.0%	3	3	25	Tea, condiments, spices, cardamom, flour, food products
Other Manufacturing Activities	6	12.0%	1	—	5	Tea powder, crusher products, stationery
Other Service Activities	3	6.0%	1	1	1	Water service, gas service, milk
Building Materials & Construction	3	6.0%	—	—	3	M-Sand, P-Sand, metals, construction
Automobile Service / Repair	2	4.0%	—	—	2	Car service, mechanical repair
General Engineering & Precision Engineering	1	2.0%	1	—	—	Mechanical / fabrication works
Wood Products	1	2.0%	1	—	—	Wood furniture
Electrical, Electronics & IT	1	2.0%	—	—	1	Electrical items
Garments, Textiles & Tailoring	1	2.0%	—	—	1	Fish net manufacturing
Video/Photo, Media, Printing & DTP	1	2.0%	—	—	1	Printing service
Total	50	100%	7	4	39	

The agro food, beverage, meat and fish Processing sector emerges as the leading sector, comprising 31 units (62.0%) of the total industrial base. It is also the most diverse in terms of enterprise scale, including 3 Large, 3 Medium, and 25 Small establishments. Large enterprises such as Eastern Condiments Private Limited and Flavors are engaged in condiment production, while Medium-scale units consist of tea factories and a packaging facility. However, the majority of activity is concentrated in the ‘Small’ category, dominated by a strong cluster of tea manufacturing units along

with cardamom grading and processing establishments. The second largest sector with 6 units (12.0%), this sector is exclusively manufacturing in nature. It includes 1 large enterprise and 5 Small enterprises engaged in tea powder production operations. The sector serves as a residual category for manufacturing activities that do not fit neatly into specialised sectors, yet it plays a significant supplementary role in the local industrial economy. With 3 units (6.0%) spanning all three scale categories (1 large, 1 medium, 1 small), the '*Other Service Activities*' sector captures miscellaneous service establishments. Items include a water service station and gas service works.

Building materials, construction and architecture sector records 3 small enterprises (6%) engaged in both manufacturing and service activities. Products include M-Sand, P-Sand, and metal/granite aggregates, alongside construction services, pointing to the sector's role in supporting infrastructure and housing development in the region. Key units include Mar Basil Granites & Metals and Thannikkott Metals and Granites. The Automobile Service/Repair sector contributes 2 Small units (4.0%), both exclusively service-oriented. Units offer car servicing and mechanical repair activities in the area. Other additional sectors each record a single unit (2.0% each). General Engineering and Precision Engineering is represented by Meenakshi Engineering Works, a 'Large' enterprise engaged in mechanical fabrication. Wood Products is represented by Shiva Furniture (Large), producing wood furniture. The Electrical, Electronics and IT sector has one 'Small' service unit dealing in electrical items.

Overall, the sectoral composition reflects a strong concentration in agro food processing, closely linked to the region's plantation-based economy of tea, cardamom, and spices. Diversification into sectors such as engineering, electronics, and wood-based industries is still at an early stage, indicating considerable potential for future industrial expansion and strategic investment.

2.5.2.Sector-Wise Distribution of Industrial Units in Ernakulam District

The sector-wise distribution of industries in Ernakulam district shows that the district has a diverse industrial structure with industries belonging to different sectors during 2012–13 to 2018–19 as indicated in Table 15. Among all sectors, Service Activities had the highest number of industrial units throughout the study period. The number of units increased from 466 in 2012–13 to 846 in 2015–16 and later decreased to 396 units in 2018–19. Miscellaneous industries also had a significant share, with the highest number of 413 units recorded in 2014–15.

Mechanical/General/Light Engineering industries were another important sector in the district, with more than 200 units in most years.

Table 15 Sector-wise growth of MSMEs in Ernakulam District

(Source: MSME Development Institute Thrissur ,2019)

Sl. No	Sectors	2012-13	2013-14	2014-15	2015-16	2016-17	2017-18	2018-19
1	Textiles & Garment	68	146	90	158	270	215	238
2	Glass & Ceramics	4	19	23	5	8	3	6
3	Mechanical/General/Light Engineering	264	217	147	241	246	212	166
4	IT&ITES	52	134	110	83	75	29	24
5	IT Hardware	14	26	13	18	4	1	4
6	Rubber Products	18	45	46	26	23	10	9
7	Chemical	30	31	48	64	32	13	17
8	Plastics	60	54	20	33	39	26	29
9	Paper products	30	54	42	15	39	16	30
10	Fruits and Food based products	12	69	31	180	111	184	175
11	Wood products	149	268	169	88	133	126	79
12	Printing & Allied	54	88	61	49	56	62	42
13	Building Materials	81	79	35	31	53	26	15
14	Resin/Leather Products	14	16	5	11	11	14	13
15	Electrical & Electronics	32	96	43	38	40	26	14
16	Pharmaceuticals	0	8	4	1	1	4	5
17	Ayurvedic products	5	8	4	10	11	14	7
18	Service Activities	466	512	766	846	662	591	396
19	Miscellaneous	317	387	413	313	154	121	115
20	Food & Agro Based Products	190	81	158	88	183	95	103
21	Cement Products	82	81	20	21	76	84	25
22	Wax Candles	9	42	15	19	40	23	19
Total		1951	2461	2263	2338	2267	1895	1531

Textiles and Garment industries showed growth during the study period, increasing from 68 units in 2012–13 to 238 units in 2018–19. Food-related sectors such as Fruits and Food Based Products and Food & Agro Based Products also had a notable presence in the district. Wood products, Printing & Allied industries, and Building Materials industries were important sectors during the earlier years, but the number of units gradually decreased towards 2018–19. Other sectors such as IT & ITES, Electrical & Electronics, Plastics, Chemical industries, and Rubber Products also contributed to the industrial development of the district. Pharmaceutical and Ayurvedic product industries had comparatively fewer units during the study period.

Sector-wise distribution details of industrial units for the Thrissur district portion of the Periyar River Basin were not included in the present study based on the data available at the time of the study.

3. Industrial Water Demand

Industrial water demand constitutes a critical component in the overall water resource assessment of the Periyar River Basin. Industries require water for multiple operational purposes, including raw material processing, washing, cooling, steam generation, product formulation, cleaning, and ancillary services. In agro-processing sectors such as tea, spices, and food manufacturing, water plays a vital role in processing and quality maintenance. Assessment of industrial water demand is essential not only for evaluating pressure on surface and groundwater resources but also for estimating wastewater generation, effluent load, and potential impacts on river water quality. Therefore, integrating industrial water demand analysis within the Industrial Profile Report supports basin-level water budgeting, pollution load estimation, and regulatory planning under integrated river basin management frameworks.

Within Kerala, the Periyar River Basin constitutes a major industrial corridor, supporting a substantial share of the State's industrial base. A significant proportion of industrial establishments are located along the river and depend on it as a primary source of water. The Eloor–Edayar (Udyogamandal) industrial belt in Ernakulam district, situated north of the Kochi harbour region, represents one of the most densely concentrated industrial clusters, accommodating a wide spectrum of small, medium, and large-scale industries. In addition, the Greater Kochi region exhibits a high concentration of red-category industries, particularly within the Eloor–Edayar and Ambalamugal clusters, reflecting both elevated water demand and the need for stringent environmental management and regulatory oversight (Room for River, 2022).

The present assessment provides a synthesis of block-level industrial water demand within the Periyar River Basin, focusing on Ernakulam and Thrissur districts. The analysis is based on data derived from the District Irrigation Plan (2017) prepared under the Pradhan Mantri Krishi Sinchayee Yojana (PMKSY). The dataset incorporates the number of industries, existing water potential (2017 baseline), projected industrial water demand for 2020, and the additional water potential required to address future demand–supply gaps.

Industrial water demand in the Ernakulam district portion of the Periyar River Basin demonstrates marked spatial variation across the selected blocks. The assessment covers eight blocks for which industrial water demand data are available, comprising a total of 13,090 industrial units. The total projected industrial water demand for 2020 is estimated at 3.214 MCM, while the existing water potential is assessed at 3.893 MCM. Despite the apparent adequacy at the aggregate level, the requirement for additional water resource development is significant, with 4.698 MCM identified as necessary to meet future industrial demand. Blocks such as Alangad and Angamaly exhibit relatively higher demand, corresponding to dense industrial concentrations, whereas variations in demand across other blocks indicate differences in industrial composition and water-use intensity. The detailed block-wise distribution is presented in Table 16.

Table 16 Industrial Water Demand in Ernakulam District within the Periyar River Basin

(Source: District Irrigation Plan, Ernakulam, 2017)

Name of Block	No. of Industries	Existing water Potential - 2017 ((MCM)	Water demand - in 2020 (MCM)	Future demand (MCM)
Vypin	638	0.208	0.258	0.049
Paravoor	874	0.245	0.306	0.61
Kothamangalam	126	0.9	0.128	0.18
Edappally	2864	0.113	0.139	0.265
Alangad	2018	0.746	0.921	0.857
Angamaly	1716	0.545	0.719	0.678
Parakkadavu	716	0.195	0.284	0.89
Koovappady	1752	0.107	0.356	0.249
Vazhakulam	2386	0.834	0.103	0.92
Total	13090	3.893	3.214	4.698

In Thrissur district, industrial water demand within the basin is comparatively higher, driven by sectors including cement production, packaged drinking water, plastics, and food processing industries. The total projected demand for 2020 is highest in Irinjalakkuda with a total demand of 16.01 MCM. A substantial gap exists between existing water potential and projected demand, necessitating the creation of additional water resources across multiple blocks. The variation in demand across Chalakudy, Mala, Irinjalakuda, and Vellangallur reflects the distribution and intensity of industrial activities. The block-wise and sectoral distribution of industrial water demand is presented in Table 17.

Table 17 Industrial Water Demand in Thrissur District within the Periyar River Basin*(Source: District Irrigation Plan, Thrissur, 2017)*

Name of Block	Name of Industry	Existing Water Potential-2017 (MCM)	Water Demand in 2020 (MCM)	Future demand (MCM)
Chalakyudy	Cements products	1	1.8	8
	Packaged drinking water	3.21	6.24	3.2
	Plastics	2	3	1
	Food products	1.4	1.48	1.08
	Others	1.54	3.44	1.3
	Sub total	9.2	15.96	14.58
Mala	Cements products	0.36	1.44	1.24
	Food products	0.28	1.12	0.5
	Crusher / M-Sand	0.76	3.04	1.5
	Others	0.862	3.448	1.52
	Sub total	2.262	9.048	4.76
Irinjalakuda	Cements products	0.38	1.52	0.81
	Plastics	0.36	1.44	7.3
	Food products	0.24	0.96	0.44
	Others	0.76	3.04	1.03
	Sub total	4.002	16.01	14.34
Vellangallur	Cements products	0.09	0.36	0.18
	Food products	0.1	0.4	0.2
	Others	0.46	1.84	0.93
	Sub total	0.65	2.6	1.31

The assessment of industrial water demand within the Idukki portion of the Periyar River Basin is presently constrained by the limited availability of unit-level water consumption data. Data requests were made to concerned agencies such as the KSPCB, Directorate of Industries & Commerce, and the DIC; however, datasets on industrial water demand for Idukki district were not received at the time of the industrial profile assessment. This gap in data availability can be understood in the context of Kerala's overall industrial distribution. Ernakulam district, particularly the Eloor-Edayar industrial belt, has long been the centre of industrial activity in the state and has therefore received greater focus in terms of monitoring, research, and data documentation. Idukki, with its comparatively smaller industrial base, is still in the process of developing equally robust data systems.

In view of this, a detailed quantitative analysis of industrial water demand could not be incorporated at this stage of the Industrial Profile Report. However, the identification of this data requirement provides a clear direction for future data consolidation and coordination with regulatory agencies. Incorporation of structured industrial water consumption reporting will significantly enhance basin-level water budgeting, demand forecasting, and pollution load estimation for the Periyar River Basin in subsequent assessments.

4. Wastewater Generation

With the growth of industrial development, rapid urbanization, and population increase, the demand for water has escalated significantly (Aditya *et al.*, 2025). Most of this water is extracted from groundwater sources and rivers, and after use, it generates effluents from industrial units. To regulate this discharge, the KSPCB issues a combined CTO under the Water (Prevention and Control of Pollution) Act, 1974, the Air (Prevention and Control of Pollution) Act, 1981, and the Environment Protection Act, 1986. This consent specifies the maximum permissible discharge, quality standards for treated effluent or sewage, location of disposal outlets, and the mode of disposal to ensure compliance and pollution control.

The Periyar River Basin's industrial landscape is influenced by various establishments, including large-scale chemical, fertilizer, and metal-processing units, which rely on the river for water, transportation, and effluent disposal. The Eloor-Edayar belt is a major industrial hub, contributing to the region's economy. However, this concentration has led to environmental challenges, including pollution, disrupting aquatic biodiversity, and undermining traditional livelihoods. Sustainable strategies are needed to ensure a resilient riverine ecosystem.

Based on KSPCB records, industrial wastewater generation within the Periyar River Basin is largely associated with red-category industries such as chemical, petrochemical, fertilizer, mining, leather, rubber, rendering, electroplating, and resin manufacturing units concentrated mainly in the Eloor–Edayar industrial belt. The quantity of wastewater generated and the treatment practices adopted vary considerably depending on the type and scale of industry, production processes involved, and the extent of effluent treatment and reuse systems implemented by individual units.

The assessment of industrial wastewater generation within the Idukki portion of the Periyar River Basin is presently constrained by the limited availability of unit-level wastewater generation data. A reliable estimate of wastewater generation from industries in the Idukki district of the Periyar River Basin could not be developed, as the water consumption data required for such calculations was not available. Outreach to agencies such as the KSPCB, the Directorate of Industries and Commerce, and the DIC did not yield the necessary figures. Since wastewater generation is typically derived as a proportion of total water intake, the absence of consumption data made it difficult to arrive at a credible estimate. Apart from its dependency on the total water intake, the quantity of this generated industrial wastewater depends on various other parameters, such as type and size of industry, manufacturing processes that are involved, amount of water reuse and the treatment methods that are used onsite, if any.

The limited data availability in Idukki reflects the broader pattern of industrial monitoring in Kerala, where Ernakulam has historically received more attention given its higher concentration of industries. Idukki's relatively smaller and more dispersed industrial presence means that formal data collection in the district is still developing.

4.1. Impact on Water Resources in the Periyar River Basin

Industrial impacts on basin water resources are predominantly concentrated in the downstream reaches of the Periyar Basin, particularly within the Eloor–Edayar industrial belt in Ernakulam district, which represents one of the earliest industrialized regions in Kerala, comprising major chemical and manufacturing industries situated along the banks of the Periyar River. These industrial activities exert considerable pressure on the river system through industrial effluent discharge and associated pollution loads. According to the report, the lower reaches of the Periyar are heavily polluted, with studies indicating the presence of heavy metals such as lead, cadmium, mercury, chromium, nickel, cobalt, and zinc in river bed sediments (Sreelakshmi *et al.*, 2018). The report further notes that the river ecosystem has developed several dead zones and that visible impacts of pollution, including fish mortality and changes in water colour, have been observed particularly around the Eloor industrial region. In addition, reduced river flow, salinity intrusion, and deterioration in water quality have contributed to increasing stress on basin water resources in the downstream stretches of the Periyar River. In contrast, the relatively low industrial density in

Idukki district, primarily due to physiographic and land-use constraints, has limited large-scale industrial impacts on water resources in the upstream regions of the basin.

To supplement the basin-level assessment, field investigations were carried out in selected Local Self Government Institutions (LSGIs), including Perumbavoor Municipality and the Grama Panchayats of Vazhakkulam, Okkal, Kalady, Malayattoor–Neeleswaram, and Kanjoor. The investigations documented the presence of polluted drain stretches and drain outlets discharging into the Periyar River and its tributaries. Pollution associated with industrial discharges, domestic wastewater, slaughterhouse waste, and agricultural runoff was recorded at several locations. Visible observations included direct discharge pipes entering drainage channels, coloured wastewater, stagnant drainage stretches, solid waste accumulation, foul odour, and aquatic weed growth in certain drains.

Overall, the findings from the field investigations are consistent with the reported pollution concerns in the Periyar Basin and document the occurrence of multiple polluted drain stretches and outfalls within the surveyed LSGIs.

5. Key Issues & Compliance Gaps

The industrial profile of the Periyar River Basin indicates significant environmental and regulatory concerns, particularly in the downstream industrial regions of Ernakulam district. The Eloor–Edayar industrial belt, which represents one of the oldest and most concentrated industrial clusters in Kerala, exerts substantial pressure on basin water resources due to the presence of chemical, petrochemical, fertilizer, metal-processing, and other red-category industries. These industries depend heavily on the Periyar River for water extraction, industrial processing, and effluent disposal, resulting in increased stress on the river ecosystem.

One of the major issues identified is industrial wastewater generation and effluent discharge. Although industries operate under the CTO mechanism issued by the KSPCB under the Water Act, Air Act, and Environment Protection Act, concerns remain regarding the cumulative pollution load entering the river system. The Eloor–Edayar industrial belt has historically been associated with contamination of river sediments by heavy metals such as lead, cadmium, mercury, chromium, nickel, cobalt, and zinc. Reports also indicate the occurrence of dead zones, fish mortality, and

visible changes in water colour in stretches downstream of the industrial cluster, reflecting the ecological stress imposed by industrial discharge and inadequate environmental assimilation capacity.

Another critical issue relates to increasing industrial water demand and associated pressure on water availability. In both Ernakulam and Thrissur districts, projected industrial water demand exceeds or closely approaches existing water potential in several blocks, necessitating additional water resource development. The requirement for future water potential creation indicates emerging demand supply gaps, particularly in industrially concentrated blocks such as Alangad, Angamaly, Chalakudy, and Mala. This situation is further aggravated by reduced river flow and salinity intrusion in downstream reaches, which affect both water quality and freshwater availability.

Data and compliance gaps also remain significant across the basin. Spatial disparities in industrial monitoring and regulation are also evident. Ernakulam district, owing to its high industrial concentration, has relatively better documentation and regulatory focus, whereas districts such as Idukki have comparatively weaker industrial data systems despite the growing presence of micro and small-scale industries. Many industries in upstream regions are small and dispersed, making monitoring and enforcement more challenging.

In addition, the dominance of micro and small enterprises across the basin presents further compliance challenges. Such units often operate with limited infrastructure, lower investment capacity, and minimal environmental management systems, increasing the risk of inadequate wastewater treatment, improper solid waste disposal, and non-compliance with environmental standards. The dispersed nature of these enterprises further complicates regular inspection and monitoring by regulatory authorities.

Overall, the key issues within the Periyar River Basin industrial sector include industrial pollution and effluent discharge, increasing pressure on water resources, inadequate wastewater assessment, lack of comprehensive industrial water-use databases, spatial inequalities in monitoring systems, and compliance limitations among small-scale industries. These gaps highlight the need for strengthened industrial environmental monitoring, improved data integration, enhanced wastewater reporting mechanisms, and basin-scale regulatory coordination to support sustainable industrial development and river basin management.

In the context of the Industrial Profile of the Periyar River Basin, Key Issues & Compliance Gaps refer to regulatory, infrastructural, and information-related limitations that may affect effective environmental management of industries within the basin.

5.1. Key Issues & Compliance Gaps in Idukki District

One of the primary issues identified during the preparation of this Industrial Profile is the limited availability of structured data relating to industrial water demand, wastewater generation, and effluent discharge within the Idukki district of the Periyar River Basin. While relevant authorities, including the KSPCB, DIC, and Directorate of Industries & Commerce, were approached for datasets, consolidated information at the level of individual industries or at least by scale category (Large, Medium, and Small) was not available. From a basin management perspective, such data forms the foundation for estimating industrial water use, wastewater generation loads, and potential pollution contributions to the Periyar River system. In the absence of this information, it is difficult to quantify the cumulative industrial footprint on basin water resources.

Another critical compliance dimension relates to the availability and operational status of Sewage Treatment Plants (STPs), Effluent Treatment Plants (ETPs), and other pollution control systems in industrial units. Treatment infrastructure constitutes a fundamental component of industrial environmental compliance, particularly in a river basin of high ecological and economic importance such as the Periyar. Documentation regarding the existence, design capacity, and operational efficiency of STP/ETP facilities in industries located within Idukki district was not available. Availability of such records is essential to verify whether industries are equipped with adequate effluent treatment systems and whether treated discharge meets prescribed standards prior to disposal or reuse.

Regular inspection and performance monitoring by the Pollution Control Board are equally important to ensure that treatment systems function consistently within regulatory limits. Continuous monitoring of effluent quality is necessary to prevent untreated or partially treated wastewater from entering water bodies. At present, there are no authorized direct industrial discharge points into the Periyar River from Idukki district, unlike the five permitted discharge points identified in the Ernakulam stretch as shown in Figure 12. According to the National Green Tribunal report (May 2024), These five industries are allowed to discharge treated effluent into the

Periyar river: The Fertilizers and Chemicals Travancore Limited (FACT), Indian Rare Earths Limited (IREL), Sud-chemie Private Limited, Cochin Minerals and Rutile Limited (CMRL), and TMS Leathers. However, an important study gap remains regarding the possibility of micro-scale or small-scale industries discharging treated or untreated effluents into nearby minor streams or local drainage channels that eventually merge with tributaries of the Periyar. Even limited discharges into upper catchment tributaries can cumulatively influence downstream water quality, particularly during low-flow conditions.

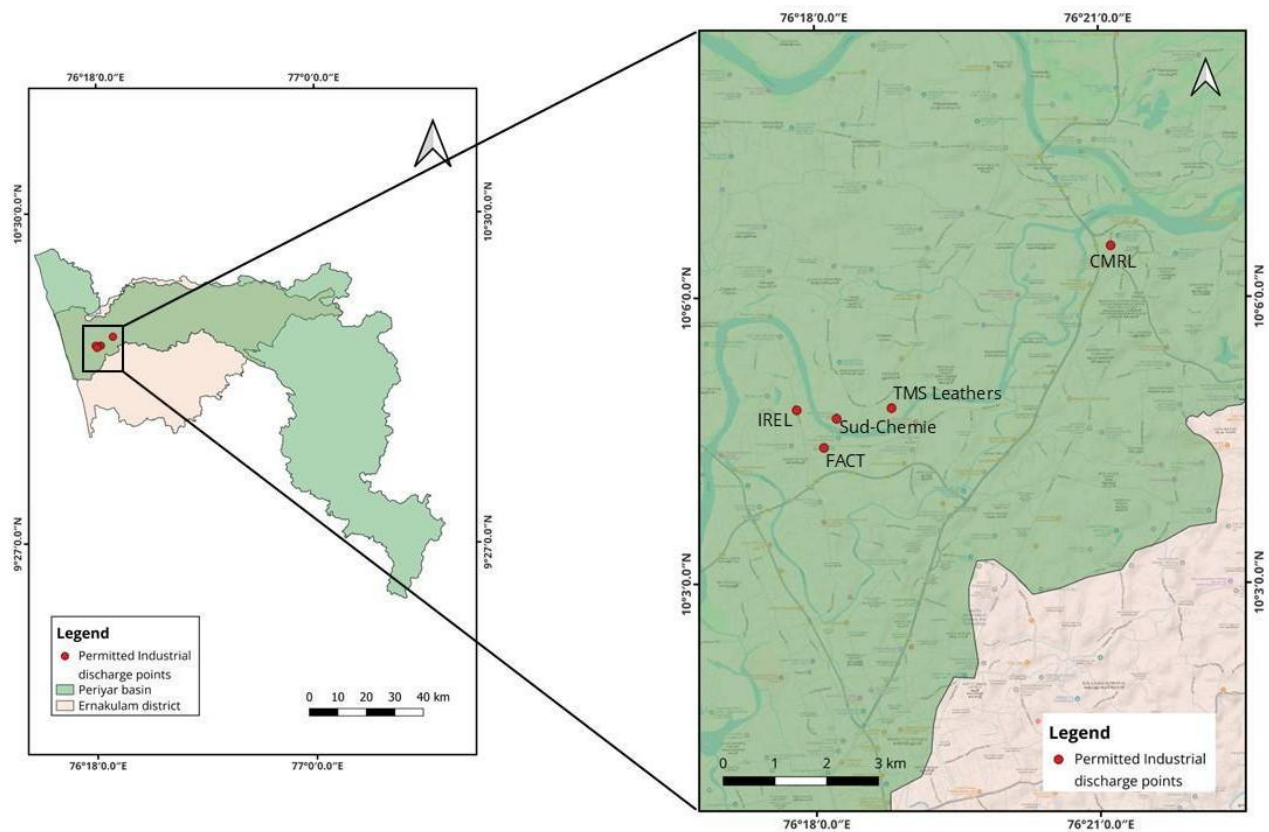


Figure 12 Industries permitted for the direct discharge of treated effluent into the Periyar

The identification of these key issues and data gaps should not be interpreted as an indication of non-compliance; rather, it underscores the necessity for improved data integration mechanisms, strengthened inter-agency coordination, and the establishment of structured and systematic environmental reporting frameworks within the Periyar River Basin. Establishing a basin-level industrial environmental information system for the Idukki segment of the Periyar River Basin would significantly improve regulatory oversight, facilitate informed decision-making, and align

industrial growth with sustainable water resource management objectives. Addressing these gaps will be crucial for protecting the upper reaches of the Periyar River system while enabling responsible industrial development within the district.

6. Conclusions

The industrial concentration within Ernakulam and parts of Thrissur has resulted in increased industrial water demand and greater dependence on the Periyar River system for industrial operations. The presence of large industrial clusters, particularly in the Ernakulam industrial belt, highlights the increasing pressure on surface water and groundwater resources, along with concerns related to wastewater generation, effluent discharge, and pollution load accumulation. The projected industrial water demand within both districts further emphasizes the necessity for integrated water resource planning and sustainable industrial management within the basin. Overall, the downstream districts of Ernakulam and Thrissur within the Periyar River Basin are characterized by relatively concentrated industrial activity, established industrial infrastructure, and significant manufacturing and service sector presence. These districts together form the major industrial corridor of the basin and support a substantial share of the industrial activities associated with the Periyar River system.

Ernakulam district represents the most industrially intensive segment of the basin, particularly within the Eloor–Edayar industrial corridor, where large- and medium-scale industries related to chemicals, petrochemicals, fertilizers, rubber, engineering, food processing, and allied manufacturing sectors are concentrated. Within the basin boundary, the district contains six major industrial areas and development plots comprising 761 developed plots, of which 698 units are currently operational, indicating a high degree of industrial occupancy and operational activity. The industrial structure is further supported by a large base of micro and small enterprises, with 27,413 operational micro and small units recorded in the district. Sector-wise analysis indicates strong representation of agro and food-based industries, engineering units, repairing and servicing units, wood-based industries, and miscellaneous manufacturing and service activities. Large-scale and medium-scale industries within the basin include fertilizer, petrochemical, chemical, rubber, engineering, printing, paper product, power generation, spice processing, and food-processing industries. Spatially, industrial concentration is highest in central Ernakulam, particularly around

Kochi Corporation, Eloor, Angamaly, Kadungalloor, and nearby industrial regions within the basin.

Thrissur district constitutes another important industrial region within the Periyar River Basin, although the industrial intensity remains comparatively lower than Ernakulam. The district contains six Development Plots comprising 237 industrial plots, all of which have been allotted, while 210 units are currently functioning, reflecting considerable industrial utilisation. The industrial profile is largely dominated by micro and small enterprises, with 16,272 operational units recorded in the district. Agro-based industries, textiles, engineering units, mineral-based industries, leather products, repairing and servicing units, and other service-oriented sectors form the major industrial components. Although several large-scale industries are present in Thrissur district, spatial analysis indicates that most of these industries are located outside the Periyar Basin boundary. Certain industrial areas such as Puzhakkalpadam and Varavoor presently show limited industrial development, indicating that parts of the industrial infrastructure are still evolving within the basin region.

Industrial concentration within Ernakulam and parts of Thrissur has resulted in increased industrial water demand and greater dependence on the Periyar River system for industrial operations. The projected industrial water demand for 2020 is estimated at 3.214 MCM in Ernakulam district within the assessed basin areas. The presence of major industrial clusters, particularly within the Ernakulam industrial belt, highlights increasing pressure on surface water and groundwater resources, along with concerns related to wastewater generation, effluent discharge, and pollution load accumulation. The identified gaps between existing water potential and projected industrial demand further emphasise the requirement for integrated water resource planning, pollution control measures, and sustainable industrial management within the Periyar River Basin.

Overall, the downstream portion of the Periyar River Basin is characterised by concentrated industrial development, organised industrial infrastructure, expanding MSME sectors, and significant manufacturing and processing activities that contribute substantially to employment generation and regional economic growth. At the same time, the concentration of industrial activities within the basin underlines the importance of continuous environmental monitoring, industrial water demand assessment, pollution management, and regulatory compliance to support environmentally sustainable industrial development within the Periyar River Basin.

Although a major geographical extent of the Periyar River Basin falls within Idukki district, the industrial presence in this upstream segment remains comparatively limited when assessed against downstream districts such as Ernakulam and Thrissur within the basin. Idukki continues to be categorised as an industrially backward district (Low urbanization rate but moderate to high per capita gross value), primarily due to its physiographic constraints, hilly terrain, forest cover, and limited availability of developable industrial land. Nevertheless, following basin-specific filtration and verification of operational status, a total of 2,164 currently functioning industrial units were identified within the Periyar River Basin portion of Idukki district. The scale-wise distribution clearly indicates a predominance of micro enterprises. Out of the 2,164 operational units, Large-scale industries account for 7 units (0.32%), Medium-scale industries for 4 units (0.18%), Small-scale industries for 39 units (1.80%), and Micro-scale industries for 2,114 units (97.69%). Nature-wise classification shows a relatively balanced but slightly service-oriented structure, with 1,156 service units (53.42%) and 1,008 manufacturing units (46.58%).

The industrial portfolio of Idukki is diversified yet strongly influenced by agro-based resources and local consumption demand. Large-scale industries are primarily engaged in condiment manufacturing, while medium-scale units include tea factories and packaging-related industries. Small-scale industries are largely associated with tea manufacturing and allied agro-processing. In sectoral terms, 50 units from the large, medium, and small categories have been classified into 10 broad sectors, with Agro - Food and Beverage Processing alone accounting for nearly two-thirds of the registered units, indicating a concentrated agro-processing-driven industrial structure.

Spatial analysis reveals notable intra-district disparities. At the block level, Nedumkandam (567 units), Adimali (515 units), and Azhutha (476 units) exhibit significant industrial clustering, whereas Elamdesom (3 units) and Idukki Block (35 units) show minimal industrial presence. Taluk-wise distribution indicates that Udumbanchola leads with 1,048 units, followed by Devikulam (639) and Peerumade (477). Large-scale industries are confined to Devikulam (4 units) and Udumbanchola (3 units), while medium-scale industries are concentrated in Devikulam (3 units) and Udumbanchola (1 unit). At the local body level, Adimali Grama Panchayat (301 units), Udumbanchola Grama Panchayat (237 units), and Kattappana Municipality (234 units) record the highest industrial presence, whereas Mariyapuram (4 units), Chinnakkanal (6 units), and Mankulam (10 units) have the least.

Overall, the Idukki district of the Periyar River Basin is characterised by a dispersed, micro-scale-dominated, agro-oriented industrial ecosystem with limited large-scale industrial intensity. While the current industrial footprint suggests relatively lower cumulative environmental stress compared to downstream regions, the high proportion of micro and small enterprises underscores the need for structured environmental reporting, decentralised monitoring, and sustainable industrial planning to ensure that future growth remains aligned with integrated basin management objectives for the Periyar River.

7. Role of Stakeholders

7.1. Directorate of Industries & Commerce and District Industries Centres (DIC)

The Directorate of Industries & Commerce plays a pivotal institutional role in shaping the industrial landscape of the Periyar River Basin, including the Idukki district segment. Headed by the Director of Industries & Commerce at the state level and operationalized at the district level through the DIC under the General Manager, the department is responsible for promoting entrepreneurship, facilitating industrial growth, and supporting sustainable economic development. Its vision of nurturing entrepreneurship through effective utilization of local human and natural resources aligns closely with the industrial structure observed in Idukki, where agro-based and micro-scale enterprises dominate. Through capacity-building initiatives, skill development programs, infrastructure facilitation, financial incentives, and *Ease of Doing Business* support systems, the Directorate and DIC's contribute to strengthening the district's industrial ecosystem. In the context of the Industrial Profile of the Periyar River Basin, these institutions are critical for maintaining updated industrial databases, enabling sectoral diversification, supporting environmentally responsible industrial expansion, and ensuring that future industrial development remains inclusive, decentralised, and aligned with basin-level sustainability objectives.

7.2. Kerala State Pollution Control Board (KSPCB)

The KSPCB serves as the primary environmental regulatory authority overseeing industrial compliance within the Periyar River Basin. Its mandate includes granting *Consent to Establish* (CTE) and *Consent to Operate* (CTO), monitoring effluent discharge standards, enforcing pollution control norms, and ensuring that industries adopt appropriate sewage treatment plants (STPs) and

effluent treatment plants (ETPs). In the context of the Idukki district's predominantly micro and small-scale industrial base, the role of KSPCB becomes particularly significant in preventing cumulative environmental impacts on the Periyar River and its tributaries. Regular inspection, compliance verification, water quality monitoring, and enforcement of environmental standards are essential to safeguard basin water resources. This report may serve as a decision-support tool for KSPCB by providing spatial and sectoral information on industrial activities, effluent generation, and outfall locations. It can aid in targeted inspections, compliance assessment, pollution load management, and the formulation of basin-scale pollution mitigation strategies.

Within this Industrial Profile framework, strengthened coordination between KSPCB, the Directorate of Industries & Commerce, and district-level agencies is fundamental to ensuring data transparency, effective environmental governance, and sustainable industrial development across the Periyar River Basin.

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