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

Hydraulic Profile of
Periyar River Basin

December 2024

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National River Conservation Directorate (NRCD)

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

This report is a comprehensive outcome of the project jointly executed by IIT Palakkad (Lead Institute) and NIT Calicut (Fellow Institute) under the supervision of cGanga at IIT Kanpur. It was submitted to the National River Conservation Directorate (NRCD) in 2024. We gratefully acknowledge the individuals who provided information and photographs for this report.

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Preface

Hydraulic data such as river cross sections and longitudinal sections, details of hydraulic structures, storages, releases etc are necessary for performing hydraulic modelling of riverine systems. Simulations performed using hydraulic models help in developing a clear understanding of river hydrodynamics, predicting flood risks, and implementing effective and efficient water management strategies. In this report, details pertaining to the hydraulic data of the Periyar River Basin collected till date are presented. Few river cross-sections and details of various hydraulic structures on the river were obtained from the Dept. of Water Resources, Govt. of Kerala and the Central Water Commission. The major dam owner in the Periyar River Basin is the Kerala State Electricity Board Limited (KSEBL). Hydraulic data related to the dams owned by the KSEBL including reservoir water levels and storages, elevation-storage-water spread area curves, releases, inflows etc have not been obtained yet. It is expected that this data will be obtained soon and this document will be updated once this is obtained.

Beyond its technical value, this report is expected to play a pivotal role in enhancing regional resilience and guiding informed policy decisions for sustainable water resource management in the Periyar River Basin. The insights gained from this data can help policymakers and planners design more effective flood mitigation strategies, optimize infrastructure management, and develop long-term climate resilience frameworks. Moreover, by identifying data gaps and suggesting actionable recommendations, this report supports future initiatives aimed at improving hydraulic data quality and promoting collaborative efforts among stakeholders. The knowledge shared here is intended to assist Government Departments, Engineers, Environmentalists, Researchers, and Policymakers in their efforts to safeguard communities, protect ecosystems, and ensure sustainable management of water resources in the region.

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

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1. INTRODUCTION

This report provides a comprehensive overview of the hydraulic data collected, with a particular focus on river cross-sections and details of infrastructure. Accurate and reliable cross-section data is crucial for understanding channel geometry, including width, depth, and slope, which are essential for calculating flow area, velocity, and resistance. Over time, cross-section data highlights changes in bed levels and channel shapes, offering insights into the dynamic interaction between flow and the river channel. In addition to cross-section data, the presence of infrastructure such as dams, check dams, and other structures significantly influences river flow patterns and alters the storage capacity of the system. Understanding these structural influences is critical for predicting hydrodynamic behavior, especially during extreme events like floods.

The collected data plays a pivotal role in several practical applications, including flood risk mitigation, water management, and infrastructure planning. By analysing changes in channel geometry and evaluating the impact of structures, the data helps simulate flood scenarios, enabling accurate prediction of flood extents and identifying vulnerable areas, thereby supporting the development of flood management plans and early warning systems. It also aids in optimizing water allocation, regulating flow, and ensuring sustainable management of water resources, while providing the foundation for designing and maintaining critical infrastructure. Simulations performed using hydraulic models, calibrated with this data, enable the development of a clear understanding of river hydrodynamics, aiding in informed decision-making and the implementation of effective water management strategies.

2. DATA COLLECTED

The hydraulic data collected for the Periyar River Basin offers valuable insights into the hydrological behavior and dynamics of the river. A summary of the key data categories is presented in Table 1, with detailed descriptions provided in the following sections.

Table 1. Collection and collation of hydraulic data

Sl. No	Tasks	Source	Deliverables	Outcomes
1	Cross sections of the main stream, major tributaries of the river and drains to determine hydraulic parameters such as bed slope, water surface slope, surface roughness and channel velocity	CWC, IDRB	Excel, Shape file	For hydraulic model
2	Longitudinal section of the mainstream, major tributaries and drains of the river	Not available		
3	Infrastructure in/ on rivers (e.g. Bridge, Dam, Barrage, Intake wells, Canal offtake, Sewer Outfall, Ghats, etc.)	IDRB	Excel, Shape file	For hydraulic model

2.1 CROSS SECTIONS

Data on cross-sections has been partially received. The data obtained till date was made available by the Irrigation Design and Research Board (IDRB), Dept. of Water Resources, Govt. of Kerala and the Central Water Commission (CWC). Data from the Kerala State Electricity Board Limited (KSEBL) is still awaited. The overall scenario w.r.t. availability of cross-section data is summarised in the Table 2.

2.1.1 Cross sections obtained from the CWC

The river cross-sections at two points for the period from 2000 to 2023 were obtained from the CWC. The locations of the gauging stations are presented in Fig. 1, and the details of the locations were cross-section data was provided are presented in Table 2.

Table 2. Details of the cross section data collected

Sl. No.	Data Collected		Source	Time Period
	Order of the stream	No. of c/s available		
1	Main stream	5	IDRB	2022
	Major tributary	1		
	5th order stream	2		
	1st order stream	1		
2	Main stream	1 (Neeleswaram)	CWC	2000-2023
	Major tributary	1 (Vandiperiyar)		

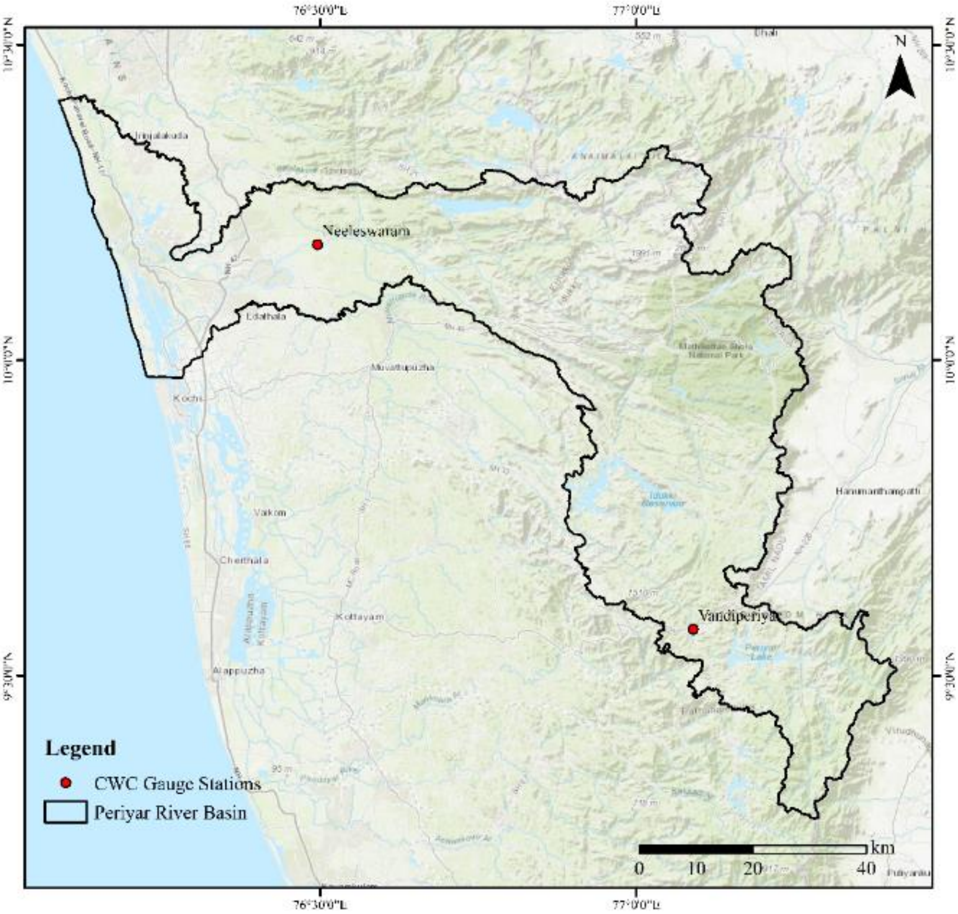

Fig.1 Location of the CWC gauging stations

Table 3. Cross sections from the CWC

Sl. No.	River Point	Latitude (^{0})	Longitude (^{0})	Period	Frequency	No. of data available
1	Neeleeswaram	10.18333333	76.49555556	2000 to 2023	Yearly twice	42
2	Vandiperiyar	9.573333333	77.09055556	2000 to 2023	Yearly twice	37

The cross section data includes the following details:

- **Serial No**
- **Reduced Distance:** The horizontal distance of the point from the common origin
- **Elevation CGL:** Elevation with respect to the mean sea level for central gauge line (CGL)

2.1.2 Cross sections obtained from the IDRB

River cross-sections at nine locations along the river for the year 2022 were obtained from IDRB, Kerala. Three adjacent cross-sections are available at each location listed in Table 4. The locations of the cross-section sites are presented in Fig. 2.

Table 4. Cross sections from the IDRB

Sl. No.	Name	Latitude (⁰)	Longitude (⁰)	Year	No. of data available
1	Karumalloor	10.13646	76.29327	2022	3
2	Uliyannoor Bridge (Aluva)	10.106	76.348	2022	3
3	Aluva	10.0841	76.33289	2022	3
4	Manjummal/ Muttar River	10.05798	76.307	2022	3
5	Bhoothathankettu	10.13021	76.68294	2022	3
6	Munnar	10.086	77.061	2022	3
7	Panamkutty Bridge	9.952	76.979	2022	3
8	Erattayar	9.799	77.107	2022	3
9	Upputhura	9.699	77.027	2022	3

The data contains the following details:

- **FID:** Feature identifier
- **X:** Easting
- **Y:** Northing
- **String:** elevation value from the MSL in metres

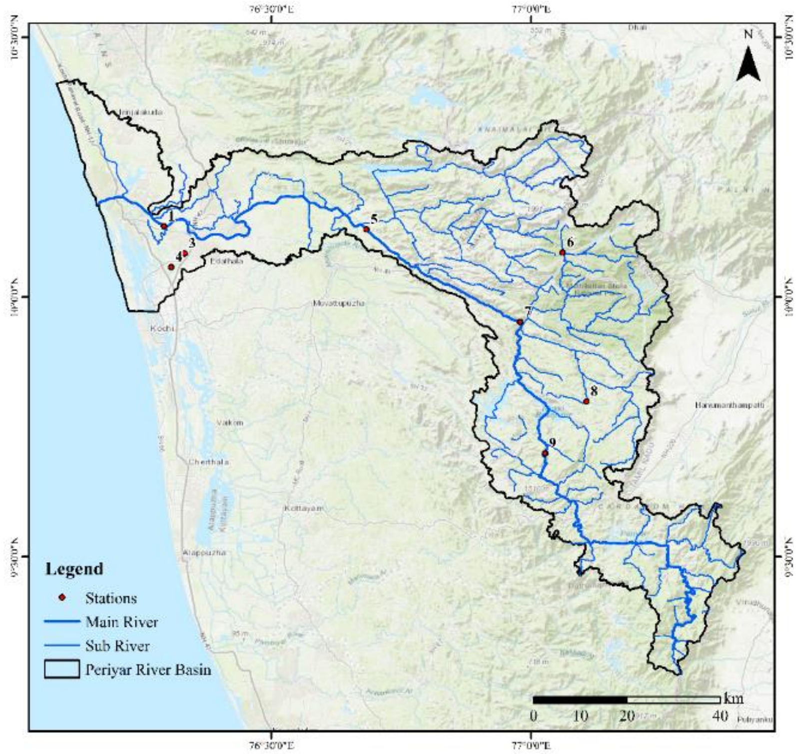

Fig. 2 Locations of cross sections provided by the IDRB

2.2 INFRASTRUCTURE IN/ ON THE PERIYAR RIVER

The infrastructure in/ on the river includes dams, check dams, lift irrigation (LI) schemes, rain gauges, river gauges, regulators, vented cross bars (VCBs), wells, ponds, bridges and weirs. Data pertaining to many of these were obtained from the Irrigation Design and Research Board

(IDRB). This data is available in both CSV and shape file formats, and the details associated with each structure are listed below:

2.2.1 Dams

The total number of dams in the Periyar River Basin is 17. The name and location of these dams are presented in Table 5 and their locations are indicated in Fig. 3.

Table 5. Location of Dams

Sl. No	Name of dam	Latitude (^{0})	Longitude (^{0})
1	Anayirankal Dam	10.00901389	77.20733
2	Bhoothathankettu Barrage	10.137549	76.66198
3	Cheruthoni Dam	9.845666667	76.96703
4	Erattayar Dam	9.810277778	77.10583
5	Idamalayar Dam	10.22207222	76.70649
6	Idukki Dam	9.8431	76.9764
7	Kallar Dam	9.824683116	77.15621
8	Kallarkutty Dam	9.980077778	77.00133
9	Kulamavu Dam	9.8028	76.8856
10	Kundala Dam	10.14348611	77.19863
11	Pambla Dam	9.962455556	76.95708
12	Madupetty Dam	10.10636111	77.12351
13	Mukkudil Dam	9.9467	77.1077
14	Mullaperiyar Dam	9.528691667	77.14433
15	Ponmudi Dam	9.960283333	77.0565
16	R.A. Headwork	10.068092	77.06712
17	Sengulam Dam	10.01088333	77.03266

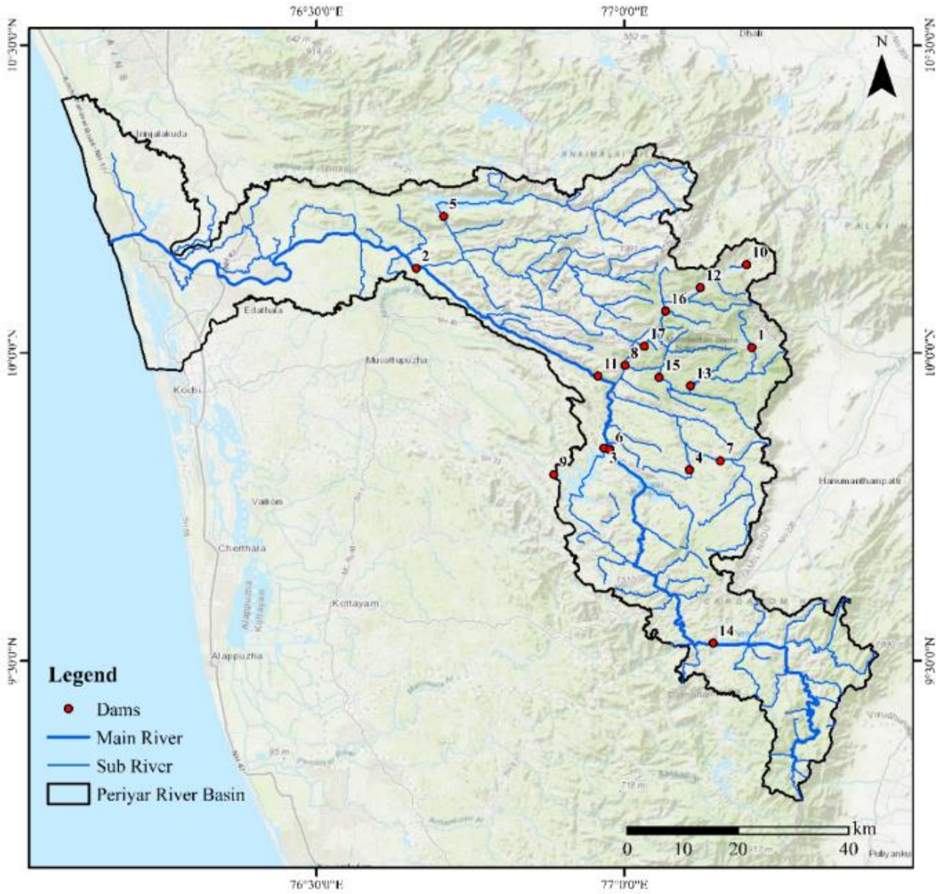

Fig. 3 Location of dams

2.2.2 Check dams

The total number of check dams in the basin is 132. These are shown in Fig. 4. The details available are mentioned below.

- **Sl. No.**
- **BD_NaSubBasin:** Name of sub basin
- **NaStru**: Name of structure
- **Lat:** Latitude
- **Long:** Longitude
- **TyStruct:** Type of structure
- **L:** Length in m
- **B:** Breadth in m
- **H:** Height in m
- **District**
- **NaGrPan:** Name of Grama Panchayat
- **NaBasin:** Name of Basin

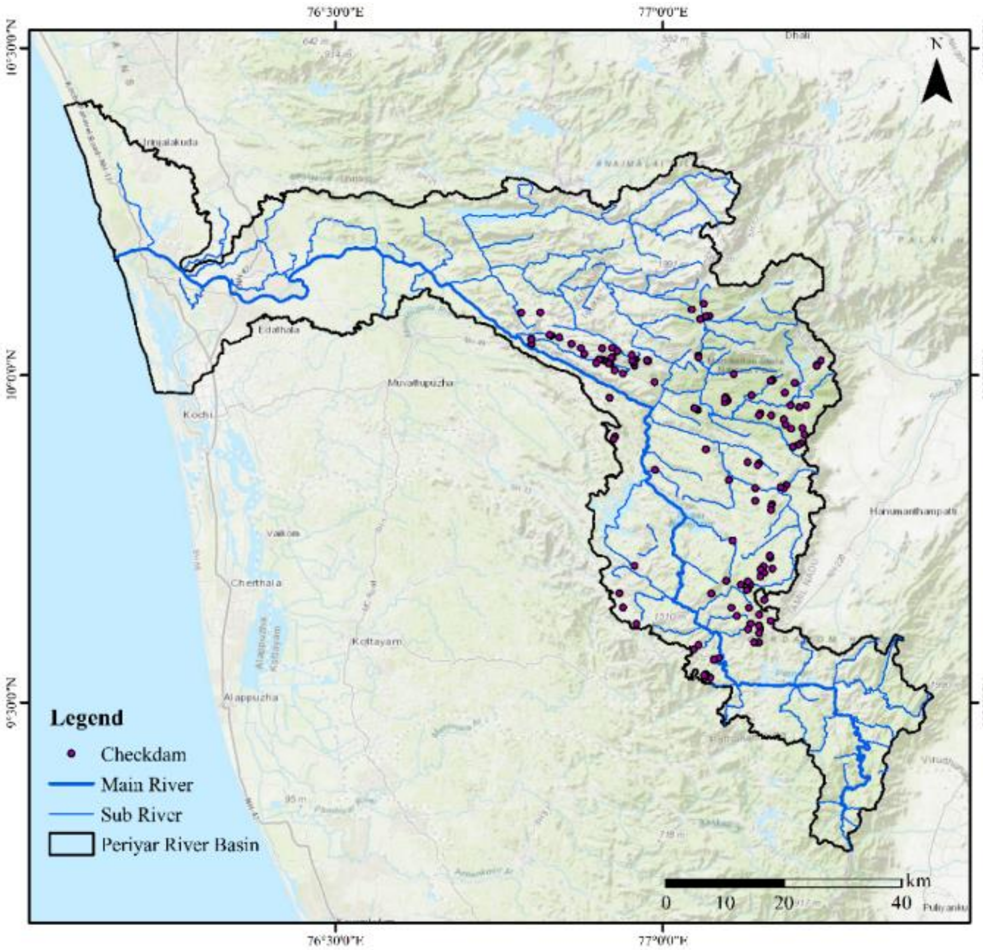

Fig. 4 Location of check dams

2.2.3 River gauges

The total number of river gauges in the basin is 3. The name and location of these river gauges are presented in Table 6 and Fig. 5.

Table 6. Location of river gauges

Sl. No.	Name of the Site	Latitude (⁰)	Longitude (⁰)
1	Kalady	10.168516	76.45111
2	Mangalapuzha	10.126657	76.340056
3	Marthandavarma	10.111995	76.346548

The details available are mentioned below.

- **River**
- **District**: The district where the gauge is situated.
- **Fund source** (CGO or NHP/HP2/HP1 or Other agency funded)
- **Current Meter reading available** (Yes/No)
- **Current meter reading done for last monsoon season** (Jun-Sep 2023) (Yes/No)

- **Remarks** (Condition of the station/ Bottlenecks for current meter reading/ Proposals for current meter available).

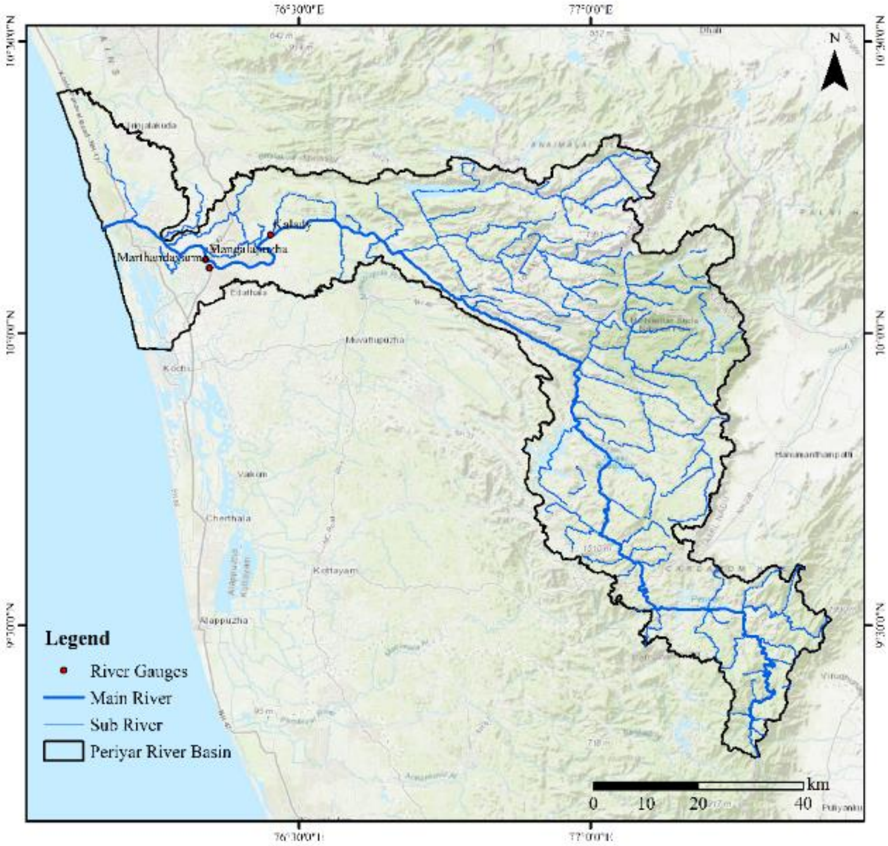

Fig. 5 Location of river gauges under the IDRB

2.2.4 Rain gauges

10 rain gauge stations are available in the Periyar River Basin. The names and locations of the rain gauges are provided in Table 7 and shown in Fig. 6.

Table 7. Location of rain gauges

Sl. No	Name of site	Latitude (⁰)	Longitude (⁰)
1	Aluva	10.11186	76.345303
2	Bhoothathankettu	10.13475639	76.66300585
3	Neriyamangalam	10.056095	76.773758
4	Mathilakam	10.2936111	76.1677778
5	Chinnar Estate (Semini valley)	9.6452	76.9722
6	Kumili	9.608975	77.170619
7	Nedumkandam	9.83357	77.15935
8	Vandanmedu	9.72229	77.15227
9	Keerampara	10.1085	76.6735
10	Painavu	9.8513	76.9437

The details available are mentioned below.

- **Section**: The administrative section where the gauge is located.
- **River**: The name of the river stretch.
- **District**: The district where the gauge is situated.

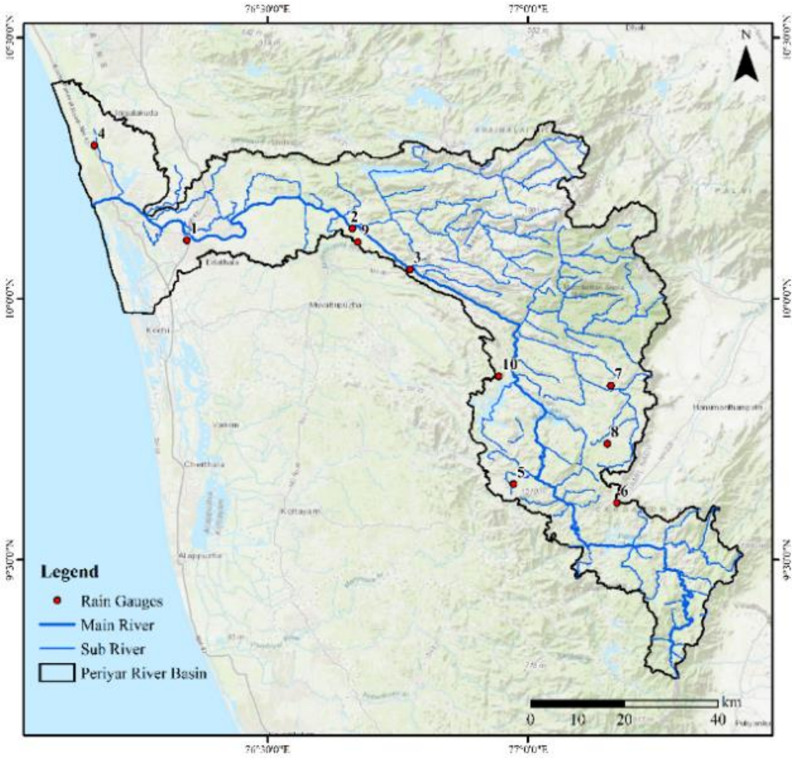

Fig. 6 Location of rain gauges installed by the IDRB

2.2.5 Lift irrigation (LI)

Total number of lift irrigation schemes in the basin is 103, and these are presented in Fig. 7. The following details are available with respect to lift irrigation schemes:

- **Sl. No.**
- **River Basin**
- **Panchayat**
- **District**
- **Structure Name**
- **Grama Panchayat**
- **Latitude**
- **Longitude**

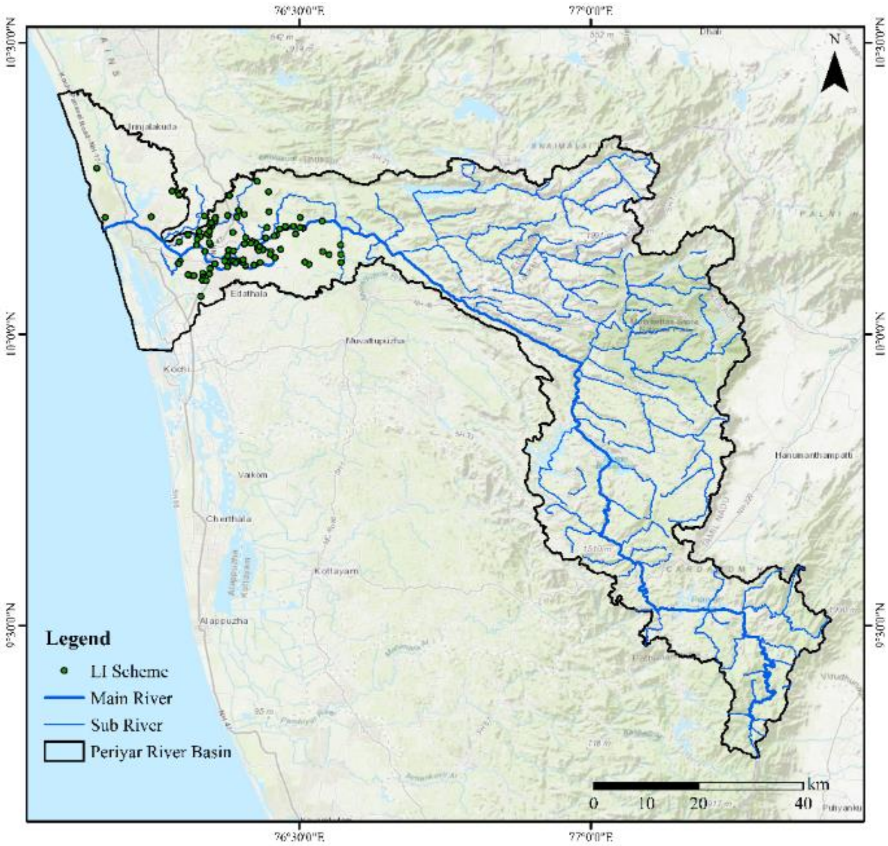

Fig. 7 Location of lift irrigation schemes

2.2.6 Regulators

There are three regulators in the Periyar River Basin and their locations are presented in Fig. 8. Details available with regard to regulators are as follows:

- **Sl. No**
- **River Basin**
- **Type of Structure**
- **Panchayat**
- **District**
- **Structure Name**
- **Ownership**
- **Latitude**
- **Longitude**

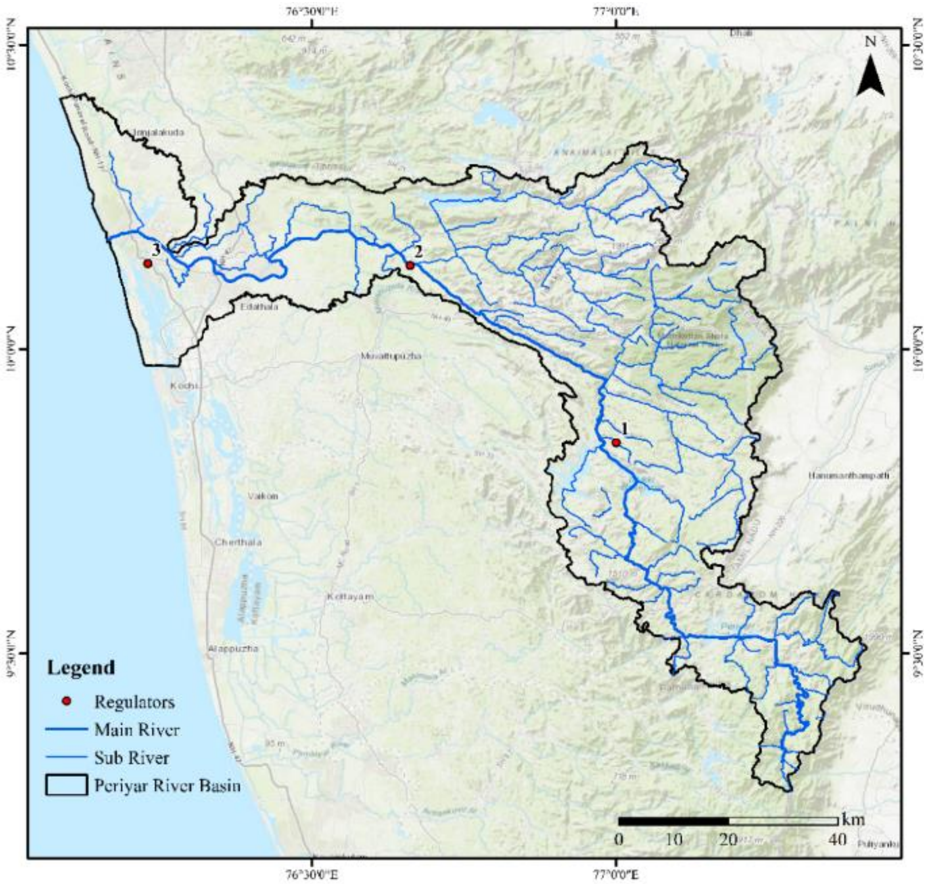

Fig. 8 Location of regulators

2.2.7 Wells

There are about 120 wells in the Periyar River Basin and these are shown in Fig. 9. The data available includes:

- **Sl. No.**
- **Structure Name**
- **Details**
- **River Basin**
- **Sub basin**
- **Type of Structure**
- **District**
- **Gram Panchayat**
- **Latitude**
- **Longitude**
- **Altitude**
- **Height**
- **FRL**: Full reservoir level
- **FSD**: full storage depth
- **Pond Storage (FRL)**

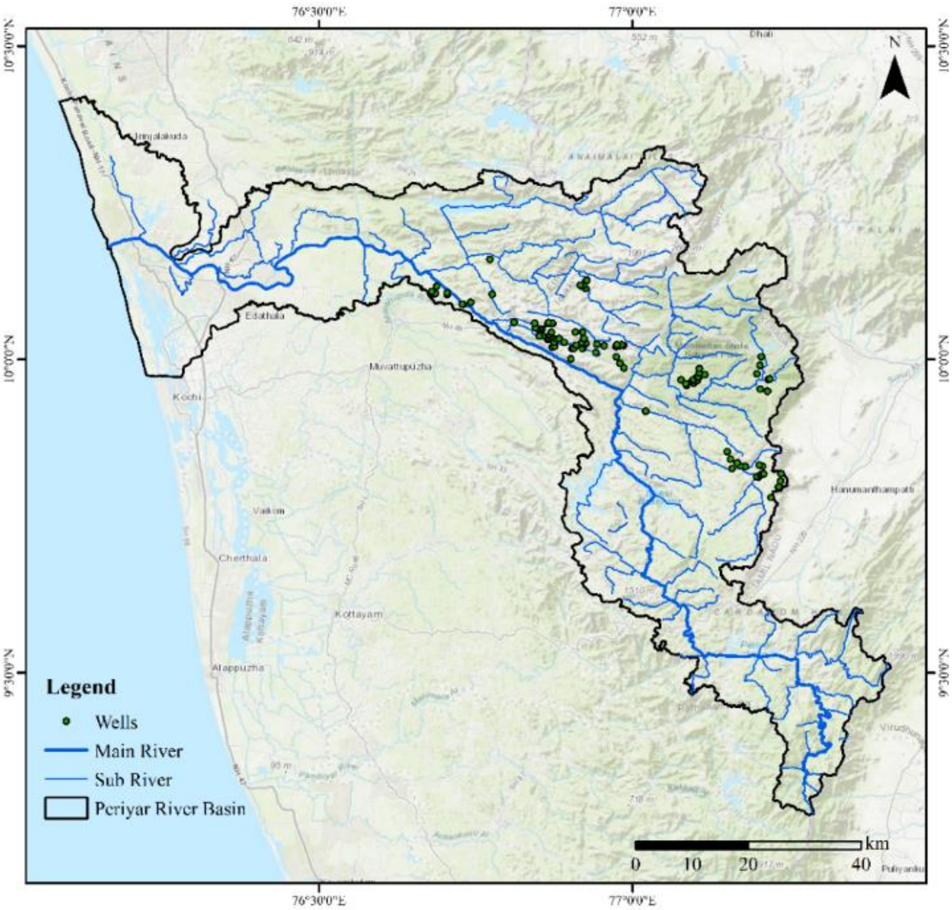

Fig. 9 Location of wells

2.2.8 VCBs

There are seven VCBs in the river basin and their locations are indicated in Fig. 10. The details available with regard to the VCBs are as follows:

- **Sl. No**
- **Structure Name**
- **Type of Structure**
- **River Basin**
- **Grama Panchayat**
- **District**
- **Latitude**
- **Longitude**
- **Length**
- **Breadth**

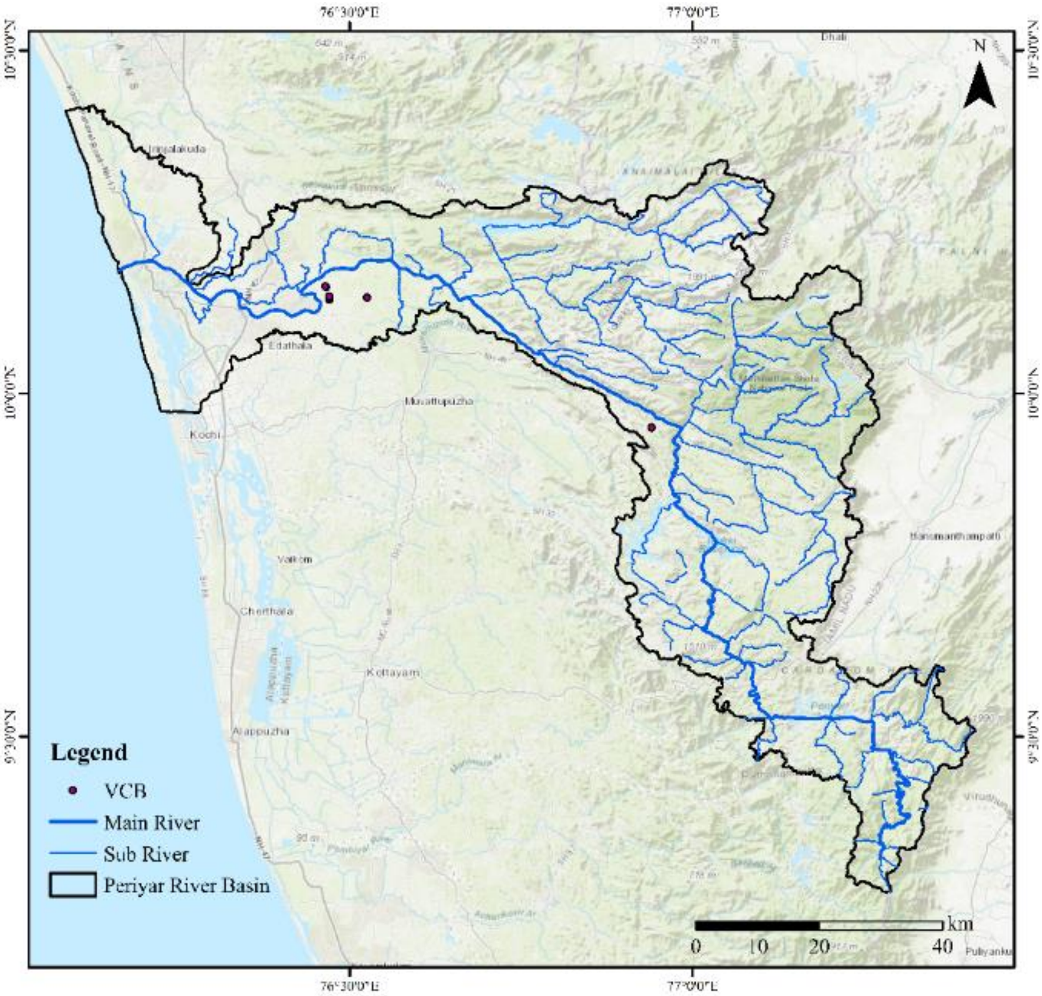

Fig. 10 Location of VCBs

2.2.9 Ponds

The total no. of ponds in the river basin is 4326, and their locations are presented in the Fig. 11. The data available includes:

- **Sl. No.**
- **River Basin**
- **Type of Structure**
- **Structure Name**
- **Panchayat**
- **District**
- **Latitude**
- **Longitude**
- **Length**
- **Breadth**
- **Height**
- **FRL**
- **Pond Storage (FRL)**

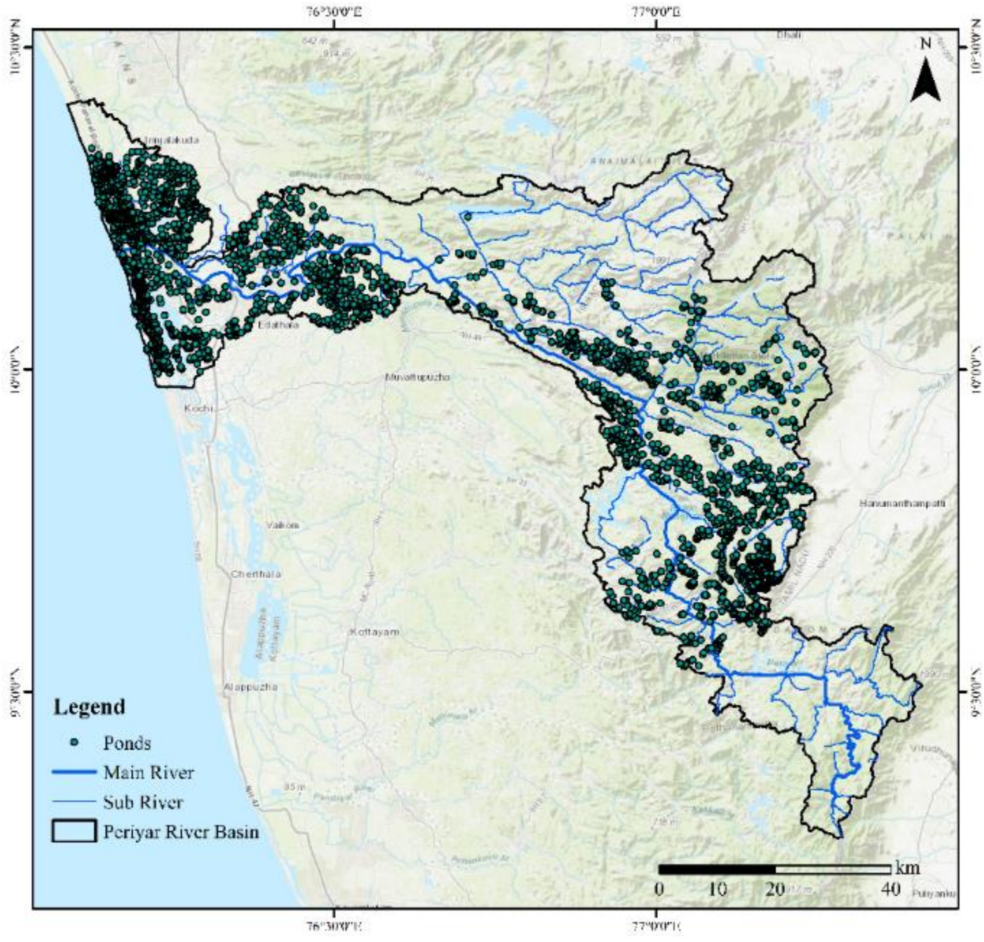

Fig. 11 Location of ponds

2.2.10 Bridges

The total no. of bridges in the river basin is 203, and their locations are presented in the Fig. 12. The data includes the location name, latitude and longitude.

2.2.11 Weirs

Viripara and Vellathooval weirs are the two major structures in the Periyar River Basin. Their locations are shown in Fig. 13.

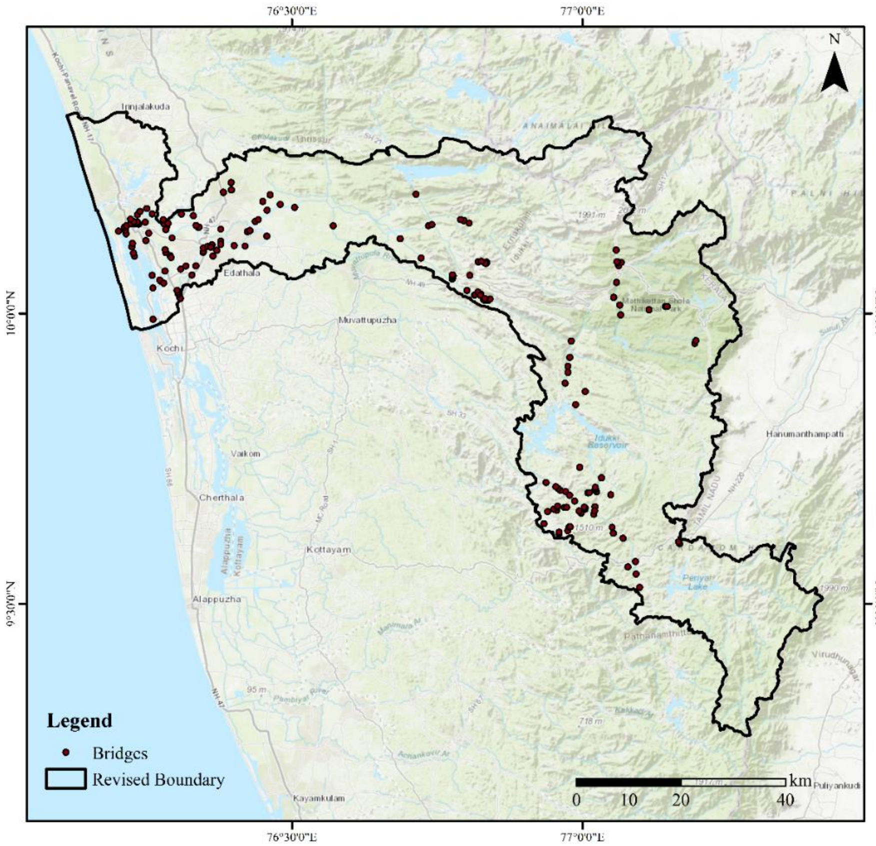

Fig. 12 Location of bridges

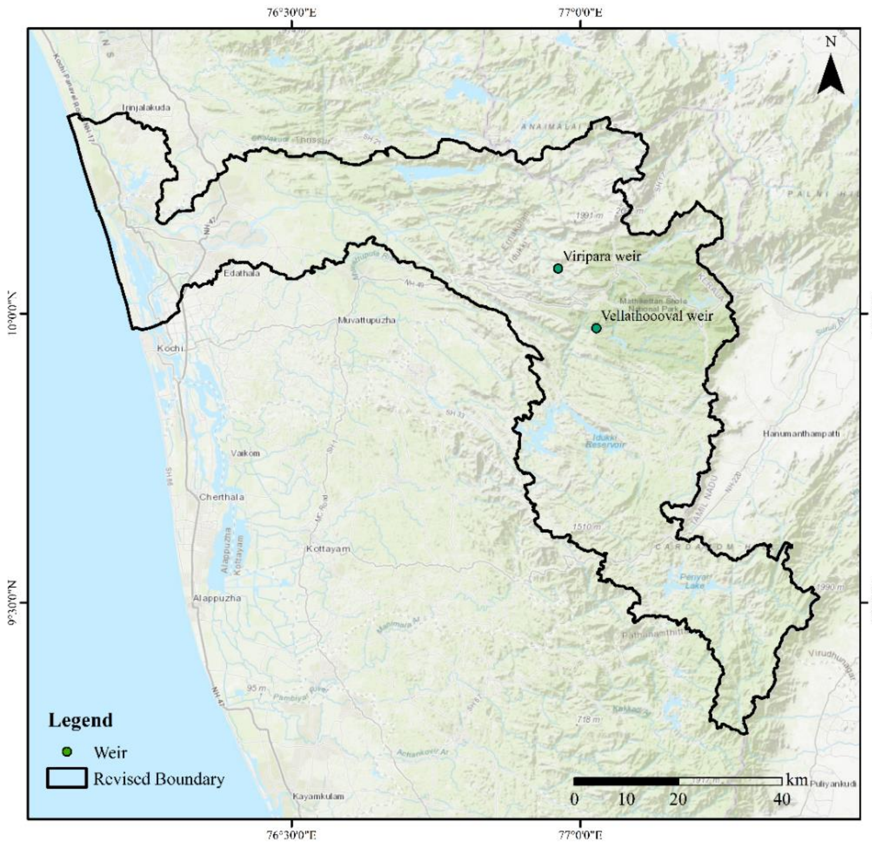

Fig. 13 Location of weirs

3. DATA GAPS

Comprehensive and accurate datasets are essential for reliable and efficient hydraulic modelling, but the available dataset reveals several critical gaps that hinder the ability to simulate flow dynamics, forecast flood risks, and develop effective water management strategies. One of the major gaps is the inadequacy of cross-section data at key locations along the Periyar River. Cross-section data is fundamental for determining channel geometry, flow area, velocity, and resistance, all of which are essential inputs for hydraulic models. For the Periyar, a total of 11 cross-sections are available, including 6 across the main stream, 2 across major tributaries, and the remaining 3 across lower-order streams. However, among these, only three cross-sections are located upstream, while the rest are concentrated downstream, leaving the upstream segment inadequately represented. This uneven distribution makes the available data insufficient for capturing the variability in channel geometry, especially in the upstream reaches where hydrodynamic changes often originate. As a result, the absence of adequate upstream data limits the ability to accurately simulate flow behavior, identify vulnerable areas, and assess risks associated with flooding and erosion.

Another major gap is the lack of metadata for infrastructure on the river, particularly the year of construction of dams, check dams, and other structures. While the location of these structures has been provided by the IDRB, the absence of information about their construction timeline limits the ability to assess their long-term impacts on river flow, sediment transport, and overall river morphology. This temporal context is essential for comparing river behavior before and after the construction of these structures, which is crucial for understanding changes in hydrodynamic conditions over time. Moreover, hydraulic data pertaining to the dams owned by KSEBL, including reservoir water levels, storage capacities, elevation-storage-water spread area curves, releases, inflows, and operating policies, has not been obtained yet. Without this information, it is impossible to accurately model reservoir operations and their downstream impacts, making it difficult to predict flood risks and manage water resources effectively.

These cumulative data gaps have a profound impact on the reliability of hydraulic modelling and decision-making processes. Incomplete and inconsistent data limits the ability to develop calibrated models that reflect real-world conditions, reducing the accuracy of predictions related to flood extents, sediment transport, and changes in river morphology. This, in turn, affects the formulation of flood management plans, hinders the identification of vulnerable areas, and compromises the development of effective mitigation strategies. Addressing these gaps is essential to improve the accuracy and reliability of future hydrodynamic analyses and ensure the development of robust, data-driven strategies for sustainable water management and disaster mitigation.

4. SUMMARY & CONCLUSIONS

The hydraulic data of the Periyar River Basin that has been made available provides critical insights into the river's hydrodynamics and offers detailed information on the infrastructure built along the river. This dataset includes cross-sectional measurements from the Central Water Commission (CWC) and the Irrigation Design and Research Board (IDRB), Kerala**,** covering key aspects such as channel geometry, flow area, and sediment transport. Infrastructure data highlights the locations of various structures such as dams, check dams, lift irrigation schemes, wells, and ponds, which influence river flow, sediment deposition, and overall hydrodynamics. However, despite the value of this dataset, significant gaps remain, such as the absence of longitudinal profiles, inadequate cross-section data, and missing metadata on infrastructure. These limitations restrict the full potential of hydraulic modelling, flow analysis, and risk assessment, affecting the accuracy of flood forecasting, sediment transport modelling, and infrastructure optimization.

4.1 STAKEHOLDER IMPACT

This report provides valuable information that can assist a wide range of stakeholders, including Government Departments and Agencies, Engineers, Policymakers, Environmentalists, and Water Resource Managers. The data and insights presented here can guide efforts aimed at improving flood management, optimizing infrastructure performance, ensuring ecological conservation, and enhancing climate resilience. By utilizing the available data, stakeholders can develop more informed strategies to mitigate flood risks, plan for sustainable infrastructure, and promote the preservation of ecological balance in the basin.

4.2 RECOMMENDATIONS FOR DATA ENHANCEMENT

To fully leverage the potential of hydraulic modelling and improve the accuracy of future analyses, targeted actions to enhance data quality are essential. One critical recommendation is the collection of longitudinal profile data across key stretches of the Periyar River, which will provide detailed information on bed slope variations, enabling improved modelling of sediment transport and energy gradients. Expanding cross-section surveys, particularly in the upstream reaches and tributaries, will capture spatial variations in channel geometry, enhancing the precision of flood and erosion models. Additionally, obtaining infrastructure metadata, including information on the year of construction and operational details of key structures such as dams and check dams, will facilitate a more thorough assessment of long-term impacts on hydrodynamics and sediment dynamics.

Equally important is the acquisition of reservoir operation data from KSEBL, covering reservoir water levels, storage capacities, inflows, and operating policies. This data will enable more realistic simulations of downstream impacts and improve flood risk assessments. Furthermore, the application of advanced surveying techniques such as LiDAR, drone-based surveys, and remote sensing can significantly enhance the spatial and temporal resolution of data, providing a more comprehensive understanding of river dynamics and infrastructure behavior. Finally, strengthening collaboration between relevant agencies, including government departments, research institutions, and local authorities, will ensure a more integrated and consistent approach to data collection and management. By addressing these data gaps and adopting advanced data collection methods, the quality of hydraulic models can be greatly improved, leading to more effective flood management, infrastructure planning, and sustainable water resource management.