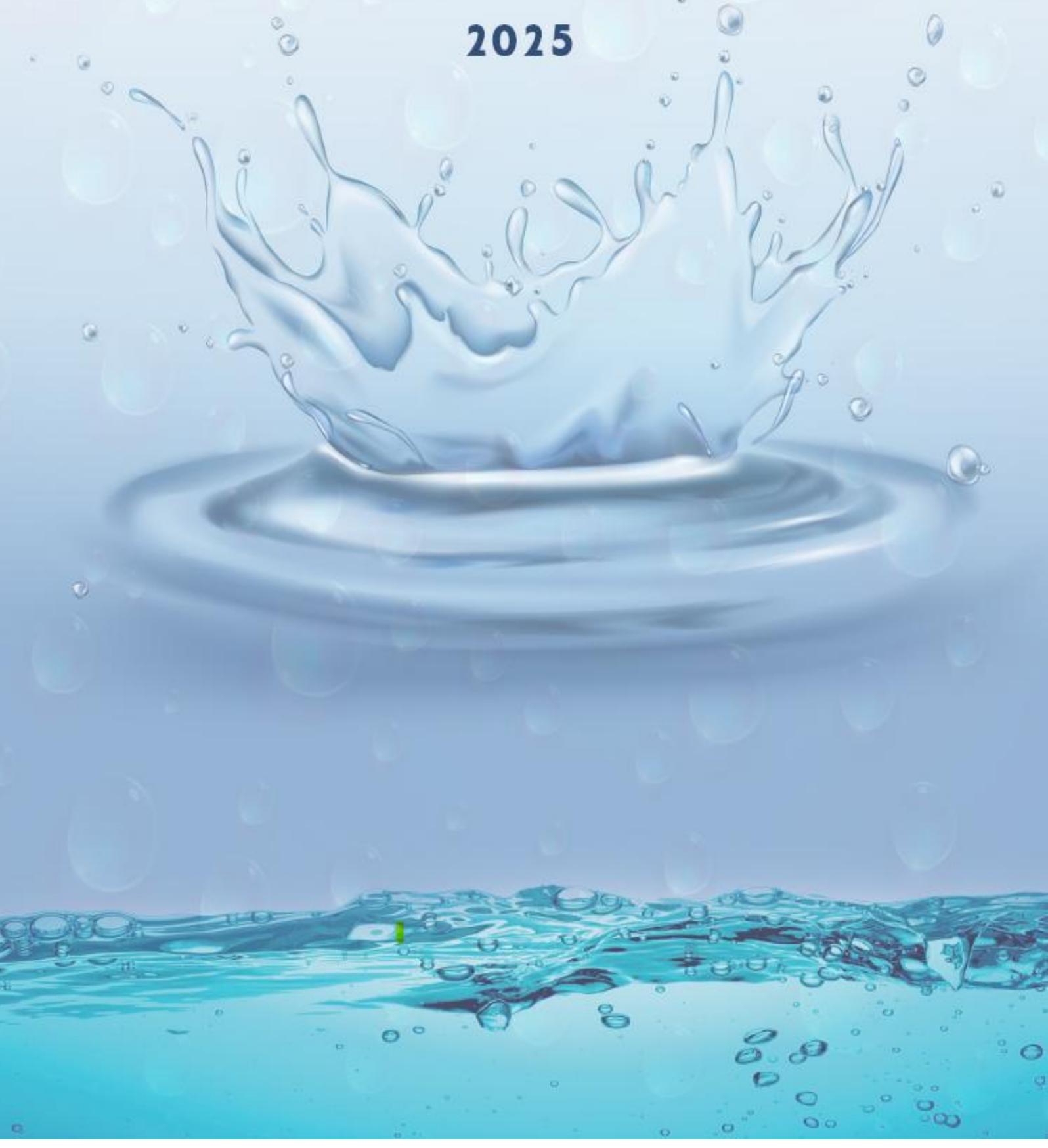75 വയസ്സിലെ കേരളം

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Message from Hon'ble Minister for Water Resources

It is with profound hope and dedication that I present this Vision Document for the Water Sector, a critical outcome of the comprehensive seminar held in Kattappana, Idukki, on October 17, 2025. This initiative stands as a vital component of the Government of Kerala's ambitious "Vision 2031" series, designed to propel our state towards becoming a truly progressive and developed realm. Our focus remains resolutely on the welfare of the common people, ensuring that the fruits of development reach every citizen.

This exercise is fundamentally a commitment to future generations, charting practical and futuristic developmental goals uniquely suited to Kerala's distinct socio-environmental landscape. By commemorating the journey towards the 75th anniversary of Kerala's formation in 2031, we are not merely reflecting on past progress but actively defining a resilient and prosperous future. The seminar successfully brought together an unprecedented congregation of eminent national and international panelists, policymakers, experts, and, crucially, the general public and students. This inclusive approach underscores our belief that the most effective solutions emerge from collective wisdom, integrating expert knowledge with the ground-level aspirations of our community.

The core mission enshrined in this document is the **sustainable development, resource management, environment protection, and infrastructural transformation** of our water sector. We recognize that water security is the bedrock of public health, environmental stability, and economic growth. Our immediate priority is fulfilling the basic needs of every household through targeted, resilient interventions. The plan encompasses definitive strategies to achieve universal household coverage of piped drinking water supply and set clear per capita supply standards for both urban and rural areas. Furthermore, we are firmly committed to transitioning towards continuous, 24x7 drinking water availability, a crucial step in enhancing the quality of life for all citizens. Major, Medium, and Minor projects and the irrigation canal networks are key to long term sustainable development of our state. Its importance has been recognized by the government and steadfast efforts are taken in terms of its maintenance, upgradation, and policy and legislative interventions.

We are also addressing the specific vulnerabilities inherent in our geography. This Vision Document outlines targeted strategies for coastal, tribal, and water-scarce regions, ensuring that development is equitable and leaves no community behind. It also mandates that our water supply systems are made resilient to natural disasters, bolstering public trust and safety during times of crisis. The insightful discussions covered vital areas such as pollution abatement, technological interventions for infrastructure improvement, and the fundamental work of groundwater conservation.

The ideas and recommendations compiled in this guiding framework will soon be consolidated with inputs from all 'Vision 2031' seminars and presented at a grand state-level event chaired by the Hon'ble Chief Minister. This assures the community that the outcomes captured here are not just theoretical concepts but form the basis of a comprehensive, implementable policy designed to fulfil the aspirations of the people. We look forward to realizing this ambitious roadmap together, reinforcing hope and trust in a government dedicated to shared prosperity.

ROSHY AUGUSTINE

Message From Additional Chief Secretary, Water Resources

It is a privilege to introduce the Water Sector Vision Document for 2031, a compilation of pragmatic resource-linked action plans developed following the highly effective seminar held in Kattappana, Idukki. Organized as part of the Government of Kerala's progressive journey, this document serves as the essential guiding framework for the State's future water policies and strategies. The Water Resources Department is fully committed to translating the insights gathered into tangible, measurable outcomes for the state.

The seminar was structured to elicit realistic, outcome-oriented approaches that would immediately strengthen policy and practice in Kerala. We were privileged to host rigorous panel discussions that presented implementable solutions utilizing available resources and innovative methods relevant to our unique context. The specificity and practicality of the discussions are directly reflected in the detailed commitments outlined in this framework. Our commitment to achieving infrastructural transformation hinges on implementing robust, integrated strategies. This Vision Document is not merely a record of discussions, but rather a robust, specific, and detailed action plan that captures the state's future strategies for sustainable development, resource management, and infrastructural transformation within the water sector. It reflects a rigorous methodology aimed at identifying practical solutions and utilizing available resources effectively to address complex challenges.

The specificity of this document lies in its comprehensive scope, ensuring that all key aspects of water management are strategically addressed. The departmental roadmap covers critical supply components, including Drinking Water provision and all scales of Irrigation—both Major and Minor—alongside a renewed focus on Micro Irrigation strategies. The strategies detailed herein extend to crucial areas of Hydrological and meteorological data management. Furthermore, critical infrastructure protection and planning are secured through dedicated sections on Flood Management and Disaster Management, which incorporate areas such as the integrated operation of reservoirs. Environmental sustainability is addressed through focused strategies on Pollution abatement in water bodies, including River pollution management and STP development.

Beyond infrastructure, the document outlines necessary modernizations in policy and governance. This includes preparations for Climate Change adaptation through a state-specific action plan, optimized management of Interstate waters, and enhancing resource management, including Groundwater management and new initiatives related to Tourism, asset management and use of renewable energy.

This Vision Document, informed by the key ideas and recommendations based on expert and public input, is an operational blueprint. The Department of Water Resources accepts the responsibility of achieving the futuristic developmental goals outlined herein, ensuring efficient utilization of the state's available resources to meet defined targets. Our focus is on diligent implementation and measurable success, ensuring that the progressive vision of the Government becomes the lived reality of every resident.

BISHWANATH SINHA

CONTENTS

EXECUTIVE SUMMARY

Kerala's unique geographic position, bounded by western ghats in the east and Arabian sea in the west, makes it special in terms of pleasant weather, lush greenery and sufficient rain fall. But on the other hand, steep and undulating terrain makes the rainfall runoff reach ocean quickly, and poses its own sets of challenges in utilizing the available water. Recognizing the importance of water conservation and necessity of its effective utilization, Govt. of Kerala has adopted policies based on principles of Integrated Water Resource Management (IWRM) and micro watershed based planning. Experts are of the view that inter-sectoral coordination based on a long-term vision on water is essential for Kerala's sustainable development planning.

Since irrigation is essential to increasing agricultural output and guaranteeing food security, agriculture and irrigation are closely related. To maximize agricultural output, especially in areas vulnerable to drought or erratic rainfall, major and minor irrigations are essential for maintaining livelihood and fostering economic growth. As of now the State has 23 Major and Medium irrigation (MMI) projects, and more than 90,000 Minor Irrigation (MMI) schemes, under Irrigation Department, providing irrigation to an extent of 4.19 lakh ha of agriculture fields which is the highest in past 20 years. Majority of the water bodies are sources to drinking water supply as well.

Social well-being, economic stability, and sustainable development depend on the availability and access of safe and clean drinking water. In Kerala, the drinking water supply is given high priority by the Government. The Kerala Water Authority (KWA) supplies drinking water to approximately 2.59 crore people across the state through 853 comprehensive water supply projects, with 45.73 lakh household connections and 1.08 lakh public taps. Over the last ten years, around 27 lakh new household connections have been provided, marking a major milestone in KWA's journey toward universal water accessibility. Kerala Rural Water Supply and Sanitation Agency (KRWSA), established in 1999, deals with water supply in rural area through Jalanidhi scheme, a World Bank-aided rural water supply and sanitation project. Beneficiaries in 227 Grama Panchayats (GPs) maintain 5886 water supply schemes initiated through the KRWSA.

In the State, groundwater caters irrigation and drinking water demands as well. Moreover, judicious use of groundwater and its recharge are essential to maintain ecological balance. The State Ground Water Department is the nodal agency for groundwater development and management in the State and it extends demand-based services to private individuals and Government agencies. Groundwater conservation and recharge is a major activity being implemented by the Department to sustain groundwater availability.

A special purpose vehicle (SPV), Kerala Irrigation Infrastructure Development Corporation Ltd. (KIIDC) is functioning under the water resources department to implement water sector related projects, and the packaged drinking water *'Hilly Aqua'*.

This VISION 2031 document focuses on the key area in water sector, viz. Drinking Water, Irrigation, Flood Management, Groundwater Management, Hydro-meteorological data management, Pollution Abatement, Climate Change and Disaster Management, Tourism, E-Governance and Policies.

In Drinking Water sector, it is envisioned to ensure universal drinking water coverage by the year 2028, with special focus on women, girl children and socially vulnerable groups. In addition, the sustainability of water sources in terms quantity and quality will be addressed. It is also planned to bring in automation where manual intervention is difficult and risky. Non-Revenue Water (NRW) reduction is critical to improving water supply reliability, financial recovery, and sustainability. Government aims to bring down NRW losses to 20% by the year 2031 through a comprehensive and phased NRW Management Program. Recognising the importance of energy self-sufficiency, it is intended to maximize the use of renewable sources, mainly solar energy.

It is also planned to take up ground water based mini drinking water schemes and rain water harvesting structures in rural areas.

Strengthening of irrigation schemes under Major, Medium and Minor irrigation projects are being considered with utmost priority. The idea is to take up mmaintenance of irrigation canals using modern, and cost-effective materials, in a phased manner, to prevent leakage and to improve water distribution efficiency. Further, it is crucial to curb the waste dumping in canals which has fathoming impacts in food security and human health. Active participation of direct beneficiaries and others are essential for better management of water and water infrastructure. Efficient irrigation like micro irrigation is a need of the hour to preserve water and to enhance productivity. Special focus will be given for rejuvenation of local water bodies through minor irrigation schemes and Harithakeralam.

Flood management is vital in sustaining the progress achieved by the State in all sector. It is envisioned to restore and manage the rivers of Kerala and the drainage channels to ensure continuous flow and flood moderation through scientific, ecofriendly and participatory measures. To address the woes of coastal community a comprehensive and climate-resilient coastal protection strategy that integrates hard-engineered structures, hybrid interventions, and nature-based solutions to protect Kerala's vulnerable shoreline from erosion, saline intrusion, and tidal flooding while promoting sustainable coastal livelihoods and ecosystem balance will be adopted. Special attention is also given to Kuttanad region.

Groundwater conservation and management is very crucial in the State of Kerala because of growing population, rapid urbanisation, and changing climate are placing immense pressure on its limited and unevenly distributed groundwater resources. Groundwater serves as a vital source for drinking, irrigation, and industrial use, especially during dry seasons when surface water becomes scarce. An integrated approach will improve the groundwater governance in the State by encouraging sustainable extraction,

scientific management, and community involvement to protect resources for future generations. Actions are planned with this objective, through collaboration with all stakeholders.

Data management is essential for informed decision making and proper planning. So, it is aimed to expand, upgrade, and automate the network of rain gauge and weather monitoring stations across Kerala to provide comprehensive coverage, real-time monitoring and improved access. It is also planned to establish State Water Informatics Centre (SWIC) as Kerala's single, authoritative nodal organisation for coordinating, validating, hosting and disseminating water-resources data, providing decision-support products, and functioning as a 24-hour Emergency Operations Centre for extreme water events.

The government is actively engaged in comprehensive pollution abatement efforts across its major water bodies. Irrigation Department has made significant progress in restoring polluted river stretches across the state, adhering to the National Green Tribunal (NGT) mandate. It is envisioned to provide 100% sewer network with at least one STP in all the Municipal Corporations and one STP with minimum network/FSTP in Municipalities. It is also planned to provide tertiary treatment units in all the STPs functioning under KWA for the reuse of effluent from STPs. Further, through KRWSA, it is proposed to install 250 Grey Water Management and Treatment Systems across the state.

Climate change poses serious challenges in effective water management, and the water resources department has been steadfastly addressing these challenges. Further, a State Specific Action Plan (SSAP) is formulated representing Kerala's long-term strategic framework for integrated water resources management.

It is widely accepted that water management crisis is a governance crisis. Government is encouraging wide use of e-governance measures to improve transparency, efficiency, and sustainability through digital tools for real-time monitoring, data-driven decision-making, and enhanced stakeholder engagement. All the departments under water resources are utilising e-office plat forms for file movement, preparation of estimates, and monitoring of works. Further, online portal facilities are made available for general public to submit applications, pay fees/charges, and RTI applications.

Government is of the view that policies in water sector is vital in determining long term strategic planning of water resources. Kerala State has always focused on integrated water resources management (IWRM) and micro water shed based planning to ensure water sustainability. It is guided by an integrated and multi-sectoral approach to address challenges like water scarcity, pollution, and climate change impacts, while ensuring sustainable and equitable water management for all citizens. The Department has updated the State Water Policy to suit the present scenario, formed a new Micro Irrigation Policy, Data dissemination policy, Standard Operating Procedure for Desiltation, Amendments to Groundwater act, and Kerala Irrigation and Water Conservation Act and will be published soon.

Water Wisdom for a Resilient Kerala:

Towards an Integrated and Sustainable Future

INTRODUCTION

The Vision 2031 initiative represents the Government of Kerala's ambitious strategy to transform the state into a developed and progressive entity by the year 2031. This pivotal year also commemorates the 75th anniversary of the formation of Kerala. The overall goal is to chart practical and futuristic developmental goals specifically tailored to Kerala's unique socio-environmental conditions, reflecting on the state's progress over past decades.

To develop this roadmap, the Government of Kerala undertook a rigorous process, organising a series of seminars titled "Vision 2031," each focusing on selected developmental themes under the leadership of respective Ministers. These seminars encouraged wide participation from various groups, including eminent national and international panelists, policymakers, experts, students, and the general public. The exchange of ideas and insights gathered from these events will be consolidated and presented at a grand state-level seminar chaired by the Hon'ble Chief Minister in January 2026.

As part of this progressive journey, a significant one-day seminar was held on October 17, 2025, at Kattappana, Idukki, explicitly aimed at presenting the roadmap of Vision 2031. The ideas and recommendations emerging from these discussions contributed to the compilation of a comprehensive vision document. This document outlines the State's future plans and strategies, particularly focused on sustainable development, resource management, and infrastructural transformation within the crucial water sector.

The core focus of the Vision 2031 document, as shaped by the seminars, is the identification of practical, implementable solutions and innovative approaches relevant to the Kerala context, utilising the state's available resources. Discussions covered key subjects such as ensuring resilient water supply systems, pollution abatement, groundwater conservation, water resource management, and technological interventions for infrastructure improvement. The resulting development document for the water sector serves as a vital guiding framework for the state's future water policies, indicating a specific and pragmatic resource-linked action plan. Key sectors addressed include drinking water, irrigation, flood management, groundwater management, and pollution abatement in water bodies.

What is intended to achieve through vision 2031

The "Vision 2031" initiative by the Government of Kerala is fundamentally aligned with the universal principles of the Sustainable Development Goals (SDGs), particularly the core tenet of "Leaving no one Behind". The state has strategically integrated the SDGs into its flagship umbrella scheme, the "Navakeralam Karmapadhathi," demonstrating a commitment to translating global goals into local action. This comprehensive program

encompasses four critical missions, with the Harithakeralam Mission being directly pertinent to the water sector, as it integrates water resources management with waste management and organic farming. The Vision 2031 seminar on water resources, held on October 17, 2025, in Kattappana, served as a crucial platform to operationalize these goals, shaping a pragmatic roadmap for a water-secure future in alignment with SDG targets.

The discussions and intended outcomes of the seminar directly address the targets of SDG 6: Clean Water and Sanitation. Kerala's approach, as outlined in the seminar's agenda, reflects a nuanced understanding of the interconnected challenges within this goal.

- Access to Safe and Affordable Drinking Water (SDG Target 6.1): The seminar's first panel discussion, "Ensuring Universal and Resilient Water Supply Systems", is a direct response to this target. The state aims to move beyond basic access and achieve universal household coverage of piped drinking water, transition towards a continuous 24x7 supply, and develop targeted strategies for vulnerable coastal, tribal, and water-scarce regions. Initiatives like the Jal Jeevan Mission (JJM) and AMRUT are key instruments in this effort.

- Water Quality and Wastewater Management (SDG Target 6.3): The second panel on "Advancing Pollution Control, Treatment Technologies, and Water Reuse Strategies" tackles this issue head-on. The outcomes focus on expanding sewerage network coverage, promoting decentralized treatment systems, upgrading underperforming sewage treatment plants (STPs), and encouraging the reuse of treated wastewater. This reflects a circular economy approach to water management, aiming to reduce pollution in water bodies and create a new resource from waste.

- Water-Use Efficiency and Integrated Management (SDG Targets 6.4 & 6.5): The seminar dedicated significant attention to sustainable resource management. Panel discussions on groundwater conservation, sustainable water conservation practices, and Integrated Water Resources Management (IWRM) underscore the state's commitment to these targets. The intended outcomes include promoting rainwater harvesting, implementing behavioral approaches to reduce domestic water use, improving energy efficiency in water operations, and preparing integrated planning frameworks for holistic governance. These efforts are designed to ensure that water use is both efficient and sustainable in the long term, protecting vital resources for future generations.

Through the *Navakeralam Karmapadhathi* and the focused deliberations of the Vision 2031 seminar, Kerala is creating a cohesive strategy. This strategy not only aims to meet the specific targets of SDG 6 but also embeds them within a broader vision of inclusive and sustainable development for the state by 2031.

The Vision 2031 seminar served as a crucible for forging a comprehensive and resource-linked action plan for Kerala's water sector. By bringing together a diverse group of experts, policymakers, and the public, the seminar facilitated discussions that yielded practical,

implementable, and innovative solutions tailored to Kerala's unique socio-environmental context. The key ideas and recommendations from the six panel discussions have been compiled into the "Vision 2031" development document, which will serve as the guiding framework for the state's future water policies. The outcomes address several critical sectors, creating a multi-pronged strategy for a resilient water future.

Drinking Water and Pollution Abatement

A primary outcome is the renewed focus on providing resilient and universal access to drinking water. This involves not only achieving 100% household piped water coverage through schemes like JJM but also elevating the standard of service towards a 24x7 supply system. Critically, this goal is linked to robust pollution abatement strategies. The seminar highlighted the need to expand urban sewerage networks, upgrade existing STPs for measurable outcomes, and promote the reuse of treated wastewater, thereby tackling river pollution at its source.

Irrigation and Resource Management

The vision for irrigation is one of modernization and efficiency. Outcomes point towards a dual strategy of rejuvenating major irrigation projects through the retrofitting of old structures and adopting new, economical technologies for canal maintenance and waterproofing. This is complemented by a focus on minor irrigation, including the renovation of local water bodies and the promotion of micro-irrigation systems. This is intrinsically linked to sustainable groundwater management, with an emphasis on best practices for rainwater harvesting and conservation to replenish this vital resource.

Flood, Disaster, and Climate Management

Recognizing Kerala's vulnerability, the seminar produced outcomes aimed at building robust resilience. A key strategy is the implementation of integrated reservoir operations and the enhancement of flood forecasting capabilities through a statewide Water Resources Information System (WRIS) and dam automation. These technical interventions are part of a broader framework for disaster management and climate adaptation. The vision document will incorporate policy frameworks for climate-adaptive water governance and a state-specific action plan to address the impacts of climate change on the water sector.

Data-Driven Governance and Policy

Underpinning all sectoral goals is a commitment to modern, transparent, and data-driven governance. A significant outcome is the plan to establish a State Water Informatics Centre (SWIC) and expand the network of hydrological and meteorological data stations. This will empower decision-making with real-time analytics, GIS, and remote sensing technologies. Furthermore, the seminar's insights will inform crucial updates to existing legal and policy frameworks, including the State Water Policy and the Kerala Irrigation and Water Conservation Act, ensuring that governance structures are agile and responsive to future challenges.

CHALLENGES IN WATER SECTOR

Kerala receives an average annual rainfall of about 3000 mm. But its distribution over time and space is highly inconsistent, leading to a water shortage that lasts about 5 to 6 months, with the intensity of this shortage worsening due to climate change on one side and increasing demand on the other. Even though Kerala receives abundant rainwater, numerous areas within the state are presently experiencing issues related to both the quantity and quality of water. Sloping and undulating topography of the State, where midland and highland constitute about 88% of the land area, cause the surface runoff quickly flow into streams, rivers and ultimately to the Arabian Sea. Indiscriminate water usage and declining water quality have resulted in a gradual decrease in the availability of good quality water.[1] All river basins are not equally productive, as water yield depends on rainfall, catchment characteristics like terrain, soil, drainage pattern, and land use. The catchment character of drainage basins and rainfall distribution trends across the State vary. Further, the social and ecological functions vary depending upon the demographics and ecosystem of the region. The often-conflicting requirements and priorities of various stakeholders for meeting demands of drinking water, water for domestic use, irrigation, industry, fisheries, tourism etc make the situation more complex. Climate changed induced weather extremes often lead to frequent spells of flood and drought. State has witnessed unprecedented rain and consequent flooding in 2018 and 2019. Limited storage structures and improper maintenance of local water bodies may lead to water scarcity and drought in case of below normal monsoon.

Drinking Water

The drinking water supply through pipelines in Kerala is confronted with a range of technical, administrative, environmental, and socio-economic challenges that collectively hinder the goal of ensuring reliable, safe, and equitable water delivery to all households.

- **Degradation and Instability of Water Sources:** Many drinking water projects rely heavily on surface water sources—including rivers, reservoirs, and lakes—which are increasingly vulnerable to pollution, sedimentation, and reduced flow, especially during dry periods. Unregulated sand mining, rapid urbanisation, and encroachments within catchment areas have further degraded both the quality and quantity of these essential sources.
- **Infrastructure Ageing and Non-Revenue Water (NRW):** A significant portion of the pipeline network, particularly within older schemes, has exceeded its intended design life, resulting in frequent bursts, continuous leakages, and substantial pressure losses across the system. High levels of Non-Revenue Water persist, stemming from physical losses, unauthorized connections, and systemic inefficiencies in metering and measurement.

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[1] Report of Working Group on Irrigation and Water Management (2017), State Planning Board, Govt. of Kerala

- **Contamination Risks due to Supply Practices:** The common practice of providing intermittent water supply often results in negative pressure forming within pipes, significantly increasing the risk of contamination through the ingress of polluted external water. Furthermore, reports indicate that up to 80% of drinking water sources across the state already suffer from biological contamination.
- **Impacts of Groundwater Over-extraction:** In specific regions, notably coastal and midland areas, excessive groundwater extraction for various needs has resulted in aquifer depletion and saline intrusion. This contamination makes many existing bore wells unusable for safe drinking purposes.
- **Demand Outpacing Capacity:** The continuous increase in demand, driven by expanding urban areas and the development of new housing complexes, frequently outpaces the existing capacity of the current network. Consequently, water infrastructure requires constant augmentation and modernisation efforts to meet the needs of the growing population.

Irrigation

Most of the irrigation projects in the State are at least 50 years old. Moreover, the irrigation canals operate in a unique environment of heavy monsoon rains, steep and undulating terrains, alignment through densely populated residential areas, rapidly changing land-use patterns, dense vegetation, and indiscriminate dumping of waste in canal and adjoining bunds. These factors create recurring maintenance challenges such as rapid siltation, weed growth, bank erosion, water loss due to seepage, blockages from debris, and difficulties in frequent manual inspection. Climate changed induced extreme weather events exacerbates the situation. Deterioration of existing irrigation infrastructure has the grave risk of more and more farming households reverting to rainfed farming with consequent implication on poverty and productivity and increased exposure to the vagaries of monsoon. Moreover, it leads to unsustainable and non-productive use of water resources which leads to highly reduced water use efficiency.

- **Deterioration of Ageing Infrastructure:** A majority of the state's irrigation projects are decades old, some dating back at least 50 years, and operate under unique operational difficulties. These conditions, which include heavy monsoon rains, steep terrains, dense residential alignment, and rapid land-use changes, create severe recurring maintenance challenges.
- **Chronic Maintenance Deficiencies:** Maintenance issues are frequent and complex, including rapid siltation, pervasive weed growth, bank erosion, significant water loss due to seepage, and blockages caused by debris and indiscriminate waste dumping in canals and adjoining bunds. The lack of maintenance and high establishment costs have historically been cited as main problems facing the irrigation sector.
- **Pollution:** Pollution has emerged as a major threat to public health and water quality. Major river stretches in Kerala face serious pollution threat due to industrial

discharge and indiscriminate exploitation of resources. The latest study by Central Pollution Control Board (CPCB) identified 18 heavily polluted river stretches in Kerala. Moreover, during non-irrigation months, canals are routinely used to dump solid and liquid waste, particularly in urban stretches, creating serious hazards to both the canal ecosystem and human health.

- **Reduced Water Use Efficiency and Productivity Risk:** The deterioration of existing irrigation infrastructure poses a grave risk that increasing numbers of farming households will revert to relying solely on rainfed farming methods. This situation leads to unsustainable and non-productive use of water resources, resulting in highly reduced water use efficiency and increased exposure to the vagaries of the monsoon.
- **Financial Limitations:** The sector is constrained by low water rates charged for irrigation water and corresponding poor collection efficiency, which limits the funds available for operation and upkeep. Given the unique geographical and demographic characteristics of Kerala, innovative and dedicated strategies are essential to effectively carry out canal maintenance.

Groundwater Management

Groundwater storage plays an important role in meeting major demands and in maintaining ecological equilibrium particularly during non-rainy seasons. However, the vital resource faces serious threats in terms of sustainability.

- **Illegal Extraction and Management Deficits:** The Kerala State faces significant hurdles concerning groundwater sustainability, primarily related to widespread illegal extraction and persistent management issues. Securing this finite resource for future generations necessitates strengthening legal enforcement and expanding monitoring networks.
- **Reduced Effective Recharge:** Climate variability, coupled with rapid urbanisation and shifting land use patterns, collectively reduce the effectiveness of natural groundwater recharging processes. This reduction in recharge, exacerbated by climate shifts, disrupts the overall groundwater balance.

Pollution

- **Widespread Contamination of Sources:** Indiscriminate water usage and declining water quality have resulted in a gradual decrease in the overall availability of good quality water across the state. Frequent contamination of wells and aquifers occurs due to inputs from industrial discharge, agricultural runoff containing pesticides and fertilisers, domestic wastewater, and poor sanitation practices.
- **Source Pollution and Catchment Degradation:** Surface water sources are increasingly affected by pollution and sedimentation. Factors such as rapid

urbanization and encroachments in catchment areas significantly degrade both the quantity and quality of these surface water resources.

Climate Change

- **Shifts in Rainfall Patterns and Distribution:** Although Kerala receives abundant average annual rainfall (about 3000 mm), its distribution across both time and geographical space is highly inconsistent. Long-term analysis shows a weakening of the early south-west monsoon rains in parts of the south-central belt, alongside a strengthening of September rains in the northern regions, indicating a clear spatial shift in monsoon patterns that requires attention in planning.
- **Intensification of Weather Extremes:** Climate change has intensified the severity of existing water shortages. Climate-induced extreme weather events frequently result in recurring spells of both flood and drought, and these extremes exacerbate the existing problems of infrastructure deterioration.
- **Disruption to Groundwater Balance:** Climate change directly disrupts Kerala's groundwater balance by reducing effective recharge, primarily through fewer rainy days, higher rainfall intensity, rising temperatures, and shifting monsoon patterns. This situation leads to earlier depletion of aquifers before the monsoon and delayed recovery post-monsoon, increasing reliance on deep aquifers and subsequent tanker supplies.

Weather Extremes and Coastal Erosion

- **Vulnerability to Flooding and Drought:** The state has experienced unprecedented rainfall and consequential flooding, particularly in 2018 and 2019. In contrast, the lack of sufficient storage structures and improper maintenance of local water bodies heighten the risk of severe water scarcity and drought during periods when monsoon rainfall is below normal.
- **Severe Coastal Erosion and Community Risk:** Protecting Kerala's 576 km coastline from sea attacks and erosion is a major departmental challenge. The coastal zone is extremely thickly populated, housing 30% of the state's population in only 15% of the land area, with an average density of 2,262 people per square kilometre.
- **Threats to Coastal Livelihoods:** Even during normal monsoon seasons, rising sea levels and storm surges have intensified coastal erosion, posing a severe threat to the survival of local communities and their livelihoods. The high frequency and intensity of natural disasters along the coast, including storm surges and cyclones, cause deep public concern regarding the safety and security of homes.

Governance and Policies

- **Administrative and Procedural Hurdles:** Major bottlenecks arise from administrative delays due to the necessity of obtaining multiple clearances from numerous government agencies, including the Public Works Department, Railways, Forest Department, and Local Self Government Institutions. Procedural hurdles related to road cutting permissions, utility shifting, and land acquisition for infrastructure often cause water projects to stall for extended periods, sometimes for months or even years, leading to cost escalation and incomplete work.
- **Fragmented Institutional Structure and Coordination Deficits:** Fragmented institutional responsibilities and a lack of effective coordination between the Kerala Water Authority, local bodies, and other related departments result in overlapping jurisdictions and inefficiencies in the planning and execution of projects. An integrated, long-term approach combining institutional streamlining and public participation is necessary to achieve sustainable water security.
- **Financial Sustainability Constraints:** Financial sustainability of water supply operations is consistently weakened by rising energy costs required for pumping operations, coupled with inadequate tariff collection from users and delayed government grant disbursements. Due to these fund shortages, essential maintenance and replacement works are often postponed, further deteriorating infrastructure.

Other Issues

- **Water Scarcity despite Abundant Rainfall:** The state's sloping and undulating topography, where the midland and highland areas constitute about 88% of the land area, causes surface runoff to flow quickly into the sea, limiting infiltration. This results in a persistent water shortage lasting approximately five to six months annually, despite the state receiving high average rainfall.
- **Conflicting Demands on Limited Resources:** The situation is complexified by the often-conflicting requirements and priorities among various stakeholders for meeting their diverse demands. These competing needs include drinking water, domestic use, irrigation, industry, fisheries, and tourism, making integrated water resource management challenging.

IMPORTANT SECTORS

പ്രധാന മേഖലകൾ

DRINKING WATER	**IRRIGATION**
FLOOD MANAGEMENT	**GROUNDWATER**
HYDRO – METEROLOGICAL DATA MANAGEMENT	**POLLUTION ABATEMENT**
DISASTER MANAGEMENT	**CLIMATE CHANGE**
TOURISM	**INTER-STATE WATER**
GOVERNANCE	**POLICIES**

DRINKING WATER

DRINKING WATER

United Nations' Sustainable Development Goal - 6 (SDG- 6) envisions to *ensure access to water and sanitation for all*, which is the most basic need for human health and well-being. Though raw water is abundant, safe and clean potable water is a scarce resource. Drinking water has always been placed at the top pedestal among all demands on water. In the State, Government is striving to provide clean and safe drinking water to all at an affordable cost. Kerala Water Authority (KWA), Kerala Rural Water Supply and Sanitation Agency (KRWSA – Jalanidhi), and Groundwater Department are the lead agencies in supplying drinking water.

Kerala Water Authority (KWA)

The **Kerala Water Authority (KWA)** is an autonomous body established by the Government of Kerala to plan, implement and manage schemes related to drinking water supply and wastewater collection and treatment across the state. Over the past decade, the institution has made remarkable progress in expanding its services, modernizing operations and ensuring the delivery of clean drinking water to millions of people in Kerala.

In **2016**, the Kerala Water Authority was supplying clean drinking water to about **1.75 crore people** through **1,078 water supply projects**, covering **18,12,528 household connections** and **2.08 lakh public taps**. Since then, the Authority has significantly enhanced its infrastructure and reach. Currently, KWA supplies drinking water to approximately **2.59 crore people** across the state through **853 comprehensive water supply projects**, with **45.73 lakh household connections** and **1.08 lakh public taps**.

During this period, the Authority undertook a major restructuring of its supply network by integrating thousands of smaller, less efficient schemes into larger, more comprehensive drinking water projects. This integration improved service efficiency and sustainability. As a result, while the number of public taps has decreased, the number of individual household connections has increased substantially reflecting the Authority's goal of delivering clean water directly to every home.

The capacity of water treatment plants across Kerala has also seen significant growth. A decade ago, the total treatment capacity stood at **3,367 million litres**, whereas today, it has increased to **4,283 million litres**, ensuring better quality and higher availability of treated water throughout the state. Over the last ten years, around **27 lakh new household connections** have been provided, marking a major milestone in KWA's journey toward universal water accessibility.

The Kerala Water Authority has also implemented numerous **rural and urban water supply projects** with financial support from both the Central and State Governments, as

well as various funding agencies and programs such as **Jal Jeevan Mission (JJM)**, **NABARD**, **State Plan**, **KIIFB**, **AMRUT** and **Rebuild Kerala Initiative (RKI)**. Currently, around **2,768 projects** worth approximately **₹19,700 crore** are at various stages of implementation across the state, supported by these agencies.

In terms of digital transformation, KWA has made significant strides. Ten years ago, computerization was limited only to billing processes. Today, the entire service spectrum from meter reading to bill payment has been fully computerized. Consumers can now access a range of online services including grievance redressal, bill payment and service applications, ensuring greater convenience and transparency.

Through these sustained efforts, the Kerala Water Authority has evolved into a modern, service-oriented institution committed to delivering safe and reliable drinking water to the people of Kerala. Its achievements over the last decade stand as a testament to its dedication to improving water infrastructure, enhancing service quality and promoting digital governance in the water sector.

The **VISION 2031 Action Plan**, which outlines a comprehensive **five-year roadmap** for sustainable water supply and wastewater management, is presented below. This forward-looking plan envisions a transformative shift in Kerala's water sector by integrating modern technology, efficient resource utilization, and community participation to ensure long-term water security. It seeks to strengthen system resilience against climate variability, enhance the reliability and quality of water services, and promote circular economy principles through effective wastewater reuse and energy-efficient operations. The Action Plan is closely aligned with **Kerala's overarching goals of environmental sustainability, public health protection, and inclusive development**, paving the way for a more resilient and resource-conscious future.

1. **Universal Coverage of Functional Household Tap Connections (FHTCs)**

   (a) Rural

Vision:
To cover all rural households in the state with Functional Household Tap Connections ensuring safe drinking water at specified quantity, quality and regularity to the households.

Present Scenario:
The total households estimated in rural Panchayats is 69.82 lakhs. Out of this, Functional Household Tap Water Connection (FHTC) provided to 38.71 Households so far (October 2025). Thus, the present coverage of rural households in the state is 55.44%. 31.11 lakh Households depends on Public taps/private wells/other sources for drinking water at

present. Government aims to provide safe drinking water through tap connections to these remaining households by the year 2028.

Implementation Programme:

Planning and Administrative sanctions already available for achieving the vision through the ongoing Jal Jeevan Mission programme jointly funded by Central and State Governments. Total Administrative sanction received is for providing 54.45 lakh FHTCs amounting to Rs.44714.79 crores. Out of this 21.22 lakh FHTCs provided so far incurring expenditure of Rs.17682.57 crores (including pending bills of Rs.6039 crores). By completing all the works envisaged under this Mission, the vision can be achieved.

Financial Requirement:

Total administrative sanction obtained	– Rs. 44714.79 Crores
Payment made so far	- Rs. 11643.57 Crores
Balance amount reqd (GoI & GoK share)	- Rs. 33071.21 Crores
Balance state share required in 3 years	- Rs. 16535.61 Crores

Benefits/Advantages:

By providing safe potable drinking water through taps to households, the health hazards through contaminated water can be avoided. The project will greatly help the women, girls, SC/ST population, people living in hilly areas where there is difficulty in getting safe drinking water throughout the year. The time spend by rural women, girls etc. for fetching safe drinking water can be saved and utilized for productive things. This will also improve the living standards of the rural population.

Measurable Deliverables:

No. of Functional Household Tap Water Connections provided to fill the gap ensuring specific quantity, quality and regularity of supply.

Time Required for Implementation:

Provided sufficient funds are made available, all the works envisaged under the mission can be completed by the year 2028.
Present coverage is 55.44%
Can attain 70% by the year 2026, 90% by the year 2027 and 100% by 2028.

(b) Urban

Vision:

To provide every urban household in the state with reliable tap water connections, ensuring a consistent supply of safe and quality drinking water in adequate quantity.

Present Scenario:

The total households estimated in 93 urban local bodies (6 corporations and 87 municipalities) is estimated as 22.93L in 2021 and at present it is 24.87L. Out of this, water connection was provided to 11.49L Households as on 2021. Upon implementation of AMRUT scheme which is a state-central shared programme for Urban Water supply so far (October 2025), the present connection status increased to 13.57L which is 54.56% coverage including connections under other schemes. Thus the present coverage of urban households in the state is 54.56%. At present, 155 MLD of additional drinking water is being produced and supplied to urban areas through the completed projects under AMRUT 1.0 and 2.0.

Implementation Programme:

Planning and Administrative sanctions are already in place for achieving the vision in urban areas through the ongoing AMRUT programme, jointly funded by the Central and State Governments. Under AMRUT 1.0 and 2.0, administrative approval has been accorded for drinking water supply and sewerage projects amounting to a total of Rs. 4,489.81 crore. Out of this, projects worth Rs. 1,580.94 crore have been completed so far, achieving substantial progress in strengthening urban water supply infrastructure. To attain the goal of universal coverage, the remaining gap of 8 lakhs household tap connections is proposed to be covered, requiring an additional administrative sanction of Rs. 6,614.55 crore. By completing all ongoing and proposed works under the AMRUT programme, the vision of ensuring safe, reliable, and sustainable drinking water connections to all urban households by the year 2031 can be achieved.

Financial Requirement:

Total administrative sanction obtained (AMRUT 1.0 & 2.0)	– Rs. 4498.809 Crores
Payment made so far (AMRUT 1.0 & 2.0)	– Rs. 1953.85 Crores
Balance amount reqd (GoI & GoK share)	– Rs. 6614.55 Crores

It is expected that the financial requirement for the saturation of piped water supply in urban sector will be taken up as a continuation of AMRUT 2.0 as CSS project by GoI. The required state share to be included in budgetary provision of LSGD.

Benefits/Advantages:

The AMRUT projects aim to ensure continuous access to safe, potable drinking water for all urban households, improving the overall health and living conditions of city dwellers. The initiatives reduce dependency on unsafe water sources, prevent waterborne diseases and improve sanitation through integrated sewerage management. The projects particularly benefit marginalized communities, women and children by ensuring time-saving access to drinking water and a cleaner urban environment.

By upgrading old pipelines, constructing modern water treatment plants and expanding water distribution networks, urban water security and service reliability are significantly enhanced.

Measurable Deliverables:
Piped drinking water connections provided to urban households, ensuring specific quantity, quality and regularity of supply, enhanced treatment capacity through new and upgraded water treatment plants, improved wastewater management via rehabilitated sewerage projects and strengthened service efficiency by reducing non-revenue water losses.

Time Required for Implementation:
All ongoing works under AMRUT 1.0 and AMRUT 2.0 are scheduled for completion by the year 2026. Upon completion, a total of approximately 366 MLD of treated water will be distributed daily to urban areas across Kerala, ensuring universal coverage of drinking water supply in cities. 100% coverage of urban households will be completed by 2031 depending on the availability of funds.

(c) Water Supply to Special institutions/Places of Importance:

Kerala Water Authority proposes the establishment of two major new Water Treatment Plants (WTPs) — one with a capacity of 125 MLD in Thiruvananthapuram at an estimated cost of ₹650 Cr and another with a capacity of 190 MLD in Kochi costing approximately ₹550 Cr.

Thiruvananthapuram, being the State Capital, hosts several critical institutions and fast-developing hubs such as Vizhinjam International Seaport, Technopark, IT corridors and major educational and healthcare centers. The city's water demand has surged significantly, necessitating reliable and enhanced water infrastructure to sustain its economic and social growth.

Similarly, Kochi, the commercial capital of Kerala, is witnessing rapid expansion driven by Infopark, Smart City, the Cochin Port, industrial zones, and urban population growth. A new 190 MLD WTP will ensure uninterrupted and quality water supply to these vital sectors, supporting the city's continued role as Kerala's economic powerhouse.

In addition, a dedicated proposal for augmenting water supply to Sabarimala and adjoining pilgrimage centers is also included, with an estimated cost of ₹75 crore. Given the region's religious and tourism significance, reliable water supply infrastructure is essential to cater to the seasonal surge of pilgrims while ensuring environmental protection and sustainable resource use.

2. Ensuring Sustainability of Water Supply Scheme Sources

Vision:

Ensure that all sources used for water supply schemes are sustainable in terms of quantity and quality during all seasons and resilient to climate change, disasters etc.

Present Scenario:

Under Jal Jeevan Mission, water supply schemes are planned to provide FHTCs to all rural households in the state. While achieving the universal coverage of tap water connection to all rural households, the major challenge will be maintaining the source sustainability of the water supply schemes throughout the year. Hence identification of stressed sources and impact of climate change, disasters etc. is to be made and remedial measures taken to make the sources sustainable and resilient to climate change, disasters etc. As per preliminary assessment of sources utilized for implementing JJM, 65 sources identified having risk of water scarcity especially during peak summer months.

Implementation Programme:

(i) River based sources:

Out of the 65 sources identified in preliminary assessment, 23 are river-based sources. These schemes predominantly face seasonal issues in water availability, particularly during summer months. Many rivers supplying these schemes experience a significant drop in water levels during the summer season. In certain locations, clay or sand deposits obstruct intake structures. In others, the river flow reduces to such an extent that drawing sufficient water becomes practically unfeasible.

Proposed Interventions:

*   **7 schemes:** Inadequacy can be resolved through construction of weirs, check dams, or Regulator-cum-Bridge (RCB) structures. Proposals have been submitted to the Irrigation Department or are already sanctioned under JJM/NABARD.
*   **10 schemes:** To be addressed through the commissioning of ongoing comprehensive JJM schemes or by interconnection with adjoining schemes for which work is currently ongoing under JJM.
*   **6 schemes:** Require weir/check dam construction, removal of sand deposits upstream of check dams, or interconnection with adjoining schemes; however, no proposal currently exists. These schemes are dependent on rivers such as Manimala (Kottayam, Pathanamthitta), Chaliyar (Malappuram) and Uppala (Kasaragod).

(ii) Groundwater, Open Well, Stream and Pond Sources:

The remaining 42 schemes are dependent on groundwater-based sources, open wells (OW) - as well as surface sources like ponds and small stream flows. Many of these

sources are shallow or deteriorating in yield due to long-term extraction, seasonal stress etc. Wells and ponds particularly exhibit drying or insufficient levels during summer. Tube wells in some areas have aged and their output has declined substantially.

Proposed interventions:

- **11 schemes:** Ground water sources - To be addressed through recharging through Ground water department, commissioning of ongoing comprehensive JJM schemes etc.
- **26 schemes:** reliant on open well sources. These wells are particularly vulnerable to depletion during summer, often due to shallow depths and cumulative withdrawal over time. Out of this, 23 schemes to be addressed through the commissioning of ongoing comprehensive JJM schemes and 3 schemes require new borewells and storage tanks.
- **5 schemes:** dependent on surface sources such as ponds and small stream flows. These sources typically experience drying or critically low water levels during summer, compromising the reliability of supply. To be addressed through the commissioning of ongoing comprehensive JJM schemes.

Detailed analysis of all sources are to be studied with respect to resilient to climate change, disasters also and combined efforts and intervention of different agencies such as Irrigation Department, Ground Water Department, KRWSA along with KWA required for addressing the source sustainability issues.

Financial Requirement:
1) Detailed Assessment study of all sources of KWA (953 sources) – Rs. 5 Crores
(@ Rs. 0.50 lakh/source)
2) Interventions
   a) Construction of weirs/check dams etc (10 nos @ Rs. 10cr/E   ) – Rs.100 Crores

   b) Construction of recharge structures   – Rs. 10 Crores
   c) Protection of sources   to make resilient to disasters   –   Rs.   5 Crores

Benefits/Advantages:
By making the sources adequate and resilient to climate change and natural disasters, regular water supply to the households can be ensured.

Time Required for Implementation:
Detailed assessment study – 1 year (2026)
Interventions – 5 years from 2027 to 2031

3. Ensuring Quality of Water Supplied

Vision:

To develop a system for timely and real-time monitoring of water quality at sources, Water Treatment Plants (WTPs) and various points within the distribution network using IoT and to make available in the public sphere.

Present Scenario:

At present samples are collected from various sampling locations including sources, WTPs and various distribution locations and the samples are taken to the quality control labs for testing parameters. Currently, real-time monitoring of water quality is not being carried out.

Implementation Programme:

An IoT-based water quality monitoring system, utilizing sensors to collect real-time data on various water quality parameters, is proposed to be implemented at sources, Water Treatment Plants (WTPs), and key points within the distribution network. The initiative aims to achieve 20% annual coverage of all sources, WTPs and distribution locations under the IoT-based water quality monitoring system and to establish a **centralized data dashboard** for real-time monitoring and analysis. Also the scope of existing laboratories can be expanded to include testing for additional parameters.

Financial Requirement:

For Sources:	- Rs.100 Crores
For WTPs:	- Rs.100 Crores
For Distribution points:	- Rs.100 Crores
For Scope expansion of labs:	- Rs.50 Crores
Total requirement:	**- Rs.350 Crores**

Benefits/Advantages:

The system could predict the quality and potential scarcity of water sources, as well as the output quality of water supplied from WTPs. Making the water quality data of drinking water supplied by KWA available in the public domain would enhance transparency, create public awareness and build confidence among consumers regarding the quality of water supplied.

Measurable Deliverables:

Achieving 20% annual coverage of all sources, WTPs and distribution locations.

Time Required for Implementation:

Provided sufficient funds are made available, all the works envisaged under the vision can be completed by 2030.

4. Asset Management

Vision:

Asset mapping has been started in KWA as a part of JICA project in which surface and subsurface assets have been mapped using GIS tools and techniques. The mapping is still being done in house using open source softwares and mobile applications. Also a dedicated mobile application named JalGeoData has been developed exclusively of KWA in collaboration with CUSAT. Surface assets include Water treatment Plants, intake wells, pump houses, storage reservoirs etc. while pipelines and valves are covered under subsurface assets.

Present Scenario:

Details of Asset Data in Digital Registry			
Sl. No.	**Asset**	**Quantity**	**Unit**
1	Street Taps	126900	Nos.
2	Pipeline	113843	km
3	Tanks	2645	Nos.
4	Pump House	925	Nos.
5	Buildings	573	Nos.
6	Lands	999	Nos. (Parcels)
7	Valves	25414	Nos.

A dedicated webpage called GeoWaternet has been developed where all the mapped data have been hosted with option for both public view and officers login. Under Officers login adding and modification of data options are available.

Rural:

JJM Asset Mapping and Monitoring: For the pipelines laid under JJM around 90% of the pipelines have been mapped. The mapping of other structures like Water Treatment Plants, Storage reservoirs, Intake well cum pump house is around 80% complete. The asset mapping is expected to complete by 2028.

Urban:

The pipelines and other assets being create are mainly from AMRUT, KIIFB etc. The mapping of such assets generated have started and is ongoing.

Financial Requirement:

Funds are only required for engaging human resources for data handling and management (Rs.2Crores for a period of 5 years)

Benefits/Advantages:

KWA's GIS platform integrates data from various sources, enabling dynamic visualization, water demand forecasting, and outage monitoring. This allows KWA to make data-driven decisions, particularly in managing water resources more efficiently.

- Development of Geo O & M to monitor all the operations and maintenance activities of KWA.
- KWA-Land Information System: A new GIS based land information portal has been developed in order to spatially locate the KWA land assets. This portal provide addition of data, modification and report generation based on land assets can be done.

Measurable Deliverables:

- Complete roll out of JALGEO Data Mobile application, exclusive mobile app for asset management in KWA.
- Spatial data centre for KWA assets.
- Integration of Flow meters, energy meter and level sensors with IoT devices and AI applications.

Time Required for Implementation:
Provided the works are completed on time and with sufficient financial support. The complete asset mapping of KWA can be completed with in five years, by December 2030.

5. Automation and Digital Monitoring of Pump Houses

Vision:

To transform Kerala Water Authority into a technologically advanced and energy-efficient utility through automation and digital monitoring of pump houses, thereby improving operational efficiency, reducing manpower dependency and ensuring real-time control and transparency in operations.

Present Scenario:

KWA currently operates more than 1700 pumping stations across Kerala. The daily operation of these stations requires significant manpower for manual control, resulting in high recurring expenditure and operational delays.

To address these challenges, KWA proposes to automate 490 pumping stations — comprising 173 Vertical Turbine (VT) pump houses and 317 Submersible pump houses — integrating remote monitoring, SCADA-based automation and CCTV surveillance. The automation will enhance real-time visibility, reduce manual dependency and optimize pumping efficiency.

Implementation Programme:

Phase	Period	No. of Pump Houses	Estimated Cost (₹ Crore)
Phase I	2025–2027	175	9.50
Phase II	2027–2029	161	9.65
Phase III	2029–2031	154	9.76
Total	**2025–2031**	**490**	**28.91 Cr**

Financial Requirement:

Phase	Period	Financial Requirement (₹ Crore)
Phase I	2025–2027	9.50
Phase II	2027–2029	9.65
Phase III	2029–2031	9.76
Total	**2025–2031**	**28.91 Cr**

Benefits/Advantages:

• Manpower Optimization: Reduction of approximately 200 operator shifts per day, leading to annual savings in HR expenditure.
• Operational Efficiency: Centralized remote control and data logging for pump operations.
• Energy Efficiency: Optimized start–stop cycles and motor operation will reduce energy consumption.
• Enhanced Reliability: Early fault detection and real-time alert systems.
• Transparency & Monitoring: Integration of CCTV surveillance and IoT-based telemetry for performance tracking.
• Sustainability: Long-term cost reduction and improved service reliability.

Measurable Deliverables:

• Automation of 354 pump houses by 2031.
• Reduction of 200 operator shifts/day.
• Annual savings of approximately ₹8–10 crore through reduced manpower and energy use.
• Enhanced operational reliability and customer satisfaction through reduced downtime.

Time Required for Implementation:

Phase	No. of Pump Houses	Period
Phase I	175	2025–2027
Phase II	161	2027–2029
Phase III	154	2029–2031
Expected Completion		2031

6. Non-Revenue Water (NRW) Management

Vision:

NRW reduction is critical to improving water supply reliability, financial recovery, and sustainability. The Authority aims to bring down NRW losses to 20% by the year 2031 through a comprehensive and phased NRW Management Program.

Present Scenario:

Kerala Water Authority (KWA) presently operates 853 water supply schemes with an average daily production of 3634 MLD. Despite significant infrastructure coverage, the Authority faces high Non-Revenue Water (NRW) levels, estimated at 35–40%, losses in aged pipelines, unauthorized connections and theft, meter inaccuracies, hidden leaks etc.

Implementation Programme:

   (a) Replacement of Old Pipelines

Existing Asbestos Concrete (AC) pipeline and other old pipe lines: 5000 km
Old Pre-Stressed Concrete (PSC) pipelines: 100 km

These aging networks contribute significantly to leakage and water loss due to brittleness, joint failure, and corrosion. Replacement *of old AC, PSC and other Pipes* is proposed in a phased manner by 2031, prioritizing high leakage zones. *(The Proposal for replacement of old AC, PSC and other Pipes are included in the Vision 2031 Plan of Rehabilitation and Replacement Policy).*

   (b) Installation of Flow Meters

Flow meters will be installed in all 853 water supply schemes at key nodes:
    - Water Treatment Plant outlets
    - Major transmission mains
    - Pumping mains and bulk consumer points
This will enable accurate water auditing.

   (c) Pressure Management and Leak Detection
Introduction of pressure zones and automated control valves. Adoption of acoustic leak detection and step testing for real-time loss identification.

(d) <u>Capacity Building and Digital Monitoring</u>

Establishment and strengthening of NRW Management units in each region. Also strengthening of division wise anti-theft squad, blue brigade and electromechanical team. Integration of SCADA and GIS-based systems for continuous monitoring and performance evaluation.

Implementation Plan (year wise):

Phase	Flow Meter Coverage (Schemes)	Cost for Installation of Flow meters and Other Allied Instruments	Purchase of Leak Detection Equipments, Strengthening of Antitheft Squad and NRW Management units in Crores	Estimated Cost (₹ crore)
Phase I (2025–27)	285	57	12	69
Phase II (2027–29)	285	57	10	67
Phase III (2029–31)	283	56.6	12	68.6
	853	**170.6**	**32**	**204.6 Cr**

- Flow meter installation, monitoring system and allied works estimated at ₹170.6 Cr overall. (Average cost @Rs. 20 Lakh/ Scheme)
- For Purchase of Leak Detection Equipment's, Strengthening of Antitheft Squad and NRW Management units in at ₹32 crore overall. (Average cost @ Rs.1 Crore /Division)

Financial Requirement:

Phase	Estimated Cost (₹ Crore)
Phase I (2025–27)	69
Phase II (2027–29)	67
Phase III (2029–31)	68.6
Total	**204.60 Cr**

Benefits/Advantages:

- Reduction of NRW from 35–40% to below 20%.
- Enhanced water availability
- Decrease in O&M expenditure
- Improved customer satisfaction through equitable distribution and reduced disruptions.
- Strengthened financial sustainability through improved billing efficiency and cost recovery.

Measurable Deliverables:

Reduction of NRW from 35–40% to maximum possible limit

Time Required for Implementation:

The works are proposed to be completed by 2031 in a phased manner. Each phase will cover approximately one-third of the total schemes, ensuring balanced progress.

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7. Rehabilitation and Replacement Plan

Vision:

KWA aims at a phased rehabilitation and replacement policy targeting complete replacement of Concrete and Asbestos Cement Pipe Line and less efficient electrical installations by 2031.

Present Scenario:

Kerala Water Authority (KWA) presently operates 853 water supply schemes, serving approximately 2.59 crore people with an average production of 3634 MLD. The system infrastructure comprises 252 Water Treatment Plants (WTPs), 1642 pump houses with 3546 pumps, 2140 service reservoirs (OHSR/GLSR) and an extensive 1,13,843 km transmission and distribution network.

Nearly 40% of KWA's infrastructure is more than 30 years old, leading to increased operation and maintenance (O&M) expenditure averaging around ₹ 112 crore annually. The aging system components have resulted in several operational challenges such as:

- Leakage and NRW: Significant water loss reducing effective delivery and financial recovery.
- Energy Inefficiency: Old pumps and motors consume excessive power.
- Operational Disruptions: Frequent repairs cause service interruptions.
- Quality Deterioration: Old and corroded pipes affect water quality and supply pressure.

During FY 2024–25, a total of 1,37,750 pipeline leaks were reported, with Asbestos Cement (AC) pipes showing relatively high leakage density. As these pipes have outlived their design life and suffer from brittleness, obsolete fittings, and poor hydraulic efficiency, replacement of AC pipes is accorded top priority over other pipe.

KWA's operations are also highly energy dependent, with monthly energy expenses exceeding ₹42 crore, accounting for over 40% of total revenue. Hence, improving the efficiency of pumps and motors, particularly those over 15 years in service, is vital for reducing energy costs and improving KWA's financial sustainability.

Implementation Programme:

Phase	Replacing AC pipe line		Replacement of old pump sets	
	Target in Km	Rough Cost (In Crores)	Target in Nos.	Rough Cost (In Crores)
I (2025–27)	1750	1225	490	98
II (2027–29)	2000	1400	560	112
III(2029–31)	1250	875	350	70
SUB TOTAL		3500 Cr		280 Cr
GRAND TOTAL Rs. 3780 Crores				

➢ Pipe replacement cost calculated at ₹70 lakh/km (Avg. including, laying and Road restoration)
➢ For Replacing of Pumps @ Rs. 20 Lakh / Pumpset (Average Cost including installation charges)

Financial Requirement:

The proposed phased program for replacing old AC pipelines and obsolete pump sets under Rehabilitation Policy envisages an estimated total investment of ₹3,780 crore during the period 2025–2031.

- Phase I (2025–27): Replacement of AC pipelines (1750 km) and replacement of pump sets (490 nos.) — ₹1,323 crore.

- Phase II (2027–29): Replacement of AC pipelines (2000 km) and replacement of pump sets (560 nos.) — ₹1,512 crore.

- Phase III (2029–31): Replacement of AC pipelines (1250 km) and replacement of pump sets (350 nos.) — ₹945 crore.

Total Financial Requirement: ₹3780 crore (₹3500 crore for pipeline replacement + ₹280 crore for pump replacement).

Measurable Deliverables:

- Reduction of Non-Revenue Water (NRW) to possible minimum

- Reduction in O&M expenditure
- Energy savings through efficient pumping systems
- Improved service reliability and water quality
- A sustainable, financially viable, and customer-focused system

Time Required for Implementation:

The proposed replacement program is planned over a six-year period (2025–2031), implemented in three sequential phases to ensure systematic execution with minimal disruption to water supply operations.

- Phase I (2025–27): 2 years – Focus on high leak zones and replacement of old, inefficient pumps.
- Phase II (2027–29): 2 years – Coverage of moderate leak zones and moderately efficient pump sets.
- Phase III (2029–31): 2 years – Completion of minor leak zones and remaining aged pumps.

Thus, the total time required for full completion of the network rehabilitation and pump replacement program is six years (2025–2031)

8. Harnessing Renewable Energy

Vision:

To transform Kerala Water Authority into a self-sufficient and energy-efficient utility by maximizing the use of renewable energy sources. This initiative aims to reduce dependence on conventional power, enhance operational sustainability, and move towards long-term energy independence.

Present Scenario:

KWA is the single largest consumer of KSEBL in Govt sector. At present, KWA maintains 329 HT connections and 2,135 LT connections, with an average monthly energy consumption of 5.33 crore kWh (4.31 Cr from HT + 1.02 Cr from LT), incurring an average monthly electricity cost of about ₹41.31 crore (₹32.31 Cr HT + ₹9 Cr LT).

KWA has already installed solar plants of capacity 944.5 kW across various divisions of KWA under various heads.

KWA has identified 70,175 m^2 of rooftop area that is readily available and capable of producing 7,000 kW of solar energy. In addition, under the Jal Jeevan Mission (JJM) Scheme,

an additional 1,75,000 m² of rooftop area (capable of generating about 17,000 kW) corresponding to the rooftops of service reservoirs currently under construction and ongoing implementation has been proposed for solar development. The entire project, with a total potential of 24,000 kW, is planned to be implemented in three phases during 2025–2031.

Implementation Programme:

The detailed year-wise breakdown of capacity, cost, and expected energy generation is provided below:

Phase	Period	Area (m²)	Capacity (kW)	Estimated Cost (₹ Crore) Base Cost (₹) (₹ 63000/kW + GST 12% (₹)	Annual Generation (Mega Units) (@4 Units per Kw /Day)	Annual Savings (₹) in Crore (@(₹)7/Unit)
Phase I	2025–2027	70,175	7,000	49	1.02	7.17
Phase II	2027–2029	85,000	8,000	56	1.17	8.69
Phase III	2029–2031	90,000	9000	64	1.31	9.2
Total	2025–2031	2,45,175	**24,000**	**169**	**3.50**	**25.06 Cr**

Financial Requirement:

Phase	Period	Capacity (kW)	Financial Requirement in Crore (Rs.)
Phase I	2025–2027	7,000	49
Phase II	2027–2029	8,000	56
Phase III	2029–2031	9000	64
Total	2025–2031	**24,000**	**169 Cr**

*Total cost Required for installation – **Rs. 169 Crore***

Benefits/Advantages:

• By installing Generation solar capacity of 24,000 kW by 2031 across KWA facilities it is

Phase	Period	Remarks
Phase I	2025–2027	In the Roof Top area of service Reservoirs already identified area 70,175 m^2 by 2027
Phase II	2027–2029	In the roof top area of Proposed and Ongoing service reservoirs under JJM scheme by 2031
Phase III	2029–2031	
Expected Completion	2031	

proposed to produce approximately 3.50 crore units (kWh) of solar power annually.

• Estimated annual savings of ₹25.06 crore through reduced grid consumption once project is in full swing.

• Average payback period of 7 years, post which net energy savings accrue

• Reduced CO_2 emissions of annually.

• Enhancement of KWA's operational sustainability and contribution to Kerala's renewable energy goals.

Measurable Deliverables:

Production of 3.50 crore units (kWh) of solar power annually.

Time Required for Implementation:

9. Service Delivery Improvement

Vision

To strengthen and expand the service network of Kerala Water Authority (KWA) by establishing additional Section Offices across the State to ensure improved operational efficiency, timely maintenance and enhanced consumer service coverage. By 2031, the vision is to achieve an optimized service ratio wherein each Section Office caters to not more than five panchayats, ensuring faster response times and greater accessibility for consumers in both rural and urban areas.

Present Scenario

Currently, one Section Office under KWA serves an average of eight panchayats. With 941 panchayats across the State, this wide coverage leads to challenges in timely maintenance, effective supervision, and efficient service delivery. In recent years, large-scale infrastructure development under **Jal Jeevan Mission (JJM)** in rural areas and **AMRUT / AMRUT 2.0** in urban areas has significantly increased the number of household water connections. Similarly, the expansion of sewerage networks in various

towns and cities has created additional operational and maintenance responsibilities at the field level.
Given this growth, the existing service structure requires strengthening to meet the increased demand and to ensure equitable, efficient, and reliable service delivery across Kerala.

Implementation Programme

To achieve the vision, it is proposed to establish approximately **71 new Section Offices** across the State, thereby reducing the average panchayat coverage from eight to five per office. Of these, around **30 offices will require new buildings**, while the remaining can be accommodated within existing KWA premises or through the modification of available infrastructure. Each Section Office will be equipped to manage both water supply and sewerage operations within its jurisdiction, integrating modern management practices, digital monitoring systems, and GIS-based asset tracking for improved service delivery.

About **10–15% of the required personnel** for the new offices can be managed through redeployment and rationalization of existing staff resources, ensuring optimal utilization of manpower.

Financial Requirement

1. Land and Building

Of the 71 offices, 30 will need new buildings, each requiring approximately **18 cents of land**.

Item	Details	Estimated Cost (₹ Crore)
Land (540 cents @ ₹10 lakh/cent)	–	54.00
Building (30 nos. @ ₹1.25 crore)	–	37.50
Infrastructure & setup (30 nos. @ ₹0.25 crore)	–	7.50
Total Capital Cost		**99.00**

2. Human resource deployment

Since 10–15% of the required personnel for the new offices can be managed through redeployment the annual financial commitment for new deployment is expected to be around ₹25–27 crore.

Benefits / Advantages

- Enhanced operational efficiency and quicker response to maintenance and consumer service issues.
- Strengthened field-level supervision and improved preventive maintenance of water supply and sewerage networks.
- Enhanced service accessibility and management across rural and urban areas, addressing the increased connections under JJM, the expanding consumer base through AMRUT projects, and the growing sewerage networks in major towns and cities.
- Reduction in downtime of schemes, leading to reliable water supply and effective sewerage management.

Measurable Deliverables

Parameter	Present (2025)	Target (2031)
Average local body per Section Office	8	5
No. of Section Offices	234	305
New Section Offices to be established	–	71
Average response time to field issues	3–5 days	1–2 days

Time Required for Implementation

Provided sufficient funds are made available, the proposed expansion of Section Offices can be completed by **2031** in two phases:

- **Phase I (2026–2028):** Establishment of 25 Section Offices in priority rural and urban areas
- **Phase II (2028–2031):** Establishment of the remaining 46 offices, including infrastructure setup, digital integration, and operational streamlining.

10. Institutional Strengthening

Vision:

To modernize and upgrade the Kerala Water Authority Training Centre at Head Office, Thiruvananthapuram, into a premier state-level capacity-building institute for water sector professionals. The upgraded Centre will focus on enhancing staff competency, introducing

digital and hybrid learning systems, and offering structured training programs for both internal and external participants on a cost-recovery basis.

Present Scenario:
 • 2 lecture halls (40 seats each, air-conditioned)
• 1 computer lab (36 seats, air-conditioned)
• 1 main conference hall (25 capacity, A/C) and 1 mini conference hall (15 capacity, A/C)
• Faculty room and refreshment area
• Hostel facility with 20 rooms, 50 beds, and attached/common toilets
• Existing projectors and training equipment (requiring replacement and upgrade)

The Centre presently conducts around **200 training programs per year**, covering about **15% of KWA staff**, with an average of **40–50 participants per batch**. The physical condition of the classrooms, hostel rooms, and ICT infrastructure has become outdated, requiring full-scale renovation and modernization to meet future functional and technological standards.

Implementation Programme:

The upgradation aims to convert the Centre into a **digitally enabled, fully networked learning environment**, with smart classrooms, improved hostel facilities, and practical demonstration   infrastructure.
No new blocks are proposed.

Major Interventions Proposed:-

• Comprehensive renovation of classrooms, labs, hostel rooms, dining area, washrooms, and common spaces — including replacement of beds, cots, furnishings, lighting, flooring, and interior design.
• ICT and digital modernization — installation of smart interactive panels, upgraded LAN and Wi-Fi network, CCTV surveillance, digital signage systems, and biometric access control.
• **Provision for live, recordable classrooms with advanced audio-visual and soundproofing systems**, enabling **online streaming and remote participation** for staff who cannot attend in person.
• Full network revamp to the latest standards, enabling seamless connectivity for e-learning and hybrid training operations.
• E-learning and hybrid platforms integrated with KWA's internal HR/training systems for digital course management.
• Simulation labs — establishment of a mini water treatment plant model, plumbing simulation unit, and digital field practice setups.

• Power infrastructure improvement — new generator, UPS systems, and provision for solar rooftop installation.
• Furniture and fixture modernization — new classroom furniture, hostel cots, mattresses, dining furniture, and equipment.
• Safety and sustainability improvements — fire safety systems, rainwater harvesting, and enhanced waste management provisions.

Financial Requirement:

Component	Description	Indicative Cost (₹)
Civil works – renovation & interiors	Modernization of classrooms, hostel rooms, washrooms, dining hall, and façade; replacement of flooring, false ceiling, lighting, and interior design	₹3.50 crore
Furnishing & equipment	Replacement of classroom and hostel furniture, cots, mattresses, kitchen/dining setup, projectors, audio systems	₹0.75 crore
ICT & smart training systems	Interactive panels, e-learning platform, networking, Wi-Fi, CCTV, signage, access control	₹1.00 crore
Simulation labs & models	Mini water treatment plant model, plumbing and instrumentation labs	₹0.50 crore
Vehicles / field kits	Light vehicle and mobile demonstration kits for practical training	₹0.25 crore
Consultancy & content development	Curriculum design, module development, institutional tie-ups	₹0.20 crore
Project management / contingencies (15%)	Administrative overheads, unforeseen expenses	₹0.60 crore
Total Capital Cost (Capex)		**≈ ₹6.30 Cr**

Recurring Expenditure (Post-Upgrade):

Item	Approx. Annual Cost (₹ lakh)
Salaries for additional staff (2 AE, 3 Clerk, 1 Jr. Superintendent, temporary security)	70
Power, generator, water & sanitation	15
Network maintenance, ICT license renewals	10
Consumables (training materials, stationery, books, etc.)	5
Hostel O&M and housekeeping	10
Miscellaneous / contingency	10

Item	Approx. Annual Cost (₹ lakh)
Total Annual O&M (Approx.)	**₹1.20 Crore/year**

Benefits/Advantages:

Projected Revenue (2031)

Estimated annual revenue generation: **₹20 lakh,** primarily through:
• Paid external training programs (average 30 participants × ₹5000 per head × ~12 programs/year)
• Minor consultancy and collaboration with other government departments and academic institutions

(Note: Revenue projection is conservative, considering institutional pricing norms and practical limits for fee-based programs within a government setup.)

Measurable Deliverables:

The following table presents the expected measurable outcomes by 2031 upon successful implementation of the modernization plan.

Parameter	Baseline (Present)	Target (2031)	Remarks
Training programs conducted per year	200	250	Increased diversity of topics and specialized modules
Average participants per batch	40–50	80	Reflects improved capacity utilization
Training capacity per session	40 (per class × 2 classes)	50 (per class × 2 classes)	Parallel sessions in upgraded halls
Total trainees per year (internal + external)	~2000 (KWA staff only)	4000	Inclusion of external participants and hybrid sessions
KWA staff coverage per year	15%	50%	Wider reach through hybrid/e-learning platforms
E-learning or hybrid programs	Nil	Introduced	Integrated with KWA HR/training portal

Parameter	Baseline (Present)	Target (2031)	Remarks
New training modules introduced	Limited	≥10 new modules	Including finance, administration, and project management
Average external participant fee	–	₹5000 per head (5-day course)	
Annual revenue (training & consultancy)	₹4 lakh	₹20 lakh	
Quality and institutional benefits	–	Improved internal capacity, reduced external dependency	Enhanced efficiency and technical self-reliance

Summary:

The upgraded Training Centre will emerge as a **state-level knowledge and capacity-building hub**, aligning with **Vision 2031** goals of Kerala Water Authority. It will:

- Deliver modern, technology-driven training for both internal and external participants.
- Enable the introduction of hybrid and e-learning programs within KWA.
- Include live, recordable classrooms to support online participation and wider reach.
- Enhance technical, financial, and administrative competencies of KWA staff.
- Generate sustainable revenue while maintaining affordability in a government framework.
- Provide fully networked, energy-efficient, and learner-friendly infrastructure for the next decade.

11. Digital Meter Reading

Vision:
Implementing the digital system across all 31 Revenue Divisions. This will achieve KWA's overarching goal of 100% Reading, 100% Billing and 100% Collection.

Present Scenario:

To address the inefficiencies of the current manual, paper-based system for bimonthly meter reading and billing, which caters to this vast consumer base, KWA is rapidly scaling up its modern **digital meter reading system**. This strategic digital shift, first introduced on a pilot basis, is aimed at providing better service, reducing **Non-Revenue Water (NRW)**, eliminating errors inherent in handwritten entries and significantly accelerating the billing

cycle. Readings will be recorded quickly and accurately, enabling customers to receive their bills instantly either as a physical copy or via SMS/email.

Implementation Programme:

On a pilot basis, 1,060 Android Handheld devices were procured for meter reading and spot billing acquired through e-tender basis for an amount of ₹2.00 crores. The cost of each device is ₹18,822/-. This digital approach is significantly more accurate and efficient than the traditional manual, paper-based method. It eliminates handwritten entry errors and ensures readings are recorded quickly and precisely. Customers can receive their bills immediately, either in paper format or digitally via SMS/email.

Benefits/Advantages:

Meter readers are now equipped with **1,000 Palmheld devices** that allow them to record readings simply by approaching the meter. The data is instantly transmitted to a **centralized database** via a wireless connection (Wi-Fi, Bluetooth, or Cellular network). This immediate transfer dramatically **speeds up the entire billing process**, allowing bills to be prepared and issued to the consumer the moment the reading is taken.

This digital approach is significantly more accurate and efficient than the traditional manual, paper-based method. It eliminates handwritten entry errors and ensures readings are recorded quickly and precisely. Customers can receive their bills immediately, either in paper format or digitally via SMS/email.

A key advantage of this new system is the immediate application of the 15 KL free water benefit for BPL consumers. The former process delayed this subsidy, applying it two months after the reading was taken. The new *Palmheld* devices eliminate this lag, calculating and providing the BPL benefit in the same month the reading is captured, thus greatly improving the accuracy and timeliness of the billing.

Measurable Deliverables:

1. The data is instantly transmitted to a centralized database via a wireless connection
2. Dramatically speeds up the entire billing process, allowing bills to be prepared and issued to the consumer as and when the reading is taken.
3. Digital approach is significantly more accurate and efficient than the present reading system.
4. It eliminates handwritten entry errors and ensures readings are recorded quickly and precisely.
5. Customers can receive their bills immediately, either in paper format or digitally via SMS/email.

6. A key advantage of this new system is providing the BPL benefit in the same month the reading is captured.

The **Technical Specifications** for the Palmheld machines have been established as follows:

1. **Operating System:** Android 7 or a higher version (instead of the previously specified Android 8 OS).
2. **RAM and Internal Memory: 2GB RAM** (instead of the previously specified 3GB-8GB range).
3. **Battery Backup:** 5000 mAH battery, providing **8 to 10 hours** of battery backup.
4. **Battery Warranty:** A minimum **1-year warranty** on the battery.
5. **Tender Participation:** Participation from **Banking organizations (Joint Ventures)** is permitted in the tender process, in addition to manufacturers.

Financial Requirement:

Android Handheld device further required   -   1500 Nos.
Amount required Around (2000x1500)   -   3 Cr

Implementation Timeline:

As part of **Vision 2031**, and following an analysis of the performance of the presently distributed Palm held devices, KWA is committed to **implementing this digital system across all 31 Revenue Divisions by 2028**. This will achieve KWA's overarching goal of **100% Reading, 100% Billing and 100% Collection**.

12. Cashless Payment

Vision:
Tariffs for water services must be determined by ensuring rates are set in alignment with actual costs, thereby eliminating the revenue deficit and guaranteeing the Authority's long-term financial viability and service quality

Present Scenario:
The Kerala Water Authority (KWA), aligning with the Kerala Government's goal of digitizing all services, has successfully introduced multiple online channels for customers to make **cashless water bill payments** from the convenience of their homes.

Current Cashless Payment Methods:-

KWA offers several secure and convenient ways for customers to pay their water bills digitally:

- **KWA Website (Quick Pay):** Payments can be made easily using the **'Quick Pay'** option on the official website (https://epay.kwa.kerala.gov.in). Customers can check their bill amount and pay using their **Consumer Number** or **registered Mobile Number** without needing to log in.
- **KWA Official Mobile Application:** The dedicated mobile app allows customers to pay bills, view bill details, and check payment history.
- **UPI Applications:** Payments are supported through UPI apps like **Google Pay.** Customers select the **'KWA Bill Payment'** option and proceed by entering their Consumer Number.
- **Other Online Channels:**
    - Internet banking facilities.
    - Debit/Credit cards (Visa, Mastercard, etc.).
    - Websites and apps supporting the **Bharat Bill Payment System (BBPS)**.
    - Direct payment via **State Bank of India (SBI)** using the assigned **Virtual Account Number (VAN ID)**, which is *free of charge*.
    - Other services like **NEFT/RTGS** and authorized centers like **Jan Sevana Kendras** (Public Service Centers).

Implementation Programme:

To actively encourage this digital shift, the KWA has put in place an incentive program and a phased plan to reduce reliance on physical cash counters:

- **Phased Reduction of Counters:** The Authority is promoting online payments to reduce congestion at cash counters and intends to gradually **reduce the number of physical counters**. In offices with multiple counters, one is already slated for discontinuation.
- **Workforce Efficiency:** The digital system frees up counter staff for **redeployment** to other essential **Consumer Service activities**.
- **Incentive:** Customers who pay online receive a **one percent incentive** on the bill amount, up to a maximum of **₹100**.

Key Benefits and Advantages for Consumers and KWA:-

The expansion of the cashless payment system addresses the challenge of increasing water connections without a corresponding increase in staff, offering significant advantages:

Benefit	Description
Save Time	Customers no longer have to wait in long queues at KWA offices.
Convenience	Bills can be paid instantly, **anytime, from anywhere** with internet access.

Security	All financial transactions are conducted through **highly secure digital channels**.
Easy Records	Customers effortlessly receive and store payment receipts online for future reference.
Operational Efficiency	KWA can use its workforce more efficiently by reassigning staff to crucial services.

Time Required for Implementation:

As part of **Vision 2031**, KWA plans to **reduce the number of physical counter transactions** and achieve **100% digital payment by 2028**.

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13. Independent Tariff Mechanism

Present Scenario:

The Kerala Water Authority (KWA) currently operates at a significant **revenue deficit**, failing to meet the **no-profit, no-loss** operational mandate outlined in Section 23 of the Water Supply Regulation Act of 1986. While Section 15(2) iii of the Act grants KWA independent authority to determine tariffs, the rates are consistently set **far below the actual production cost** estimated at **₹24.56 per thousand liters** for the financial year 2024-25. This deficit, which continues to widen due to annual escalations in operational expenses (like electricity, chemicals, and maintenance) is only partially covered by an insufficient Non-Plan Grant from the Government.

Implementation Programme:

In recognition of this financial instability, KWA formally recommended the formation of an **independent Water Regulatory Authority** through Board Resolution No. 11124 on January 28, 2021. This proposal aligns with the earlier **Kerala State Water Resources Regulatory Authority Bill - 2012** (Ordinance No. 3 in 2013).

However, the Government of Kerala has, thus far, rejected the need for a separate Authority, asserting that water tariff determination is a **highly sensitive issue** on which it takes timely decisions.

Benefits/Advantages:

An independent Regulatory Commission would serve as a crucial mechanism to stabilize KWA's finances and protect the public interest. Its key functions would include:

- **Regulating Prices and Tariffs:** The Commission would possess the authority to determine tariffs for water services, ensuring rates are set in alignment with **actual costs** to eliminate the revenue deficit.
- **Cross Subsidization:** The most significant advantage is the use of **cross-subsidization**, where charging higher prices to one group of consumers for services allows prices to be artificially lowered for another, ensuring affordability for **low-income populations or weaker sections of society**.
- **Protecting Consumers:** It would ensure the public receives **quality and reliable services at affordable prices** and would establish a mechanism for grievance redressal.
- **Ensuring Service Standards:** The body would set and enforce high standards for the **quality, continuity, and reliability** of water treatment, transmission, and distribution.
- **Promoting Development:** By encouraging investment and monitoring adherence to rules, the Commission would help facilitate **modernization and efficiency** within the water sector.
- **Differential tariffs:** To ensure **cost recovery and promote efficiency**, water tariffs implement a differential pricing structure where different rates are charged to consumers, such as higher and lower usage non-domestic customers.

Implementation Timeline:

As part of its Vision 2031, KWA maintains the expectation that the Government of Kerala will ultimately move forward with the formulation of a **Tariff Revision Committee or a Regulatory Commission** to ensure the Authority's long-term financial viability and service quality.

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14. Non-Water Revenue (NWR) Initiatives

Vision:

To transform Kerala Water Authority's assets into sustainable, revenue-generating facilities through innovative initiatives that utilize existing infrastructure and human resources effectively, while preserving heritage, promoting public engagement, and ensuring financial self-reliance. The Non-Water Revenue (NWR) initiatives aim to generate at least 20% of KWA's total revenue through innovative projects on KWA assets—enhancing income without compromising its core mission of providing affordable and reliable water services to the public.

Present Scenario:

The Government of Kerala has accorded in-principle approval as per G.O. (Ms) No. 10/2023/WRD dated 01/02/2023 for initiating various Non-Water Revenue (NWR) projects on KWA assets to generate additional revenue and improve asset utilization. At present, KWA possesses a range of civil structures and heritage assets with significant potential for redevelopment into functional, income-generating spaces. In this regard, key projects have been identified — including the establishment of a **Water Museum** at the heritage building in Jalabhavan campus, renovation and modernization of **existing guest houses** and **construction of new guest houses** within KWA owned premises.

Implementation Programme:

Under the NWR initiatives, the flagship project involves transforming the old Jalabhavan building (constructed in 1935) into a **Water Museum** themed *"The Essence of Water – Capturing Emotions of Kerala's Water Story."* This initiative, approved by the KWA Board (Decision No. 11357 dated 12/08/2024) and declared by the Hon'ble Minister for Water resources in the Legislative Assembly, will be implemented in collaboration with the Interactive Museum of Cultural History of Kerala (IMCK).

- **Phase I**: Renovation of the heritage building
- **Phase II**: Establishment of six thematic galleries illustrating Kerala's water history, traditional and modern purification methods, vintage machinery and emerging technologies.
- A MoU was signed with IMCK on 25/02/2025, the concept note submitted and the final DPR is expected by January 2026.

In addition, the NWR project also includes:

- **Renovation and upgradation of existing guest houses** by introducing modern facilities, digital booking systems, and improved amenities to enhance service quality and attract greater public utilization.
- **Construction of new guest houses** within KWA's civil structures and assets, designed to generate sustained revenue through rentals and public utility.

Financial Requirement:

Component		Estimated Cost (₹ Cr)
Water Museum (including renovation & development)	-	13.00
Renovation & upgradation of guest houses	-	2.00
Construction of new guest houses in KWA assets	-	5.00
Funding required for the projects	-	**20.00 Cr**

Benefits/Advantages:

- Generates sustainable non-water revenue streams, reducing dependency on conventional tariff-based income.
- Preserves and revitalizes KWA's historic assets, safeguarding Kerala's water heritage for future generations.
- Enhances the visibility of KWA's contribution to the state's water sector through public engagement and educational outreach.
- Improves hospitality infrastructure for officials and visitors through well-maintained, modernized guest houses.
- Encourages tourism, awareness and public participation in water conservation and history through the Water Museum experience.
- Effective utilization of existing infrastructure and human resources for various NWR activities, reducing idle capacity and administrative costs while generating additional revenue.

Measurable Deliverables:

- Completion of the **Water Museum** at Jalabhavan with six fully functional thematic galleries.
- Renovation and commissioning of **existing guest houses** with online booking facilities.
- Construction of **new guest houses** for revenue generation within KWA premises.
- Enhanced public access to heritage spaces and improved service infrastructure for KWA operations.
- Optimized use of KWA's available infrastructure and manpower through implementation of NWR projects leading to measurable increases in non-water revenue generation.

Time Required for Implementation:

All NWR projects, including the Water Museum and guest house initiatives, are planned for phased implementation and will be completed at the earliest upon receipt of the required funding. On completion, these initiatives will collectively enhance KWA's financial sustainability, promote public engagement and ensure the optimal utilization of its assets, realizing the **Vision 2031**.

KERALA RURAL WATER SUPPLY AND SANITATION AGENCY (KRWSA - JALANIDHI)

Kerala Rural Water Supply and Sanitation Agency (KRWSA), established by Govt of Kerala as a specialized institution under the Water Resources Department, Government of Kerala, has been the driving force behind community-managed rural water supply initiatives implemented in the state. Through the successful implementation World Bank Supported Jalanidhi Phases I and II, in 227 Grama Panchayat across the state covering over 5884 rural water supply schemes, KRWSA has transformed the rural water communities by placing ownership and sustainability in the hands of user groups. KRWSA was registered on 17-11-1999 under Travancore Cochin Literacy, Scientific and Charitable Societies Registration Act 1955 (Act XII of 1955) with Registration No.T.1812.

The Gram Panchayats have a key role in implementing community-based water supply projects under Jalanidhi. KRWSA has also established a wide network of NGOs in mobilizing communities towards implementing the participatory, community driven water supply & sanitation facilities owned and managed by them. This model of scheme implementation under JALANIDHI has demonstrated successfully an equitable, inclusive and decentralized delivery system mainly benefiting the SC, ST and BPL category of rural households in Kerala. KRWSA is the nodal Agency of the State Government for the implementation of Rain Water Harvesting Programme in the State. Presently KRWSA is also an implementing Agency for the central flagship programme "Jal Jeevan Mission". The concept and implementation procedures followed in Jal Jeevan Mission is very much similar to the Jalanidhi model implemented in Kerala. KRWSA is also implementing state plan schemes since 2019-20.

Overall Achievements

The overall experience of Jalanidhi was considered satisfactory on all fronts, project preparation, design, quality of entry, implementation arrangements, monitoring and evaluation, compliance with environmental and social safeguards, fiduciary management and procurement. KRWSA had implemented 5884 schemes in Phase-1 & 2 projects covering 227 GPs benefiting 4.52 lakh households. 1.04 lakh individual latrines, 24,194 latrine conversion, 96,703 environment management plan units (soak pit, compost pit, vermin compost etc) and 1,916 bio gas units. After commissioning of the schemes, the assets created were handed over to the user group - Beneficiary Groups (BG) for Operation and Maintenance (O&M) all by themselves. The schemes in Phase 1 that were commissioned first have been operational for more than 20 years.

The performance assessment conducted by CAG found that nearly 65-70% of the schemes are sustainable even now. As an implementing agency of Jalanidhi Projects, KRWSA showed its capacity to deliver satisfactory performance. KRWSA also popularized Rain water harvesting programme in the state by constructing nearly 40,600 rain water harvesting structures.

KRWSA has gained significant experience in the field of Engineering, Social mobilization and Capacity building in drinking water sector working with marginalized and vulnerable communities viz, below poverty line, scheduled caste, scheduled tribes and fisher flocks. The organization with the support of NGOs, have established an ecosystem of small/large and Multi GP beneficiary community run Rural Water Supply models across the state. Also, KRWSA has been focusing on conservation of precious rain water through the program of Rainwater Harvesting for the last 2 decades and remain the nodal agency in the state. KRWSA has implemented house hold level rain water harvesting with ground water recharging system, open well recharge, well protection with sanitization. With this sector expertise and experience in implementation of WATSAN projects, building of local capacity of user groups and local government institutions, KRWSA is looking towards its broader vision IN 2031 to achieve its aim of CENTRE OF EXCELLENCE IN DECENTRALISED WATER SUPPLY AND SANITATION MANAGEMENT.

Looking towards 2031.
As we look ahead to 2031, KRWSA foresees a future where every rural household in Kerala enjoys safe, sustainable, and equitable access to water and sanitation services, supported by empowered local communities and resilient water management systems.

Vision Statement
By 2031, KRWSA aims to become a Centre of Excellence in decentralized and sustainable water management ensuring universal access to safe water, effective sanitation, and climate-resilient water resources through community participation, innovation, and capacity development.
Mission
- To strengthen and sustain community-managed rural water supply and sanitation systems.
- To promote integrated water resource management (IWRM) for resilience against climate change.
- To expand the scope of KRWSA as a knowledge hub for rural water governance, grey water management, and environmental sustainability.
- To enhance institutional capacity and technical expertise of stakeholders through continuous learning and digital transformation.
- To foster partnerships and innovation with government, academia, civil society, and global water networks.

Programmes planned to taken up for 2031.

1. **Rain Water Harvesting Programme massively to address seasonal water scarcity and also improve sustainable water sources:**

Sustainable Water Security through Roof Top Rain Water Harvesting and Ground Water Recharge By 2031, the Roof Top Rain Water Harvesting Programme with Ground Water Recharge will evolve into a state-wide movement ensuring universal household access to safe and sustainable drinking water, particularly in hilly, coastal, and remote regions. The programme envisions every household as a self-reliant water unit, effectively capturing and conserving rainwater to recharge groundwater aquifers, restore ecological balance, and mitigate seasonal water scarcity.

Through community participation, technological innovation, and convergence with climate-resilient water management strategies, the initiative aims to:

- Enhance local water security and reduce dependency on external water sources.
- Promote groundwater rejuvenation and improve the overall water table across the state.
- Foster a culture of judicious use water making rainwater harvesting an integral part of every household's water management practice.
- Achieve resilient and equitable access to drinking water even during periods of acute summer scarcity.

By 2031, this initiative will stand as a model of people-driven, sustainable, and climate-adaptive water resource management, ensuring that every drop of rain contributes to the collective water future of the State.

By 2031 through this programme KRWSA aims to construct 10000 units of RWH structures with a capacity of 10000 liters each with overall budget of INR -106 Cr.

2. **Long-Term Sustainability of Community Managed Water Supply Schemes**

By 2031, *Community Managed Water Supply Schemes* across Kerala will operate as **self-sustaining, efficient, and resilient systems**, ensuring reliable access to safe drinking water for all households through strengthened **community ownership** and **institutional support mechanisms**.

The *Sustainability Support to Community Managed Water Supply Schemes* initiative envisions the revival and long-term functionality of all partially or fully defunct community schemes through **technical rehabilitation**, **capacity building**, and **financial strengthening** of Beneficiary Groups (BGs). This vision recognizes that sustainable water service delivery requires not only infrastructure but also **continuous handholding, technical guidance, and monitoring support**.

Under this vision, by 2031:

- Every community-managed or Local Self Government-led scheme will have access to **professional technical support** for maintenance, troubleshooting, and performance improvement.
- A **State-level sustainability framework**, committed by KRWSA, will guide and monitor O&M practices to ensure functionality and service quality.
- **Institutional linkages** among KRWSA, LSGDs, and Beneficiary Groups will be strengthened to ensure shared responsibility and accountability in water governance.
- Capacity development initiatives will empower communities with the **skills, tools, and governance mechanisms** required for effective scheme management.
- The approach will complement the objectives of *Jal Jeevan Mission (JJM)*, preparing the State to manage and sustain **over 70 lakh household tap connections** under a community-led framework.
- Build a strong data base on community managed water supply schemes and its functionality.

By 2031, KRWSA will emerge as a **Centre of excellence in Supporting Community Water Supply Management**, providing strategic and operational support to ensure that every community-managed water supply system remains **functional, financially viable, and resilient to changing climatic and social conditions** securing Kerala's journey toward universal, sustainable water access.

By 2031 through this programme, KRWSA is proposed make the source, systems and institution are properly functioning to ensure service sustainability of 2500 water supply schemes across the state with an overall budget allocation 300 Cr.

3. **Information, Education and Communication (IEC) and Water Literacy Promotion through Jalasree Clubs**

Effective management of water resources and water supply systems requires not only infrastructure but also an informed and empowered community. The **Information, Education and Communication (IEC)** activities in the water sector aim to build capacities and create awareness among various stakeholders particularly local communities, institutions, and leadership, so that they can take ownership of the **Operation and Maintenance (O&M)** of in-village water supply systems.

The **Capacity Building and Training component** of the Sustainability Support Programme is designed to rebuild, reorient, and reenergise the existing institutional framework to scientifically and efficiently manage water supply schemes. These interventions are essential to ensure sustained service delivery and the long-term functionality of water supply systems.

To create a water-literate and responsible society that values, conserves, and manages water resources sustainably through informed participation, continuous learning, and community empowerment.

To institutionalize water literacy, strengthen capacities at all levels, and promote behavioural change for the sustainable operations and management of water supply systems and conservation of water resources across the State.

Objectives

- To enhance awareness on **water conservation, environmental sanitation, and safe drinking water practices**.
- To build **capacities of local communities and institutions** for scientific management and maintenance of water supply schemes.
- To promote **water quality monitoring, conservation techniques, and disease prevention** related to water and sanitation.
- To nurture a **culture of water literacy** beginning from schools and extending to households and communities.
- To foster **collective responsibility and leadership** in ensuring sustainability of water resources.

Jalasree Club: Water Literacy Initiative

The **Jalasree Club**, an initiative of **Kerala Rural Water Supply and Sanitation Agency (KRWSA)**, serves as a flagship school-level programme promoting water literacy and environmental stewardship among students. Recognizing that children are the citizens and change-makers of tomorrow, the programme seeks to instil lifelong values of water conservation and responsible water use.

Key Features of Jalasree Clubs

- Formation of **school-based clubs** to promote water literacy and hygiene awareness.
- Organization of **awareness campaigns, rallies, surveys, water quality testing camps, and field trips**.
- Hands-on learning experiences such as **testing household and local water sources** for quality parameters.
- Collaboration with **teachers, parents, and local communities** to amplify impact and influence behaviour change.
- Promotion of **groundwater recharge and water conservation techniques** through practical demonstrations.
- Engagement of students in **environmental sanitation drives** and advocacy for clean surroundings.

Strategic Approach

- **Capacity Building:** Develop and deliver structured training modules for teachers, students, community leaders, and local self-government functionaries.
- **Awareness Generation:** Implement multimedia IEC campaigns emphasizing safe water, sanitation, and hygiene (WASH) practices.
- **Community Participation:** Foster partnerships between schools, panchayats, and local

communities to ensure collective ownership.

- **Monitoring and Evaluation:** Establish mechanisms to measure improvements in water literacy, conservation practices, and hygiene behaviour.
- **Integration with Government Programmes:** Align Jalasree Club activities with broader initiatives such as Jal Jeevan Mission (JJM) and the State's Water Conservation Mission.

Expected Outcomes

- Enhanced community capacity for sustainable water management.
- Increased awareness and behavioural change regarding water use, hygiene, and sanitation.
- Improved water quality and reduction in water-borne diseases.
- Strengthened linkages between educational institutions and community water governance.
- Establishment of a **generation of water-literate citizens** who advocate for responsible judicious use of water.

By 2031 through this programme, KRWSA is proposed to establish Jalasree Club in all schools in Kerala for generating awareness on water management and reuse. Target is 10000 schools of various categories with an overall budget allocation 5cr.

Ground Water Based Mini Drinking Water Supply Scheme

A. Overview

The Ground Water Department, Kerala, plays a pivotal role in ensuring the sustainable utilization and equitable distribution of groundwater resources across the state. During the 2026–31 plan period, the Department aims to strengthen the state's water infrastructure by implementing an ambitious set of projects focused on expanding water supply, modernizing existing schemes, and ensuring water security for all communities, particularly in water-stressed and marginalized areas.

B. Physical Targets for 2026–31

The Department is proposed to implement the following major activities using the **Plan Fund** for the next five years period.

Financial Year	Mini Water Supply Schemes	Renovation of Mini Water Supply Schemes	Hand Pump Repair Works	Borewell / Tubewell Construction	Water Treatment Plants *(20 per year)*	SC/ST UNNATHI Projects *(20 per year)*
2026–27	29	61	787	69	20	20
2027–28	35	73	944	83	20	20
2028–29	42	88	1133	100	20	20
2029–30	50	106	1360	120	20	20
2030–31	60	127	1632	144	20	20
Total (2026–31)	**216**	**455**	**5856**	**516**	**100**	**100**

C. Proposed Financial Outlay

The required investment for the 2026–31 period is projected to increase steadily from ₹400 lakhs in 2026–27 to ₹800 lakhs in 2030–31, as shown below:

Fiscal Year	Required investment **(₹ Lakhs)**	Beneficiary Families (Nos.)
2026–27	400	11,431
2027–28	500	13,717
2028–29	600	16,460
2029–30	700	19,752
2030–31	800	23,702
Total (2026–31)	**3000 Lakhs**	**85,062**

a) Additional Initiatives

Component	Units / Year	Unit Cost	Total (₹ Lakhs for 5 years)
Water Treatment Plants	20	₹10 lakh	₹1000 Lakhs
SC/ST UNNATHI Projects	20	₹15 lakh	₹1500 Lakhs

Thus, an **additional ₹2500 Lakhs** need to be invested over the five-year period to ensure safe and treated drinking water for rural and marginalized communities.

b) Total Financial Commitment (2026–31)

The total outlay combining departmental plan fund works, water treatment initiatives, and SC/ST Unnathi projects is estimated at:

₹5500 Lakhs (2026–31)
(₹3000 lakhs under Plan Fund + ₹2500 lakhs under Special Components)

D. Implementation Highlights

1. **Mini Water Supply Schemes** implemented by Groundwater Department @ 29/year in 2026–27 will be enhanced @ 60 per year by 2030–31, ensuring drinking water coverage in water-scarce localities.
2. **Renovation of Existing Schemes** will be prioritized to restore functionality and improve service reliability.
3. **Hand Pump Repairs** and **Borewell Installations** will continue to serve as crucial interventions in drought-prone regions.
4. **Water Treatment Plants** (20 per year) will ensure potable quality water supply in fluoride and iron-affected areas.
5. **SC/ST UNNATHI Projects** (20 per year) will be implemented in tribal and Scheduled Caste settlements to guarantee equitable access to groundwater resources.

E. *Expected Outcomes*

- Construction and renovation of **over 670 water supply schemes** and **more than 5,800 hand pump rehabilitations** across Kerala.
- **100 new water treatment plants** ensuring safe drinking water in vulnerable habitations using groundwater sources.
- **100 SC/ST UNNATHI projects** benefiting marginalized communities.
- **85,000+ households** to gain direct access to improved water facilities.

Total required investment of approximately **₹5500 Lakhs** ensuring inclusive, sustainable, and resilient water infrastructure for Kerala.

IRRIGATION

MAJOR, MEDIUM, and MINOR

IRRIGATION

Major and Medium Irrigation (MMI) Projects and Canal Maintenance

1. Introduction

Kerala's irrigation network comprises 23 Major and Medium Irrigation (MMI) projects, of which twenty are completed and three are ongoing. These projects form the backbone of the state's agricultural economy, sustaining crop productivity and providing regional water security. Despite their immense contribution, the canal systems are now severely challenged by aging infrastructure, some of which is over half a century old. Excessive siltation, continuing erosion, leakage from degraded canal linings, unchecked weed and vegetation growth, encroachment, and shifts in cropping patterns have exacerbated the problem. Pollution from solid and liquid wastes, including household and chemical pollutants, further compounds these difficulties. The combination of these physical, ecological, and administrative issues is undermining the reliable delivery of irrigation water and threatens long-term agricultural sustainability. Thoughtful renovation through phased, innovative, and cost-effective approaches is crucial to sustain agriculture productivity and water availability over the coming decades.

2. Statement of Purpose

Maintenance of irrigation canals using modern, and cost-effective materials to prevent leakage and to improve water distribution efficiency must be taken up in a phased manner. Silt load management in reservoirs and canal network are also of prime importance which require water shed level interventions. Scope of automation, where it can help to improve operational efficiency, need to be explored.

3. Need for Action

The present status of the State's MMI canal system is marked by notable deterioration. Cracks, erosion, and damage to canal linings, regulators, and cross-drainage structures have significantly reduced operational efficiency, while siltation, propelled by land development and storm runoff, has altered canal bed profiles and diminished carrying capacity. As a result, water distribution has become uneven and unreliable.

The issue is further aggravated by malfunctioning and obsolete cross-drainage structures, unauthorized cutting of canal bunds, and the construction of new roads, all of which contribute to heavy silting in canals and complicate maintenance efforts.

Vegetation management presents its own set of problems. Manual cleaning, limited by funding and workforce, often leaves much of the canal system clogged with grass, weeds, and trees, causing hindrance to inspection and regular maintenance.

Many older canals and their adjacent lands suffer from poor marking and surveying, allowing illegal occupation and limiting the possibilities to enforce property rights or evict the encroachments. Overgrowth of vegetation in canal bunds also encourage infringement to government land by slowly extending temporary fencing like structures.

Another major challenge affecting the system's efficiency is the widespread defectiveness of control structures. Gates, shutters, and measurement devices are frequently rusted, broken, or altogether missing. This absence of robust control and measurement systems allows irrigation releases and water level management to devolve into manual, ad-hoc processes, resulting in significant inefficiencies and water wastage. The lack of control valves, combined with an absence of planned irrigation turns, leads to erratic releases and losses, especially at upstream points, while many areas at the tail end of the canal receive inadequate supply.

Financial constraint has played a major role in perpetuating these issues. Maintenance budgets typically addresses the most critical maintenance need, while the fund available for comprehensive - preventive repairs and upgrades are limited.

Crop-water calendars, which should serve as guides for scheduled irrigation, are not strictly followed; instead, water is often distributed based on farmer requests rather than optimized, climate-resilient schedules. This failure to coordinate agricultural planning with irrigation infrastructure further undermines system performance, reducing reliability for farmers and threatening crop yields.

The environmental and social dimensions of canal management represent additional challenges. Land acquisition for canals is poorly documented and mapped, with missing or damaged boundary stones hindering the ability to prevent or remove encroachments. Many cases linger unresolved in courts, denying the system much-needed access for maintenance.

There has also been a marked shift in agricultural patterns. The canals, originally designed to irrigate paddy fields, now serve a landscape where paddy cultivation is steadily declining, replaced by garden crops and facing increasing urban and industrial water demand. Climate change induced vulnerability is changing cropping cycles and has led to a reduction in farmer interest.

Finally, pollution has emerged as a major threat to canal health and water quality. During non-irrigation months, canals are routinely used to dump solid and liquid waste, particularly in urban stretches, creating serious hazards to both the canal ecosystem and human health.

4. Implementation Strategy

A set of structural, administrative, and environmental remedies are proposed to address these interlinked challenges and set Kerala's canal system on a path to modernization.

i. Technology assisted baseline evaluation and continuous monitoring

Comprehensive digital surveys and GIS-based mapping should lead the way, ensuring an accurate record of canal layouts, the state of physical infrastructure and encroachment extents. Surveying canal levels and quantifying silt volumes must precede the introduction of mechanical desilting, which should be phased and well-planned to avoid recontamination and maximize efficiency.

ii. Maintenance using modern, cost-effective materials

Structural repairs should utilize modern, cost-effective technologies, such as fibre reinforced concrete or mortar with mesh, geo-synthetics, HDPE (High-Density Polyethylene), EPDM (ethylene propylene diene monomer) membranes, epoxy coating for aqueducts and lined canals, and PVC sealants for joints; full re-lining could be limited for sections suffering severe leakage. Damaged regulators need to be reconstructed, cross-drainage structures, and shutters must be properly maintained before each distribution period.

iii. Water level monitoring

Manual, and eventually automated, water level monitoring should be brought online to facilitate efficient canal operation. Key canal data ought to be displayed at vital locations to aid inspection and operational workflow.

iv. Management of silt flow

Preventive measures can be implemented both in the catchment areas and within the canal system to minimize silt entry and accumulation. Adoption of contour bunding, terracing and increasing vegetation cover will stabilize soil and reduce runoff velocity and thus reducing soil erosion. Preventing entry of road drain discharges into canals by diversion and restoration of natural drainage channels to receive floodwater from super passages will reduce the silt load. Integrated watershed management programs and remote sensing and GIS based monitoring of soil erosion will be helpful to develop a sustainable silt management strategy.

v. Financial resources

Equally important are innovations in administration and resource allocation. Funds for canal rehabilitation must be distributed as per the length, ayacut (command area), and age of each canal system, with phased five-year plans and external funding streams—such as NABARD RIDF—actively sought wherever possible. Minor distributaries and field channels

can be entrusted to local bodies and stakeholders for maintenance, provided there is proper oversight from irrigation authorities.

vi. Curbing encroachment

Resolving issues related to encroachment and adapting to evolving agricultural patterns demands further targeted interventions. Routine digital monitoring, enabled by GIS mapping, supports frequent inspection and expedites legal action against those encroaching upon canal lands. Surplus project lands may be profitably repurposed, for example, as cafeterias or community spots. For effective enforcement, it is vital that staff are sufficiently trained and equipped necessary logistics.

vii. Pollution abatement

Mitigating pollution calls for joint efforts spearheaded by local bodies, NGOs, and irrigation authorities. Surveillance cameras and small-scale waste treatment units can be installed to monitor and treat hazardous waste, ensuring pollution sources are identified and punished according to relevant legal frameworks. Public engagement and awareness incentives should accompany these technological and regulatory measures to cultivate shared stewardship of canal resources.

viii. Prioritization of works

Work prioritization should favor sequences beginning from dams or barrages through to the canal tail, with primary attention given to main canals, leak repairs, and systemic desilting. The use of machinery for both earthwork and broad vegetation clearance can substantially increase the efficiency of routine maintenance, while selective lining should be reserved for stretches demonstrating maximum seepage.

ix. Irrigation calendar

The creation, maintenance, and dynamic updating of crop-water calendars is a crucial action. These calendars, in coordination with the agricultural department, form the foundation for improved irrigation scheduling. With climate variability in mind, such planning ensures that releases are both regular and responsive, and communication with farmers can occur through SMS alerts and local notifications, increasing trust and system reliability.

x. Promotion of efficient irrigation methods

Improving canal efficiency not only supports traditional irrigation but also permits high-yield, water-efficient garden crops to flourish during dry periods and supports community-based drip or sprinkler irrigation. Increasing canal capacity likewise benefits non-agricultural needs, including drinking and industrial supplies.

xi. Automation of canal operation

The irrigation requirement assessment and canal operations are being done manually which are prone to human error and inaccuracy due to absence of real-time field data. Automated canal operation uses technologies like ultrasonic Doppler sensors, microcontrollers, and IoT-enabled gates to monitor water levels and adjust flows based on real-time needs. This helps to improve efficiency, reduce water wastage, and ensure equitable water distribution even for tail-end users. As a first step, the automated canal operation could be implemented in a branch canal system as a pilot project.

4.1 Convergence with other departments

Since water is a universal resource, it is better managed collectively. It is essential to ensure coordination among the following departments to achieve the objectives of the vision and proposed action points.

Watershed management: Local Self Governments and Soil and Water Conservation departments are carrying out works related to watershed management. So, the works related to silt load management in canals need to be planned in close coordination with these departments.

Crop calendar: Agriculture department advises the farmers about cropping pattern and selection of seeds. Crop calendar preparation exercise has to be done in association with the Agriculture Department and beneficiary farmers.

5. Automation of Dam Shutter Operation

Dam structure and its water impounded reservoir are two crucial elements of any irrigation project. Rules and guidelines for operation and maintenance are available for all major and medium dams across the country. But most of these rules and guidelines are formed during the inception and construction stages of these projects, and are at least half century old. Rainfall pattern and downstream river profile have undergone drastic changes during this period. Moreover, the flood plains are utilized for residential, industrial, commercial and tourism purposes. The climate change induced extreme weather conditions, heavy rain and long drought spells, and the constraints on the river course through which the flood discharge from dam flows stresses the necessity of revision of old operational rules of major and medium dams. Very high intensity rainfalls cause sudden, unprecedented, and in most cases unexpected surge of dam water levels. When such extreme rainfall occurs towards the withdrawal phase of monsoon the reservoir levels will be 80% full and consequently leads to heavy spillway discharge to ensure safety of dam structure. The response time, for dam managers as well as the downstream dwellers, will be very minimum and causes flood damage.

One of the practicable ways to address this challenge is to automate the dam shutter operation clubbed with accurate inflow prediction system. Opening of dam shutters could

be decided based on present storage in the reservoir, predicted inflow, downstream river conditions and stage of monsoon. It is also important to ensure that the project its intended benefits during the summer season. So, the reservoir operation during flood season should be optimal such that required storage to cater the need of beneficiaries is available at the end of monsoon season. The automated system will be able to predict inflow, suggest shutter operation timings and required discharge, and ensure communication among all stakeholders including downstream dam managers and district administration.

As first step, a pilot project will be rolled out in one of the dams under irrigation department.

6. Actionable points

Sl. No.	Action point	Approx. cost (in lNR Cr.)
1	Baseline evaluation of existing irrigation projects and setting operational standards	60.00
2	Establishment of water flow monitoring system in canals	25.00
3	Lining of unlined canals where the leakages affect system performance and affect water distribution efficiency	900.00
4	Leak proofing of lined canals using modern and cost-effective materials	500.00
5	Slope stabilisation near canals and watershed management works to prevent accelerated soil erosion	200.00
6	Preparation of crop calendar	-
7	Technology assisted monitoring of canal flow	25.00
8	Formation of ward level monitoring groups to discourage the practice of waste dumping in canals	-
9	Behavioural change campaigns to sensitise people about impacts of indiscriminate waste dumping, and project beneficiaries about importance of water use efficiency	20.00
10	Surveying and fixing boundaries of land of irrigation projects	10.00
11	Pilot project on automation of a branch canal operation	5.00
12	Pilot project on automation of dam shutter operation	4.00
	TOTAL	**1749 Cr.**

7. Measurable parameters

1. Length of canal where lining/leak proofing/improvement works are carried out

2. Number of shutters/cross regulators repaired/replaced

3. Number of cross drainage works revived/maintained/made functional

4. Number of water flow measurement points established in canals

5. Extent of watershed treatment done in free catchment near canals

6. Area newly brought under micro irrigation

7. Number of projects for which irrigation calendar is prepared

8. Number of Water User Associations (WUAs) formed

8. Time frame of implementation

Expected time of completion: 5 years (2026-2031)

Overview

Minor and micro irrigation systems constitute the **foundation of Kerala's agricultural water security**. In a State where terrain, rainfall, and landholding patterns limit the spread of large canal networks, these decentralised systems — lift irrigation schemes, check dams, rubber dams, vented cross bars (VCBs), ponds, thodus, tanks, and on-farm micro-distribution networks — ensure that water reaches the last field and supports multiple livelihoods.

Minor irrigation has quietly delivered some of the most enduring public benefits in Kerala's rural sector: stabilising cropping patterns, improving groundwater tables, and cushioning small farmers from rainfall variability. They have low gestation, modest investment, and quick results — attributes that make them ideal for Kerala's fragmented agrarian geography.

Under **Vision 2031**, the Water Resources Department will consolidate and modernise this network into an integrated, digitally supported and community-driven water delivery system that complements major irrigation projects and expands the reach of assured irrigation across the State. The strategy emphasises five dimensions: **rehabilitation of existing assets**, **creation of new storage and lift systems**, **energy sustainability**, **digital and scientific management**, and **community partnership**.

Simultaneously, micro irrigation — through drip, sprinkler, and subsurface systems — will be scaled up as the **core on-farm water efficiency mechanism**, ensuring that every drop diverted through minor irrigation systems translates into maximum productivity at the field level.

Context and Current Scenario

Minor irrigation in Kerala is a diverse and evolving sector encompassing surface water and groundwater schemes implemented through both Government and local self-government agencies. The Department presently maintains about 30,000 minor irrigation schemes, including check dams, weirs, vented cross bars, and lift irrigation systems, distributed across the State's 44 river basins.

The **6th Minor Irrigation Census** conducted by the Government of India indicates that Kerala has an *Irrigation Potential Created (IPC)* of about 1.82 lakh ha and *Irrigation Potential Utilised (IPU)* of 1.39 lakh ha under minor irrigation schemes, reflecting the need for sustained modernisation, rejuvenation, and new creation.

Minor irrigation contributes significantly to this achievement, particularly through the construction of small storage structures across streams, the renovation of traditional ponds, and lift irrigation systems that draw water from rivers and canals to irrigate upland areas. These schemes also play a critical role in **groundwater recharge**, **drinking water support**, **fisheries**, and **ecosystem enhancement**.

Kerala's **undulating topography** makes such localised systems more efficient than large reservoirs in many regions. However, changing rainfall patterns, encroachment on drainage channels, and ageing of structures necessitate a shift towards integrated management using modern technologies, renewable energy, and participatory governance models.

Development Strategy for 2026–2031

1. Integrated Minor Irrigation Development

The Vision strategy for minor irrigation revolves around **restoration, modernisation, and creation** of small-scale hydraulic infrastructure that together increase water storage and enhance groundwater recharge.

The Department will pursue a **basin-wise, conjunctive approach** where surface and groundwater structures are developed as a single network. Priorities include:

● **Systematic rehabilitation of existing lift irrigation schemes** with energy-efficient pumping systems, durable pipelines, and modernisation of pump houses.

● **Construction and strengthening of check dams, rubber dams, and vented cross bars (VCBs)** across minor rivers and streams to intercept surface runoff, enhance storage and recharge, and stabilise agriculture in the adjoining ayacuts.

● **Rejuvenation of traditional ponds, tanks, and thodus**, which form the ecological backbone of village water management.
● **Integration of small surface structures with groundwater recharge shafts** to arrest declining aquifer trends in the midland and coastal belts
● **Solarisation of power supply** to lift irrigation systems to reduce energy expenditure and ensure dependable operation.
● **Use of remote-sensing and GIS** for planning, prioritisation, and monitoring of works to optimise resource use.

These measures together will strengthen local hydrological resilience, provide stable irrigation for small and marginal farmers, and support allied rural livelihoods such as fish farming and floriculture.

2. Lift Irrigation Modernisation and Expansion

Lift Irrigation (LI) schemes are among the most effective and flexible means of providing assured irrigation in areas where gravity flow is unfeasible. Many of Kerala's existing schemes were commissioned more than two decades ago and now require structural, mechanical, and electrical upgradation.

Under Vision 2031, WRD will:

- undertake a **comprehensive digital inventory** of all schemes;
- prioritise those with the highest command potential for modernisation;
- replace obsolete pumps with **high-efficiency, energy-rated units**;
- adopt **solar and hybrid power** systems wherever technically suitable; and
- expand canal networks to fully utilise the command area originally designed.

These interventions will close the IPC–IPU gap, reduce downtime, and make LI operations climate-resilient and financially sustainable.

3. Check Dams, Rubber Dams and Vented Cross Bars

Small storage and regulatory structures are vital to Kerala's hydrological balance. Check dams and vented cross bars store monsoon flows, recharge aquifers, and provide perennial base flows in streams. Rubber dams, particularly in tidal and estuarine stretches, act as barriers against saline intrusion and enable dry-season irrigation.

Future structures will adopt **modular, eco-friendly designs** with features such as:

- sediment sluices for easy desilting,
- fish passages to preserve biodiversity,
- integrated flood passage arrangements to mitigate local flooding.

Priority will be given to locations identified through LiDAR mapping and watershed analyses to maximise recharge potential and farm benefits. Construction materials and techniques will focus on durability and ease of maintenance, with local communities involved in periodic upkeep through convergence with MGNREGS.

4. Pond, Tank and Thodu Rejuvenation

Traditional ponds and small tanks have been central to Kerala's rural water management for centuries. Their revival is critical for maintaining local water balance and supporting micro-irrigation and domestic uses. The Department will implement a comprehensive rejuvenation programme including:

- desilting and embankment strengthening,
- repair of inlets and outlets,
- treatment of catchment areas with vegetative barriers, and
- introduction of integrated pond-fish-agriculture systems.

Restored ponds will also serve as **climate buffers** by improving humidity, moderating temperature extremes, and sustaining biodiversity in rural landscapes. Panchayats, Kudumbashree groups and Water User Associations (WUAs) will be entrusted with maintenance and monitoring, ensuring local stewardship.

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5. Micro Irrigation and On-Farm Water Management

Micro irrigation — including drip, sprinkler, and subsurface systems — is the most effective technology for **on-farm water use efficiency**. It enables precise delivery of water and nutrients, minimises evaporation and runoff, and improves crop quality and yield.

Under Vision 2031, the Department will facilitate expansion of micro irrigation in all districts through:

- **Micro Irrigation Clusters** integrating farmers, technology providers, and WUAs into collective implementation units.
- **Financial convergence** with PMKSY and RKVY, with targeted subsidies and low-interest credit for community systems.
- **Technology infusion**, including IoT-based soil-moisture sensors, weather stations, and automated controllers for precision irrigation.
- **Capacity building** for departmental staff and farmers to ensure effective operation and maintenance.
- **PPP arrangements** for integrated micro irrigation in high-value crop clusters and greenhouse complexes, with private participation in design, finance and management.

The micro irrigation programme will also include pilot demonstrations of subsurface drip systems for plantation crops and fertigation units for vegetable and horticultural belts, generating replicable models across districts.

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6. Source Augmentation for Micro Irrigation

Identifying and utilizing diverse water sources for micro-irrigation in Kerala requires an integrated understanding of the State's hydrology, geography, and resource distribution. Major sources such as rivers, ponds, springs, canals, groundwater, and existing lift irrigation schemes shall be systematically mapped and evaluated using satellite imagery, field surveys, and hydrological studies. Each source — from Kerala's 44 river basins to more than 51,000 ponds and 236 identified springs[2] — is assessed for yield, recharge potential, and seasonal variation. Infrastructure improvements like check dams, pond rejuvenation, canal lining, and spring protection are key measures to enhance water availability and ensure reliable supply for micro-irrigation systems such as drip and sprinklers.

Complementary and non-conventional sources, including small natural drains, reservoirs, rainwater harvesting structures, and treated greywater, play a crucial role in bridging local water gaps and promoting sustainable irrigation practices. By combining traditional water bodies with modern conservation and reuse techniques, Kerala can achieve efficient, decentralized, and climate-adaptive irrigation that supports both productivity and long-term water security. The Department will therefore implement a **source augmentation programme** to connect existing sources with distribution tanks and conveyance pipelines feeding micro irrigation units.

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7. Institutional Strengthening, Community Participation and Capacity Development

The long-term sustainability of minor and micro irrigation depends on the strength of local institutions. Vision 2031 emphasises **Participatory Irrigation Management (PIM)** through active involvement of WUAs and panchayats in operation, maintenance and monitoring.

Capacity development programmes will train engineers, technicians, and community representatives in modern irrigation technologies, water accounting, and financial management. Regular workshops will be organised with agricultural officers, local governments, and academic institutions for coordinated water planning.

Community awareness campaigns will promote responsible water use, maintenance of local assets, and gender-inclusive participation in decision making. Kudumbashree groups will be key partners in maintaining local ponds and thodus and in mobilising households for collective water conservation.

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[2] 1st Water Body Census (2024), Ministry of Jal Shakti, Govt. of India

Expected Outcomes by 2031

Strengthening of minor irrigation schemes and popularising micro irrigation programme will result in a resilient and energy-efficient irrigation landscape that complements major irrigation networks and directly benefits Kerala's farming communities. The anticipated outcomes include:

● comprehensive modernisation of lift irrigation systems with reliable, low-energy operation;
● significant increase in local water storage and groundwater recharge through construction and renovation of check dams, weirs and VCBs;
● ecological restoration of traditional ponds and thodus, improving the micro-climate and biodiversity of rural areas;
● large-scale adoption of drip and sprinkler irrigation, enhancing on-farm water productivity and crop returns;
● improved equity and inclusion through targeted support for small, marginal, women and tribal farmers;
● establishment of digital databases and telemetry systems for monitoring performance and efficiency; and
● creation of sustainable community institutions managing water assets with accountability and transparency.

Together, these outcomes will stabilise cropping in rain-shadow and upland regions, reduce pressure on groundwater, and enhance the resilience of Kerala's agrarian economy against climate variability.

Infrastructure & Financial Outlay (2026–2031)

Component	Indicative Description	Estimated Cost (₹ crore)
Minor Irrigation Works – Check Dams, Rubber Dams, VCBs	Construction of 130 new structures and strengthening of existing ones for storage, recharge and salinity control	475
Lift Irrigation Modernisation & Solarisation	Rehabilitation, mechanical upgradation, and renewable energy integration for existing and new LI schemes	375

Pond, Tank & Thodu Restoration	Comprehensive rejuvenation of traditional water bodies and drainage channels	**200**
Micro Irrigation Expansion	Implementation of at least two micro irrigation projects in each district and associated precision irrigation technologies	**100**
Source Augmentation & Distribution Support	Conveyance networks, balancing tanks and pumping systems to feed micro irrigation units	**100**
Capacity Building, IEC & Digital Integration	Training, and WUA strengthening	**5**
Total Estimated Outlay (2026–2031)		**1,265 crore**

Monitoring and Evaluation Framework

Monitoring will be undertaken through a **multi-tiered mechanism** involving the Chief Engineer (I&A), and field divisions Key performance indicators will include:.

- annual area benefitted under minor irrigation schemes
- area brought under micro irrigation,
- groundwater recharge and surface storage created,
- savings in energy consumption per hectare of irrigation,
- functional status of rehabilitated assets, and
- satisfaction and participation levels of beneficiary farmers.

Digital dashboards will provide real-time progress visualisation, and independent technical audits will be carried out biennially to ensure quality and transparency.

HARITHAKERALAM MISSION

1. Overview

The Haritha Keralam Mission is a core initiative launched by the state government on December 8, 2016 , under the Nava Keralam Karma Padhathi, aiming for the comprehensive development of the state. Its vision is encapsulated in its unique motto: Water, Hygiene, and Harvest, focusing on promoting cleanliness, water security, water abundance, and safe food production. From the financial year 2021-22, the Harithakeralam Mission is brought under Nava KeralamKarmapadhathi - II.The mission comprises three sub-missions: Water Conservation, Sanitation and Waste Management, and Agriculture. The Mission's Water Conservation component (JalaSamrudhi), for which the Irrigation Department has been entrusted responsibility, aligns with Integrated Water Resources Management (IWRM) principles through its approach:This approach integrates all stakeholders in the water sector and implements various schemes/projects scientifically and in a participatory manner. Recognizing the watershed/river basin as the natural unit for sustainable water resource management, the strategy focuses on small watersheds and follows a ridge-to-valley approach.As part of this approach, Neeruravu Master Plans have been prepared in 1013 Local Self-Government Institutions.These plans involve protecting and restoring existing water sources, ensuring groundwater recharge, and restoring the storage capacity of water bodies. The mission operates as a coordination support system, linking various departments and agencies with Local Self-Government Bodies (LSGIs), which practically lead the activities on the ground.

2. Statement of Purpose

- Protect and restore existing water sources (rivers, canals, ponds, dams).
- Restore the storage capacity of water bodies by removing silt, sediment, and other pollutants.
- Ensure groundwater recharge and stability of water flow by constructing check dams/vented cross bars in major tributaries (canals/streams).
- Increase ayacut to support expansion of agriculture

3. Need for Action

- Ensure safe and clean water for drinking and water for irrigation purposes.
- Store water received during the rainy season to ensure stability of water availability.
- Achieve food security by planning paths based on agriculture and water conservation.
- Understand the water deficit through Water Budgeting and undertake strategic interventions to deal with drought and floods.

4. Expected Benefits

- The construction of irrigation structures will increase ayacut area, the groundwater level, stabilize water flow and help in conservation of water bodies

- Restoring the storage capacity of irrigation structures like dams and barrages will ensure water availability.
- Water-related problems will be identified, and strategic interventions will be implemented to overcome them.
- Implementing micro-irrigation projects across the state

5. Implementing Strategy

- Engineers from the Irrigation Department serve as Convenors for technical committees formed at the district level. They conduct technical scrutiny of the projects outlined in the Neeruravu Master Plan.
- Prioritized activities include the conservation, protection, restoration, capacity augmentation of water sources as well as construction of irrigation structures to achieve the said objectives
- Project execution is coordinated among the Irrigation Department, Local Self-Government Institutions, and the Mahatma Gandhi National Rural Employment Guarantee Scheme (MGNREGA).
- Improvements to Irrigation facilities at Padashekharam

6.Infrastructure/Financial requirement.

- Under the Haritha Keralam Mission, a total of 164.2 crore has been allocated in the annual budgets from the financial year 2021-22 to 2025 under various heads namely *Minor Irrigation Class I-Harithakeralam, Minor Irrigation Class II-Harithakeralam, and the Renovation of Tanks and Ponds*
- To meet the goal of conservation,protection, restoration and management of water sources the funding needed for the period from 2026-27 to 2030-31 is **₹200.00 Crores**

FLOOD MANAGEMENT

FLOOD MANAGEMENT

Kerala's geographical position, nestled between the Arabian Sea on the west and the Western Ghats on the east, coupled with a tropical monsoon climate, makes Kerala highly susceptible to floods. With 44 rivers crisscrossing the state, the risk of riverine flooding is high during intense monsoon rains. The State's geography of short, steep-gradient rivers, narrow floodplains, and dense urbanization presents unique challenges in flood management.

Floods, being the most prevalent climate induced disaster worldwide, building resilience to it requires an even more urgent attention since there is a lot of uncertainty about its impacts. The conventional approach to flood management based on the assumption that climate is more or less stationary, is fizzling out. The best way to deal with the uncertainty of climate induced floods is to master the art of developing sustainable measures and flood defense that can evolve over time, to prepare for a wide range of plausible outcomes. Changing rainfall patterns—marked by extreme short-duration events—and coastal vulnerabilities caused by sea-level rise demand a new, integrated flood management paradigm.

While it is impossible to fully eliminate flood risk, actions can be taken to minimize its impact. A proactive river basin-wide approach, which is a 'whole systems' view to manage water resources and minimize flood risk, recognizes and balances all inter sectoral linkages in a given basin. The Irrigation Department envisions a holistic approach through the Living Water Network concept—an interconnected system of rivers, thodus, wetlands, backwaters, and the sea functioning as one continuous, resilient hydrological system for flood moderation and ecological stability.

River Protection and Desiltation

Statement of purpose

Restore and Manage the rivers of Kerala and the drainage channels to ensure continuous flow and flood moderation through scientific, ecofriendly and participatory measures

Need for action

- High intensity rainfall over short durations causes flash floods and rapid siltation.
- Due to repeated floods accompanied with land slides, riverbeds are rising due to debris/sediment loads
- Urban encroachments and unplanned sand mining reduce carrying capacity.
- Sustainable debris management is essential for river health and flood control

Expected benefits

- Enhanced river carrying capacity
- Reduction in local flooding in selected river systems.
- Reuse of the dredged material annually.

Implementation Strategy

- River–thodu–wetland connectivity restoration in 15 major basins
- Building or strengthening levees and embankments along rivers to physically contain floodwaters and prevent them from overflowing into surrounding areas.
- Clearing silt and debris from riverbeds to increase their capacity to hold water.
- Sediment reuse: Utilize dredged material for embankments, landfills, and eco-bricks.
- GIS mapping of sediment hotspots and annual desilting cycles.
- implementing strict regulations on building in flood-prone areas and encouraging flood-resilient construction techniques.

Infrastructure and Resource requirements

Component	Target description	Estimated Cost(In Crores)
River Rejuvenation and Connectivity	15 Basins	100
Embankment protection	30 Km	125

Monitoring Indicators

- River sections restored
- Debris removal volume per year
- Flood Damage reduction

COASTAL PROTECTION

1. Introduction

Kerala's 600 km-long coastline, home to densely populated settlements and critical infrastructure, is increasingly threatened by sea-level rise, high-energy wave attack, storm surges, and coastal erosion. The combination of natural processes and anthropogenic pressures—such as unregulated development, sand mining, and reduced sediment supply—has led to severe shoreline retreat and saline intrusion in several coastal stretches.

A sustainable and climate-resilient approach to coastal protection is therefore vital to safeguard communities, ecosystems, and economic assets. The strategy must adopt a "catchment-to-coast" perspective, linking river basin management, sediment dynamics, and shoreline stabilization to achieve long-term coastal resilience.

The Mission Directorate – Programme Management Unit (PMU) under the Water Resources Department has been constituted to plan, manage, and expedite the implementation of externally funded coastal protection works across nine coastal districts. The Directorate will serve as the nodal agency for fast-tracking projects supported by multilateral financing agencies and will ensure alignment with the Climate Change Guidelines for Coastal Protection and Management in India.

2. Statement of Purpose

Adopt a comprehensive and climate-resilient coastal protection strategy that integrates hard-engineered structures, hybrid interventions, and nature-based solutions to protect Kerala's vulnerable shoreline from erosion, saline intrusion, and tidal flooding while promoting sustainable coastal livelihoods and ecosystem balance.

3. Need for Action

- Over 40% of the coast is critically eroding, with loss of land, roads, and habitations.
- Sea-level rise and storm surges exacerbate tidal flooding and saline intrusion.
- High-value infrastructure, including highways, ports, housing and fisheries facilities, are at risk.
- Nature-based and soft interventions are needed in moderate-risk zones to enhance ecological resilience.
- Integrated coastal protection will ensure community safety, livelihood security, and long-term shoreline stability.

4. Expected Benefits

- Protection of nearly 90 km of coastal stretches from erosion and flooding.
- Protection of 90 km of coastal roads, including National and State Highways, from erosion and flooding.
- Prevention of land loss and displacement in over 33 coastal villages.

- Enhancement of nearshore fishing and tourism activities through stabilized beaches.
- Promotion of blue economy opportunities in sustainable coastal infrastructure.
- Reduction in salinity intrusion and flooding frequency in low-lying areas.
- Boost in local employment through construction and maintenance of coastal works.

5. Implementation Strategy

o Planning and Prioritization: Utilize the Shoreline Management Plan (SMP) to prioritize critical erosion stretches.

o Engineering and Nature-Based Interventions: Construct or reinforce sea walls, groynes, and revetments in high-risk stretches, deploy hybrid and soft measures.

o Technology and Monitoring: Establish a Coastal Monitoring GIS Portal under CEFS for real-time mapping of shoreline change and erosion.

o Institutional Strengthening: Strengthen the Mission Directorate for Coastal Management to coordinate SMP-based planning and monitoring.

o Capacity Development: Conduct training programs for engineers and promote academic partnerships for technical support.

6. Infrastructure and Financial Requirements

Component	Description	Estimated Cost (₹ Crores)
Coastal Protection Measures (Hard, Soft & Hybrid)	90 km of prioritized protection works including sea walls, groynes, and nature-based buffers	2913 (2163+750)
Coastal Monitoring and Maintenance	Continuous monitoring and upkeep across the 600 km coastal stretch	30
Total Estimated Investment		2943

7. Institutional and Governance Framework

The Mission Directorate will serve as the state-level coordinating body for all the multilaterally funded coastal protection initiatives. It will oversee implementation of SMP-based investments, DPR approvals, and funding convergence with agencies such as ADB, and World Bank. A Technical Advisory Group will guide planning, design and monitoring, comprising experts and scientists from national research/academic institutes.

8. Vision Statement (2031)

By 2031, Kerala shall establish a resilient and sustainable coastal protection framework that integrates engineering excellence with ecosystem restoration to safeguard lives, livelihoods, and infrastructure from coastal hazards.

9. Strategic Objectives

- ✓ To protect 90 km of high-risk coastline using engineered and hybrid measures.
- ✓ To develop a centralized coastal monitoring and decision-support system.
- ✓ To mainstream climate resilience and nature-based solutions in all coastal protection works.
- ✓ To enhance institutional coordination and community participation in coastal resilience programs.

10. Measurable parameters

Parameter	Target (by 2031)
Length of protected coastline	90 km
Establishment of Coastal Monitoring GIS Portal	By 2027
Number of coastal villages protected	>30
Increase in beach tourism & fishing livelihood activities	25% growth

11. Outcomes and long-term benefits

• Infrastructure Expansion: Completion of hard, soft, and hybrid coastal protection systems.
• Ecosystem Restoration: Rehabilitation of mangroves, dunes, and intertidal buffers.
• Technology Integration: Operational GIS-based monitoring and early warning systems.
• Institutional Strengthening: Empowered CEFS unit for coastal data collection and management
• Community Resilience: Participatory management and livelihood enhancement.

Long-term benefits

• Enhanced resilience against coastal erosion, flooding, and saline intrusion.
• Secured infrastructure and protection of livelihoods in vulnerable coastal regions.
• Strengthened institutional framework for adaptive shoreline management.
• Increased investment confidence in coastal infrastructure and tourism sectors.
• Balanced co-existence of human and ecological systems along Kerala's coast.

12. Financial Summary

The total estimated investment for implementing the Coastal Protection Vision 2031 is ₹2943 Crores, comprising ₹2913 Crores for coastal protection works and ₹30 Crores for coastal monitoring and maintenance. Funding will be sourced from state plan allocations, multilateral assistance (ADB, World Bank), and convergence with national programs such as the Blue Economy Mission and Climate Resilient Infrastructure Program.

SPECIAL FOCUS ON KUTTANAD

Kuttanad, known as the "Paddy Bowl of Kerala", is an area in Kerala where paddy cultivation is carried out at a depth of about 0.5 m to 2.5 m above sea level. Approximately 57% of the Kuttanad area is spread over 72 panchayats and 6 municipalities in Alappuzha district, 22 panchayats and 3 municipalities in Kottayam district and 5 panchayats in Pathanamthitta district. The Kuttanad area comprises 5 major rivers of Kerala namely Pamba, Achankovil, Manimala, Meenachil and Muvattupuzha as well as the Vembanad backwaters, canal networks and paddy fields. Various infrastructure development and flood control works spread over Alappuzha and Kottayam districts are being implemented through the Kuttanad Package. Out of 1145 Padasekharams Infrastructure works of 155 Padasekharams completed in first Phase and 200 paddy fields have been implemented under the 2nd Kuttanad Package. Protection works have been partially completed in 85 paddy fields. A total of 11437 hectares of paddy fields have been benefited through this. Protection works are in progress in 133 paddy fields. 742 paddy fields for which outer bund protection works are to be implemented.

Kuttanad Package - Phase 1

In addition, tot the strengthening works of Padasekharams the opening of Kochar to facilitate water outflow, cleaning of 280 km of streams in various parts including Karipuzha stream to facilitate water outflow, Thanneermukkam Barrage, Kariyar RCB, several small regulators, replacement of shutters of Thottapalli spillway, and completion of the first reach of A.C. Canal were also completed in the first phase of the package.

Statement of purpose

The aim is to prevent flooding, strengthening the bunds and improve the infrastructure of the paddy fields. R.C.C. Pile & Slab / D.R. Masonry can be used strengthen the bunds. Renovation of motor shed, motor floor, public shed and culvert. Raising the bunds using locally available mud is also can be used. Strengthening the outer bunds Protects farmland and crops, Prevents landslides, Reduces flooding, Prevents saltwater intrusion, Increases community safety.

Need for action

During the severe floods in 2018 and 2019, the paddy fields in Kuttanad where outer bund construction was not implemented, collapsed and the agriculture was completely destroyed. Bund collapses caused flooding and crop damage. Siltation in streams disrupted water flow. Water hyacinth and other vegetation fill streams and Impairs water flow, reduces water quality, adversely affects aquatic life, and interrupts water flow. Flooding due to the reduced storage capacity of the streams and the special soil structure of Kuttanad are the reasons for the weakening of the bunds.

Implementation strategy

Proposals for the next five years:-

   In 2026-27 plan proposal, 112 no of works are proposed for an amount of 25437.20 lakhs, which will benefit 4575.28 Hectares paddy fields. In 2027-28 plan proposals, 83 no. of works are proposed for an amount of 22201.70 lakhs, which will benefit 3176.99 Hectares of paddy fields. In 2028-29 plan proposals, 62 no. of works are proposed for an amount of 14157.60 lakhs, which will benefit 2314.69 Hectares of area. In 2029-30 plan proposal 75 no. of works are proposed for an amount of 15331.22 lakhs, which will benefit 1225.436 Hectares of paddy fields. In 2030-31 plan proposal 55 no. of works are proposed for an amount of 10080 lakhs, which will benefit 1078.807 Hectares of paddy fields.

Components of flood control activities in Kuttanad region are:

- Construction of outer bunds to protect/facilitate paddy cultivation
- Desiltation of streams to improve water flow
- Removal of water hyacinth and other vegetation from streams to improve water flow, quality and protection of aquatic life.
- Improve storage capacity of streams to reduce the flooding
- Strengthening of bunds
- Renovation of motor shed, motor floor etc.

Financial components

KUTTANAD PACKAGE			
FINANCIAL YEAR	**NUMBER OF WORKS (NOS)**	**AYACUT (Ha)**	**AMOUNT IN INR CRORE**
2026-2027	112	4575.28	254.37
2027-2028	83	3176.99	222.01
2028-2029	62	2314.69	141.57
2029-2030	75	1225.436	153.36
2030-2031	55	1078.807	100.80
GRAND TOTAL	**387**	**12371.203**	**872.11**

GROUNDWATER MANAGEMENT

GROUNDWATER MANAGEMENT

I. *Groundwater Conservation and Artificial Recharge: -*

Groundwater conservation and management is very crucial in the State of Kerala because of growing population, rapid urbanisation, and changing climate are placing immense pressure on its limited and unevenly distributed groundwater resources. Groundwater serves as a **vital source for drinking, irrigation, and industrial use**, especially during dry seasons when surface water becomes scarce. Effective management helps **maintain water security, prevent overextraction and contamination, and sustain ecosystems** such as wetlands and rivers that depend on groundwater discharge. Moreover, with increasing rainfall variability and declining natural recharge, **integrated and community-based groundwater management** is essential to ensure equitable access, long-term sustainability, and resilience against droughts and climate-induced water stress.

The Department will also be given priority to establish recharge structures in Critical and Semi Critical Blocks of the State where Stage of groundwater development is higher compared to Safe blocks.

Construction of small check dams in first and second order streams and sub surface dykes, Implementation of Roof top rainwater Harvesting through Dug well recharge, Recharge pits, Recharge ponds and bore well recharge schemes, Rejuvenation of small open ponds (<10cents) are proposed for the next 5 years.

Moreover, open wells and bore wells in public buildings, aided buildings, private buildings (Domestic / Institutions /commercial / infrastructure) must be recharged to augment groundwater level of the area/ panchayath/block. *'Neer Nira'* Project for recharging bore wells on subsidy basis will be extensively implemented in households and private buildings to achieve sustainable ground water availability especially in Critical and semi critical blocks of the State to become a safe category.

Financial Year wise Target of Schemes and Proposed Required Investment: -

Financial Year	No of recharge structures proposed	Bore well recharging on subsidy basis	Proposed Required Investment in Lakhs
2026-27	100	600	600
2027-28	100	500	650
2028-29	100	500	700

2029-30	100	500	710
20230-31	100	500	720
Total	**500**	**2600**	**3380**

Hence a total of 3380 Lakhs is required for the next 5-year period.

Expected Outcomes of Groundwater Conservation Schemes: -

Effective groundwater conservation and management in Kerala can lead to several important benefits:

i. **Sustainable Groundwater Water Availability** – Ensures a reliable supply of groundwater for domestic, agricultural, and industrial needs throughout the year.
ii. **Improved Water Quality** – Reduces contamination and safeguards public health by protecting aquifers from pollution.
iii. **Enhanced Drought Resilience** – Increases the state's ability to withstand dry spells and erratic rainfall caused by climate change.
iv. **Agricultural Stability** – Supports consistent irrigation, improving crop productivity and farmers' livelihoods.
v. **Ecosystem Protection** – Maintains the flow of rivers, wetlands, and groundwater-dependent ecosystems.
vi. **Reduced Overextraction and Conflicts** – Promotes equitable water distribution and minimizes disputes over water use.
vii. **Long-Term Economic and Social Benefits** – Strengthens rural livelihoods, reduces tanker dependency, and supports sustainable development.

Functionality Auditing of the Scheme: -

Functionality auditing of groundwater recharge schemes is essential to ensure that structures operate effectively, funds are used efficiently, and recharge outcomes are sustained under changing climatic conditions. A focused five-year outlay will support systematic audits, rehabilitation, and monitoring, resulting in improved groundwater levels, enhanced water security, and long-term community and environmental benefits.

Financial Year	Required Investment @ 5 Years in Lakhs
2026-27	50
2027-28	50
2028-29	50
2029-30	50

2030-31	100
Total	**300**

A proposed required investment of 300 lakhs is required for the schemes for the next coming 5 years.

II.   Groundwater Resources Management: -

The primary objective ground water management is to **control and regulate groundwater development** in Kerala through the effective implementation of the *Kerala Groundwater (Control & Regulation) Act, 2002*. It aims to **prevent overexploitation**, **mitigate adverse environmental impacts**, and **ensure equitable access** to groundwater resources for all sections of society.

i.   **Main Activities:**

Regulatory Control:

- Implementation of the Act across all districts with special focus on Notified areas
- **Issuance of permits and NOCs** to drinking water bottling plants, industries, and other groundwater users based on scientific evaluation.

Scientific Investigations:

- Conducting **hydrogeological studies and pumping tests** before granting permits for groundwater extraction.
- Continuous **monitoring of water levels and quality** through observation wells and data collection.

Awareness and Capacity Building:

- Organizing **mass awareness programmes** on groundwater conservation, sustainable use, and water quality management.
- Target audiences include **the public, school students, government officials**, and **Local Self Government representatives**.

Conflict Resolution and Compliance:

- **Addressing complaints** related to overextraction and disputes over groundwater use.

- Ensuring compliance with groundwater regulations through inspections and corrective actions.

Regulation of Drilling Activities:

- **Registration and monitoring of drilling rigs, firms, and agencies** engaged in the construction of groundwater abstraction structures.

ii. **Proposed Targets**

- The Department will conduct 490 nos of Mass awareness programmes

- Water clubs will be constituted along with science Clubs in all the Government schools

Financial Year	Mass Awareness Programme	Constitution of Water Clubs	Expected Required Investment in Lakhs
2026-27	98 Nos	28 Schools	48
2027-28	98 Nos	30 Schools	49
2028-29	98 Nos	30 Schools	50
2029-30	98 Nos	30 Schools	51
2030-31	98 Nos	30 Schools	52
Total	**490 Nos**	**148 Schools**	**250**

iii. **Outcome**

This integrated approach improves groundwater governance in Kerala by encouraging sustainable extraction, scientific management, and community involvement to protect resources for future generations. Mass awareness programmes for students and society will highlight groundwater conservation, and water clubs will be established alongside science clubs in all government schools to promote this initiative state-wide.

III. **Establishment of the State Groundwater Programming Board (SGPB) and Programme Management Unit (PMU–GWEU)**

It focuses on strengthening the **State Ground Water Authority (SGWA)** as the statutory regulatory body and establishing the **State Groundwater Programming Board (SGPB)** as the apex coordination and policy-review platform. The SGPB will be supported by a **Programme Management Unit (PMU)**, which will also function as the **Groundwater Estimation Unit (GWEU)** responsible for continuous assessment and data harmonisation in collaboration with the **Central Ground Water Board (CGWB)**. This component aims to create an **integrated, technology-enabled, and legally empowered groundwater-governance system** that unifies regulation, data management, enforcement, and participatory oversight under a single institutional architecture.

Structure and Composition

- **Chairperson:** Principal Secretary, Water Resources Department (WRD)
- **Member Secretary:** Director, Ground Water Department (GWD)
- **Members:** Senior representatives from **Central Ground Water Board (CGWB)**, **Centre for Water Resources Development and Management (CWRDM)**, **Kerala Water Authority (KWA)**, **Kerala State Pollution Control Board (KSPCB)**, **Local Self-Government Department (LSGD)**, **Agriculture Development and Farmers' Welfare Department**, **Industries Department**, **Environment Department**, **Planning and Economic Affairs Department**, and **Soil Conservation Department**. Representatives from **non-governmental organisations (NGOs)**, **community-based organisations (CBOs)**, and **research institutions** engaged in water-resource management will also participate as permanent members.

The **SGPB Secretariat** will function from the GWD Headquarters, supported by the **PMU–GWEU** as its operational and analytical arm.

HYDROMETEOROLOGICAL DATA MANAGEMENT

HYDROMETEOROLOGICAL DATA MANAGEMENT

1. Introduction

Effective water resource planning and management in Kerala hinges on the availability of accurate, timely, and comprehensive hydrological and meteorological data. Despite Kerala's abundant rainfall and dense river network, the state continues to face recurring challenges such as floods, droughts, saline intrusion, and water scarcity during lean seasons.
These issues are often exacerbated by fragmented and inadequate data systems that fail to provide real-time insights across spatial and temporal scales.

Currently, hydrological and meteorological data are collected by multiple agencies — the Water Resources Department (WRD), Kerala State Disaster Management Authority (KSDMA), Kerala Water Authority (KWA), Indian Meteorological Department (IMD), and Central Water Commission (CWC). However, the data collection methods, standards, and dissemination systems differ widely among these institutions, leading to duplication, data gaps, and difficulties in integrated analysis.

Recognizing this challenge, the Vision 2031 framework proposes a comprehensive reform under the thematic domain "Hydrological and Meteorological Data Management." The goal is to create a modern, integrated, and technology-enabled system for real-time data collection, analysis, and dissemination that supports evidence-based planning, disaster preparedness, and sustainable water resource management.

Two key initiatives are identified under this domain:

1. Expansion and modernization of the existing rain gauge and hydrometeorological monitoring network
2. Establishment of a State Water Informatics Centre (SWIC) as the central nodal agency for water data management and analytics.

2. Expansion of Existing Rain Gauge and Monitoring Network

2.1 Statement of Purpose (What We Want to Do)

The project aims to expand, upgrade, and automate the network of rain gauge and weather monitoring stations across Kerala. This includes:

- Integration of telemetry and IoT-based sensors for real-time data transmission.
- Replacement of outdated manual gauges with digital and automated systems.
- Strengthening of existing hydrological observation networks to capture data on river discharge, groundwater levels, and evapotranspiration.

With this upgraded infrastructure, data will be transmitted automatically to centralized servers and integrated with platforms such as the State Water Informatics Centre (SWIC) and the Kerala Water Resources Information System (WRIS). This will ensure seamless access to near real-time data for multiple stakeholders, including Kerala State Disaster Management Authority (KSDMA), Agriculture Department, Groundwater Department, Local Self-Government Institutions, and research and academic institutions such as CWRDM and KSCSTE.

2.2 Need for action (Why We Want to Do It)

The need for this expansion arises from the following key factors:

- Spatial Gaps: Many localities, especially highland and midland regions, lack adequate rainfall data points, limiting the precision of regional hydrological models.
- Temporal Resolution: Manual data collection results in delays, making it unsuitable for real-time decision-making.
- Disaster Preparedness: Real-time rainfall data is crucial for accurate flood forecasting and early warning dissemination.
- Agricultural Planning: Reliable data supports irrigation scheduling, crop water budgeting, and drought management.
- Climate Variability: With changing rainfall patterns due to climate change, a denser and automated observation system is vital for long-term trend analysis.

2.3 Expected Benefits (Deliverables)

- Comprehensive Coverage: Uniform rainfall and weather data across all blocks and sub-watersheds.
- Real-Time Monitoring: Continuous data streams transmitted to a centralized cloud database.
- Improved Forecasting: Enhanced accuracy of flood, drought, and landslide forecasts through improved hydrological models.
- Research and Analysis: High-resolution datasets available for academic, scientific, and policy-oriented studies.
- Public Access**:** Processed rainfall and weather data to be made available to farmers, local bodies, and other stakeholders through online dashboards.

The enhanced data flow will greatly improve the accuracy of flood forecasting and early warning systems, enable real-time dam and reservoir management, support climate modeling and drought assessment, and assist in agricultural water planning and ecosystem management. Moreover, the availability of reliable and continuous telemetry data will strengthen inter-departmental coordination during monsoon and emergency situations, allowing better preparedness and timely response. It will also aid in the development of

decision support systems (DSS), hydrological models, and spatial data platforms, fostering a more transparent and efficient water governance framework. In essence, the Department's modernization initiative represents a paradigm shift from conventional manual data collection to a smart, automated, and integrated hydromet network. By 2031, Kerala aims to achieve a resilient, technology-driven, and collaborative approach to water resources management — one that not only serves the immediate needs of monitoring and forecasting but also underpins the state's long-term sustainability and climate adaptation goals.

2.4 Implementation Strategy (How We Will Do It)

1. Gap Assessment:
   o Conduct GIS-based mapping of existing manual, standard and climatic stations (including the 91 manual, 116 standard and 21 climatic stations).
   o Identify under-monitored zones using rainfall variability indices and stakeholder needs.
2. Technology Deployment:
   o Resolve contractual issues that have rendered the ARG/AWS/AWLR telemetry network non-operational, and restore supplier/telemetry services for the 97 ARGs, 13 AWSs and 46 AWLRs installed under NHP.
   o Roll out additional ARG and AWS units (targeted deployments in data-scarce and climatically sensitive areas) equipped with GSM/GPRS or satellite telemetry, solar power units, data-loggers and protective enclosures.
3. Data Integration:
   o Link all data streams to the centralized data management system managed by SWIC (State Water Informatics Centre) and integrate with existing platforms such as Kerala WRIS. Implement automated data quality checks, calibration protocols and near-real-time validation pipelines.
   o Ensure APIs and data feeds are available to KSDMA, IMD, CWC and other stakeholder systems for rapid situational awareness and DSS ingestion.
4. Pilot & Partnership Projects
   o Scale successful basin pilots: the functioning ARG/RLS stations in Periyar and Chalakudy will be used as demonstration sites for operational procedures and model assimilation.
   o Implement the agreed project with ICFOSS (International Centre for Free and Open-Source Software) to install eight RLS stations, two ARG stations and one AWS station (agreement executed; installation to commence as planned). These decentralized, open-stack installations will inform standards and integration approaches for the wider network.
5. Capacity Building:

- Train departmental and regional staff in operation, telemetry troubleshooting, calibration and maintenance.
- Establish routine calibration schedules and field maintenance facilities, and define SLA-driven contracts for telemetry uptime and data continuity.
6. Collaboration:
- Coordinate with IMD, CWC, and KSDMA for standardization and data sharing.

2.5 Phasing & Timeline

- Short term: restore NHP telemetry and bring non-operational ARG/AWS/AWLR assets back online.
- Medium term: deploy ~300 additional ARG/AWS units in priority locations (as envisaged in the infrastructure plan).
- Long term: progressively convert manual stations to automated telemetry-enabled stations to achieve the telemetry-enabled network vision by 2031.

2.5 Infrastructure and Financial Requirements

The expansion and modernisation will leverage existing investments while budgeting for additional deployments, telemetry infrastructure, and recurring O&M. Key elements include:

- Procurement and installation of new ARG and AWS units (approx. 300 units targeted in data-scarce zones), RLS installations where required, communication modems, solar power and protective enclosures.
- Centralized data receiving and validation server(s) with integration to SWIC and WRIS, plus backup, cybersecurity and API layers for partner access.
- Field calibration and maintenance facilities at regional centres and staff capacity building.
- Support for pilot projects and partner-led installations (for example the ICFOSS-supported installs).

Estimated investment and recurring costs in the broader Hydrological and Meteorological Data Management initiative are as outlined in the financial section of this document. An amount of Rs 14 crore is estimate for the expansion, automation and ensure telemetry resilience.

3. Establishment of State Water Informatics Centre (SWIC)

3.1 Objective

To establish the State Water Informatics Centre (SWIC) as Kerala's single, authoritative nodal organisation for coordinating, validating, hosting and disseminating water-resources

data, providing decision-support products, and functioning as a 24-hour Emergency Operations Centre for extreme water events. SWIC will operate with technical guidance from the National Water Informatics Centre (NWIC) and will integrate state systems (Kerala WRIS, FFEWS, RTDAS, IROS) alongside relevant national applications (India-WRIS, WIMS, IWCIMS, RTDMS).

3.2 Statement of Purpose (What We Want to Do)

SWIC will:

- Act as the single authoritative repository for validated water datasets (rainfall, river flows, reservoir status, groundwater, water quality and related infrastructure).
- Host a robust API and data-service layer enabling programmatic access for state agencies, national systems and authorised research partners.
- Provide operational decision-support products (dashboards, nowcasts, short-lead forecasts, reservoir trade-off tools, flood scenario and damage estimation modules).
- Function as a staffed 24/7 Emergency Operations Cell during monsoon and extreme events, with on-call rosters and clear escalation procedures.
- Maintain an interoperable technology stack to support modelling, analytics, data QC, metadata management and public dashboards.
- House a state-of-the-art data repository, GIS-based analytics unit, data visualization dashboards, and hydrological modelling systems.

3.3 Need for action (Why We Want to Do It)

A dedicated State Water Informatics Centre (SWIC) is essential because Kerala currently faces structural, technical and institutional gaps that limit timely, reliable and actionable water-sector decision-making. Establishing SWIC addresses those gaps and enables data-driven, coordinated responses to routine water management and extreme events. Key reasons are:

- **Fragmented data landscape:** Water data today are scattered across departments, platforms and formats (telemetry, manual records, WRIS instances, local agency systems). SWIC will create a single validated repository and standardized API layer to eliminate duplication, reduce inconsistencies and ensure a single source of truth.
- **Need for real-time operational capability:** Floods and dam/reservoir operations require near-real-time situational awareness (RTDAS, ARG/AWLR/RLS feeds). SWIC will ingest, QC and visualise telemetry continuously and operate as a 24/7 Emergency Operations Cell during high-risk periods.
- **Improved forecasting and early warning:** Centralised, high-quality data plus operational modelling and ensemble workflows will materially improve nowcasts,

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short-lead forecasts and early-warning accuracy — reducing response time and false alarms.

- **Integrated water management:** Reservoir operation trade-offs, flood mitigation, irrigation scheduling and groundwater management require coordinated, multi-domain datasets and decision tools. SWIC will host and link modelling outputs to decision support modules used by Water Resources, KSDMA, Agriculture and Local Governments.
- **Model governance and reproducibility:** Without a model registry, performance monitoring and retraining pipelines, operational models degrade or become irreproducible. SWIC will formalise model governance (versioning, KPI monitoring, ensemble selection) to ensure reliable operational use.
- **Data quality and trust:** Automated QC, bias correction and metadata standards will raise confidence in data products for policy makers, emergency managers and researchers.
- **Interoperability with national systems:** SWIC acting under NWIC guidance will ensure Kerala's datasets and APIs integrate seamlessly with India-WRIS, WIMS, RTDMS and other national platforms — improving resource allocation and enabling access to central support/tools.
- **Capacity building and institutional continuity:** SWIC provides a staffed institutional home for technical expertise (data engineering, modelling, groundwater analytics), reducing dependence on ad-hoc external consultants and ensuring continuity across monsoon cycles.
- **Operational efficiency and cost savings:** Centralised hosting, standard APIs and in-house analytic capability reduce duplication of effort, streamline procurement/AMCs (e.g., Kerala WRIS maintenance) and optimise O&M costs over time.
- **Support for research, planning and public service:** A validated, well-documented data catalogue and controlled APIs will empower academia, civil society and local governments to build tools and advisories — improving resilience at community scale.
- **Legal and governance clarity:** Formal institutionalisation (GO, budget head, Centre Head) provides the mandate and accountability required for cross-departmental data sharing, SLAs for telemetry uptime, and rapid escalation during crises.
- **Climate adaptation and long-term resilience:** High-frequency, quality-assured datasets and mature forecasting pipelines are prerequisites for evidence-based climate adaptation planning, drought monitoring and sectoral risk assessments through 2031 and beyond.

Together, these drivers make SWIC not just a technical upgrade but a strategic necessity to transform Kerala's water governance — turning raw observations into timely, trusted and actionable information for operations, policy and resilience.

3.4 Expected Benefits (Deliverables)

Deliverables and benefits from the scaled and modernized network include:

- **Comprehensive Coverage:** Uniform rainfall and weather data across all blocks and sub-watersheds.
- **Real-Time Monitoring:** Continuous data streams transmitted to a centralized cloud database once telemetry is re-established.
- **Improved Forecasting & Early Warning:** Enhanced accuracy of flood, drought and landslide forecasts through improved hydrological models and near-real-time observations.
- **Operational Water Management:** Better real-time inputs for reservoir/dam operation and river regulation.
- **Research, Planning & Public Access:** High-resolution datasets available for academic research, policy analysis and farmer/local-body advisory dashboards.
- **Inter-departmental Coordination:** Seamless data sharing (WRD/IMD/CWC/KSDMA/KWA/LSGIs) enabling coordinated responses during monsoon and emergency situations.

The availability of reliable telemetry data will also support development of decision support systems (DSS), hydrological and hydraulic models, and spatial platforms used by stakeholders such as KSDMA, Agriculture and Groundwater Departments, Local Self-Government Institutions, and research bodies (e.g., CWRDM, KSCSTE).

3.5 Implementation Strategy (How We Will Do It)

Phase I – Planning and Design (2025-2026):

- Form a core technical team and finalize institutional structure.
- Develop standard operating procedures for data sharing.
- Design the IT architecture and data integration protocols.

Phase II – Establishment (2026-2028):

- Set up the SWIC headquarters with server infrastructure, high-speed connectivity, and data backup systems.
- Develop a State Water Data Portal and data visualization platform.
- Integrate rainfall, flow, groundwater, and reservoir data.

Phase III – Integration and Analytics (2028-2030):

- Incorporate real-time telemetry and satellite-based inputs.
- Develop hydrological and hydraulic models for prediction and forecasting.

- Train personnel in data analytics, GIS, and AI tools.

Phase IV – Expansion and Public Interface (2030-2031):

- Launch citizen-centric dashboards and mobile applications.
- Facilitate data exchange with universities, research institutions, and national data centres (WRIS, NRSC).
- Implement AI-based water demand and flood forecasting systems.

3.6 Infrastructure and Financial Requirements

The proposed **State Water Informatics Centre (SWIC)** will be established as the core data and analytics hub of the state's water information network. The Centre will be equipped with high-performance servers, cloud storage systems, GIS and modelling laboratories, data visualization dashboards, and cybersecurity-enabled backup facilities. It will host integrated databases containing rainfall, river discharge, groundwater, reservoir, and water quality information obtained from multiple agencies. The infrastructure will include advanced IT systems for data assimilation, hydrological modelling tools, AI-based forecasting applications, and a public-facing water data portal. SWIC will be staffed by a multidisciplinary team comprising hydrologists, GIS analysts, data scientists, and IT engineers. The estimated investment and recurring costs are expected to amount to approximately ₹10 crore. The expenditure is proposed to be met from the next phase of the NHP (w-AMRITAM), which is anticipated to commence in 2026.

3.7. Institutional and Governance Framework

- The State Water Informatics Centre will function under the Water Resources Department.

- It will collaborate with IMD, CWC, CGWB, KSDMA, KWA, and KSEB for data sharing and validation.
- A Technical Advisory Committee comprising representatives from these agencies and academic experts will guide standards and methodologies.
- The SWIC will also support capacity building and digital literacy for departmental staff and local bodies.
- SWIC is planned to comprise three operational wings:
  - **Data Engineering Wing** — responsible for ingestion, telemetry integration, automated quality control, metadata, storage and API management.
  - **Modelling & Operations Wing** — responsible for running and maintaining hydrological/hydraulic models, ensemble forecasting, operational nowcasting and situational dashboards.
  - **Groundwater Wing** — jointly staffed with Groundwater Department (GWD) personnel to manage groundwater monitoring, data assimilation and aquifer

analytics. Once fully operational, GWD will share Monthly groundwater level observations, Biannual water quality assessments, High-frequency groundwater level and quality data, Well Census data, and Well construction completion records to SWIC platform enabling public access to scientific data.

- The nominated physical location is at the fifth floor of Jalavijnana Bhavan, Ambalamukku, Thiruvananthapuram. Building renovation for the Centre has been completed to receive incoming staff; however, a formal Government Order (GO) sanctioning institutionalisation, staffing and a dedicated budget head remains to be issued. Issuance of the GO is the immediate institutional priority.

4. Kerala Water Resources Information System (Kerala WRIS)

4.1 Objective

To develop and operate a resilient, secure and analytics-enabled Kerala Water Resources Information System (Kerala WRIS) that serves as the state's single authoritative digital repository for water-sector data, supports operational decision-making, enables downstream applications via APIs, and is managed in-house under the custodianship of the State Water Informatics Centre (SWIC).

4.2 Statement of Purpose (What We Want to Do)

- Maintain and evolve Kerala WRIS as a continuously updated MIS + GIS platform combining telemetry, manual observations, remote sensing and third-party datasets.
- Transition the current third-party-hosted system into a modern, modular, API-first in-house platform to reduce recurring AMC dependence and give the Department direct control over feature development, maintenance and costs.
- Provide machine-readable access (APIs/CSV) and role-based permissions to authorised departments and partners, while offering public-facing dashboards and mobile data-capture for field officers.
- Embed automated data-quality controls, anomaly detection, and AI/ML capabilities for gap-filling, inflow estimation, nowcasting and self-learning model improvements.
- Integrate WRIS tightly with SWIC's operational workflows so modelling outputs, alerts and telemetry feed directly into emergency response and routine water-management decisions.

(Background: Kerala WRIS was developed by the Irrigation Design & Research Board (IDRB) under the Rebuild Kerala Initiative (RKI) and officially launched on 31.08.2022. The application is currently hosted in the Kerala State Data Centre (SDC) and has been used by agencies such as KSDMA for flood management.)

4.3 Need for Action (Why We Want to Do It)

- **High recurring vendor costs:** Since the system was started (2020) through a third-party agency the Government bears a substantial recurring annual outlay under an Annual Maintenance Contract (AMC). Transitioning to an in-house platform will reduce long-term O&M spend and vendor dependence.
- **Operational control & agility:** Direct custodianship allows faster feature releases, tighter integration with SWIC and priority implementation of state-specific analytics (e.g., reservoir optimisation, water-budgeting).
- **Advanced analytics requirement:** Modern water management requires automated inflow calculation, gap filling, anomaly detection and ML-assisted nowcasting — capabilities easier to iterate on and operationalise when the platform is managed internally.
- **Interoperability & data governance:** An in-house, API-first WRIS will provide consistent metadata, role-based access and clear SOPs for data ownership/frequency — prerequisites for integration with SWIC and national systems.
- **Field usability & resiliency:** A resilient mobile app with offline data capture and improved ingestion pipelines will increase data quality and timeliness from field officers and regional offices.
- **Security & compliance:** Institutional control enables routine CERT-In compliant audits, stronger security posture and enforceable SLAs for uptime and data continuity.
- **Future proofing to 2031:** Building in-house capability now positions the Department to scale analytics, reduce vendor lock-in and capitalise on evolving AI/ML methods through 2031 and beyond.

4.4 Expected Benefits (Deliverables)

- A modular, API-first Kerala WRIS hosted under departmental custodianship (SWIC) with public and authorised private access layers.
- Automated ingestion and QC of RTDAS, ARG/AWLR/RLS, IMD, CWC, KSEBL and satellite feeds.
- AI/ML modules for: automatic river inflow estimation, time-series interpolation/gap-reconstruction, anomaly detection and self-learning forecasting components.

- Decision support tools: water-budgeting, reservoir optimisation modules, flood scenario generation, configurable alerts and emergency dashboards (used by KSDMA and other agencies).
- Mobile data-capture application with offline support and sync capabilities for field staff.
- Reduced recurring AMC costs over time, clearer data governance (SOPs, metadata standards) and regular security audits.
- Strengthened integration with SWIC so WRIS feeds model runs, ensemble outputs and operational dashboards used in 24/7 EOC workflows.

4.5 Implementation Strategy (How We Will Do It)

Assessment & Planning

- Audit the current WRIS codebase, data model, hosting arrangement (SDC), AMC terms and recurring costs.
- Produce a functional requirements document, prioritising operational needs from SWIC, KSDMA, Reservoir Ops, Groundwater and Agriculture.

Architectural Design

- Adopt a modular microservices architecture with an API gateway, metadata catalog, data lake for raw telemetry, and an analytics layer for models and ML pipelines.
- Ensure role-based access control, audit trails and support for machine-readable exports (CSV/JSON/APIs).

Development & Migration

- Phase 1: Build core ingestion, QC and API layers; provide parity with current WRIS features; launch internal pilot.
- Phase 2: Migrate datasets and modules from third-party system to the in-house platform; implement mobile app and analytics modules.
- Phase 3: Deploy AI/ML modules (inflow estimation, gap-filling, anomaly detection) and integrate with SWIC operational workflows.

Integration & Interoperability

- Implement robust APIs to consume and provide data to SWIC, India-WRIS, KSDMA and other authorised systems.
- Automate scheduled exports and real-time streams for priority telemetry and model inputs.

Security, Governance & Operations

- Institute CERT-In compliant security audits, backup/DR in SDC, and SLA-driven AMCs for critical infrastructure.
- Prepare SOPs for data ownership, update frequency, metadata standards and user-access policies; designate SWIC as platform custodian.

Capacity Building

- Train departmental developers and administrators to operate and evolve WRIS in-house; transition vendor knowledge during migration.

4.6 Infrastructure and Financial Requirements

- **One-time development & migration:** design, development, testing, mobile app, analytics modules, and data migration.
- **Hosting & operations:** SDC hosting, backups, monitoring, security audits and SLAs.
- **Capacity building:** staff recruitment/training and knowledge transfer from existing vendor.
- **Expected budget envelope:** The Department estimates **Rs. 5 crores** for establishing the in-house WRIS (development, migration and initial year O&M). This should be complemented by a modest recurring budget for staff, cloud/hosting fees and security audits thereafter. The Rs. 5 crores estimate will be refined during the detailed project report and procurement planning.

4.7 Roadmap to 2031 (Phasing & Milestones)

Immediate term (0–12 months)

- Audit existing WRIS, AMC and hosting; finalise functional requirements and GO for custodianship under SWIC.
- Begin core API and ingestion module development; pilot mobile app for field data capture.
- Initiate knowledge transfer with current vendor and secure temporary SLAs to avoid service disruption during migration.

Medium term (1–3 years)

- Complete migration of core datasets and modules to the in-house platform hosted in SDC.
- Deploy automated QC, inflow calculation modules and basic ML gap-filling algorithms.
- Operationalise role-based APIs for departmental access and integrate with SWIC dashboards and EOC workflows.

Long term (3–5 years to 2031)

- Mature AI/ML forecasting, anomaly detection and self-learning models with automated retraining.
- Realise sustained reductions in recurring AMC expenditures through internal maintenance and capacity building.
- Operate Kerala WRIS as a resilient, secure and fully integrated platform feeding SWIC and national systems, supporting operational decision making across Kerala by 2031.

4.8 Governance, Security & Sustainability

- **Custodianship:** Institutionalise SWIC as WRIS custodian with a clear mandate, budget head and staffing for platform operations.
- **Security & compliance:** Schedule periodic CERT-In compliant audits, vulnerability assessments and a documented incident response plan.
- **SLA & AMCs:** Where external support is required (e.g., specialised modules), use SLA-driven AMCs with clear uptime, maintenance and knowledge-transfer clauses.
- **Sustainability:** Invest in staff training and phased vendor disengagement to internalise capability, thereby lowering O&M costs and ensuring long-term platform evolution.

5. Flood Forecasting and Early Warning System (FFEWS)

5.1 Objective

To scale the Periyar–Chalakkudy pilot FFEWS into a statewide, operational Flood Forecasting and Early Warning System that delivers reliable, timely, and actionable flood forecasts, inundation maps, decision-support tools and automated alerts to enable coordinated preparedness and response across Kerala by 2031.

5.2 Statement of Purpose (What We Want to Do)

- Transform the technical and institutional foundations established under the Periyar/Chalakkudy FFEWS pilot (GIS-based FEWS platform, web portal, mobile app, source-code handover and training) into a continuous, production-grade service covering every river basin in Kerala.
- Deliver phased basin rollouts that include basin-specific model calibration, RTDAS augmentation, telemetry integration and local stakeholder onboarding.
- Adopt a hybrid–ensemble modelling architecture that couples physics-based hydrological/hydrodynamic simulations with data-driven ML/DL members to produce skillful, uncertainty-quantified ensemble forecasts.

- Implement a resilient, automated ingestion pipeline for telemetry and third-party feeds, automated QC/gap-filling/anomaly-detection, API-first dissemination and role-based access for state/district/sectoral users.
- Harden the mobile app and web portal for operational use (offline capture, push alerts, crowd-sourced reporting, operator workflows and geotagged validation).
- Institutionalise operations through a dedicated custodian unit (State FEWS/Operations Cell within the Department or SWIC), clear SOPs, training, and mandatory handover of code, documentation and playbooks to ensure long-term sustainability.

5.3 Need for Action (Why We Want to Do It)

- The Periyar/Chalakkudy pilot proved the technical viability of real-time forecasting, reservoir optimisation and online inundation mapping, but basin-by-basin hydrology, telemetry coverage and stakeholder integration vary across the State — requiring a structured scale-up.
- Real-time automated forecasts and inundation products reduce response times, minimise false alarms, and improve coordination among KSDMA, district administrations, KSEBL and emergency services.
- Hybrid ensemble approaches (mathematical + ML) improve short-lead performance and provide quantified uncertainty—critical for operational decision-making under non-linear and changing climatic conditions.
- Operational resilience (automated RTDAS ingestion, failover, QA pipelines) and API-first dissemination are prerequisites to ensure downstream systems and agencies can consume alerts without manual intervention.
- Institutionalisation and capacity building are needed so routine operations, first-level support and model governance are handled in-house, lowering long-term AMC dependence and improving responsiveness during crises.

5.4 Expected Benefits (Deliverables)

- Statewide FEWS platform with basin-level production forecasting, ensemble uncertainty metrics and automated inundation delineation for multiple return periods.
- Operational web portal and hardened mobile app with offline capture, push alerts, crowd-sourced validation, and operator workflows for release/gate logging.
- Automated RTDAS ingestion, QC, gap-filling, anomaly detection and resilient failover mechanisms ensuring continuous operations.
- API-first outputs (REST/JSON/CSV) and role-based access enabling authorised agencies to integrate forecasts and triggers directly into their operational chains.
- Decision-support modules for integrated reservoir operation, scenario planning, damage estimation and district-level alerting thresholds.

- Institutional handover: source code, documentation, playbooks and trained in-house teams supported by a designated FEWS custodian unit.
- Measurable improvement in forecasting KPIs (lead time, hit-rate, false alarm ratio) and routine post-event assessment practices for continuous improvement.

5.5 Implementation Strategy (How We Will Do It)

Phased Basin Rollout

- Prepare a basin-prioritisation matrix (risk, population, critical infrastructure, telemetry gaps).
- For each phase: perform basin-specific model calibration/validation, augment RTDAS (ARG/AWLR/RLS), deploy telemetry hardware where gaps exist, and integrate local stakeholders (district EOCs, KSEBL, LSGIs).

Hybrid–Ensemble Modelling

- Retain and operationalise physics-based hydrological and hydrodynamic models for process fidelity.
- Develop ML/DL components targeted at short-lead nowcasting, interpolation of sparse observations, time-series reconstruction and complex non-linear behaviours (e.g., cascade dam interactions).
- Combine multiple model families into ensembles; implement automated model performance monitoring, retraining pipelines and a model registry for reproducible operational selection.

Operational Resilience & Automation

- Build automated RTDAS ingestion with real-time QC, gap-filling and anomaly detection; implement redundancy and failover for communication and compute.
- Adopt CI/CD pipelines for secure deployments, staging/production separation, and scheduled security audits (SDC-compatible hosting).
- Provide machine-readable API outputs and standardized alert formats for downstream consumption.

Decision-Support & Dissemination

- Enhance web dashboards for basin-level decision views, ensemble uncertainty visualisation, and configurable alert workflows mapped to district/state thresholds.
- Produce automated inundation delineations and damage scenario outputs for multiple return periods and hydrological scenarios.
- Harden mobile app: offline capture, push alerts to officers and public, geotagged crowd-sourcing for validation, and operator log workflows for gate/release records.

Institutionalisation & Capacity Building

- Establish a State FEWS/Operations Cell (custodian unit) within the Department or SWIC to run day-to-day operations, model runs and stakeholder liaison.
- Formalise SOPs for data ownership, update frequency, model deployment, and inter-agency data-sharing.
- Deliver staged training (hands-on, tabletop exercises, remote refreshers) and embed operational playbooks into the custodian unit.

Sustainability & Vendor Strategy

- Move core platform development, governance and routine operations in-house; retain specialist vendors under time-bound contracts for complex hydrodynamic tuning, high-performance computing needs and bespoke studies.
- Use modular architecture and COTS components where appropriate to minimise lifecycle costs and permit incremental upgrades.

5.6 Infrastructure and Financial Requirements

- Telemetry augmentation (ARG/AWLR/RLS), solar power and communication modems for RTDAS expansion.
- Compute and hosting resources compatible with SDC (staging + production), CI/CD pipelines, and backup/DR arrangements.
- Development costs for model integration (physics + ML), API development, web portal and hardened mobile app.
- Capacity building, documentation, and initial O&M costs for the custodian unit.
- Contingency for high-performance model tuning or outsourcing of niche technical tasks.
- **Expected budget envelope: Rs. 30 crores**, covering phased state-wide scale-up, telemetry augmentation, software development, initial operations and capacity-building through the critical rollout phases. This estimate will be refined in the DPR and procurement planning.

5.7 Roadmap to 2031 (Phasing & Milestones)

Immediate term (0–12 months)

- Consolidate pilot handover artifacts (source code, documentation, training).
- Establish State FEWS/Operations Cell, define SOPs and priority basins for Phase 1.
- Start telemetry gap assessment and implement critical RTDAS upgrades in priority reaches.

Medium term (1–3 years)

- Conduct phased basin rollouts with calibrated models, automated telemetry ingestion and portal/app upgrades.
- Deploy hybrid-ensemble forecasting for operational use and integrate API feeds with KSDMA, district EOCs and KSEBL.
- Institutionalise routine model performance monitoring, retraining pipelines and post-event assessment workflows.

Long term (3–5 years to 2031)

- Achieve continuous FEWS coverage across all basins with mature ensemble operations, resilient automation and established in-house operational capability.
- Realise measurable KPI improvements (lead times, hit rates) and operate FEWS as an integrated component of Kerala's 24/7 Emergency Operations architecture by 2031.

5.8 Governance, Monitoring & Performance Management

- **Model Governance:** Maintain a model registry, automated skill dashboards, retraining schedules and version control for reproducibility.
- **Performance KPIs:** Track forecast lead time, hit-rate, false alarm ratio, model latency and ensemble reliability; conduct regular post-event reviews and stakeholder feedback loops.
- **Audit & Security:** Host in SDC with secure CI/CD, periodic security audits and a documented incident response plan.
- **Sustainability:** Balance in-house operations with targeted vendor support under clear SLAs; plan for progressive vendor disengagement as internal capability matures.

6. GROUNDWATER MONITORING INITIATIVE

To implement groundwater management in the State more efficiently and scientifically, 160 additional monitoring wells will be constructed to fill the gap area. This initiative will help address issues such as saltwater intrusion into coastal aquifers, drinking water scarcity in industrial zones, and water quality deterioration in areas surrounding waste disposal sites.

To obtain high frequency data (four times a day) groundwater level data, telemetry-enabled automatic water level recorders will be installed in 700 selected monitoring wells. In regions vulnerable to groundwater pollution, automatic water quality sensors will also be deployed in selected wells and industrial belts. The high-frequency data thus collected will be effectively utilized in disaster management and climate change adaptation activities. This data will also aid in predicting drought conditions, assessing and mitigating the extent of groundwater contamination during floods, and improving overall water resource resilience in the coming years.

a. Physical Targets for 2026–31

The Department is installing additional monitoring wells for the next five years period.

Financial Year	New Monitoring wells	Monitoring wells with Digital Water Level Recorder	Monitoring wells with Water Quality probes	Monitoring wells to be fitted with digital telemetry
2026–27	40	200	25	100
2027–28	40	200	25	100
2028–29	40	100	50	150
2029–30	40	100	50	150
2030–31		100	100	200
Total (2026–31)	**160**	**700**	**250**	**700**

b. Proposed Required Investment:-

The required investment for the 2026–31 period is projected as Rs. 1120 lakhs

Fiscal Year	Estimated required investment (₹ Lakhs)	Beneficiaries (Nos.)
2026–27	240	This data will aid in predicting drought conditions, assessing and mitigating the extent of groundwater contamination, managing risk assessment, and improving overall precise groundwater resource management in the coming years.
2027–28	240	
2028–29	220	
2029–30	220	
2030–31	200	
Total (2026–31)	**1120 Lakhs**	

B. Mapping of Groundwater Abstraction structures (Well Census)

The Groundwater Department has initiated the Well Census Project to collect comprehensive data on all groundwater structures in the State. This is the first project of its kind in India exclusively focused on wells. The data collection is being carried out through the "Neerarivu" mobile application, developed with the support of KSREC, and implemented through the Kudumbasree Mission. The project has been launched in 563 panchayats across 93 blocks, with data collection fully completed in 331 panchayats and partially completed in 232 panchayats. So far, data for 2.1 million wells has been collected. The project is expected to be completed in the coming years by covering entire wells in the state. This will help to reach Kerala the first state to achieve the well census in India

The resulting database will facilitate scientific water budgeting, assist in formulating water-related policies, address future water challenges, and support research and planning in the water resources sector.

A. Physical Targets for 2026–31

The Department is installing additional monitoring wells for the next five years period.

Financial Year	Number of Blocks	Number of Panchayath	Number of Municipalities and Corporation	Number of Wards
2026–27	41	249	25	5900
2027–28	50	272	25	5900
2028–29	31	232	20	5906
2029–30	30	188	20	5906
2030–31				
Total (2026–31)	152	941	93	23612

B. Proposed Required Investment

The Required Investment for the 2026–31 period is projected as Rs. 2500 lakhs

Fiscal Year	Required Investment (₹ Lakhs)	Beneficiaries (Nos.)
2026–27	700	This data will provide a permanent data base for precise and accurate water budgeting system. The data is multifaceted and can be used for various scientific planning and scientific water conservation and management in the state
2027–28	700	
2028–29	500	
2029–30	600	
2030–31		
Total (2026–31)	2500 Lakhs	

POLLUTION ABATEMENT

POLLUTION ABATEMENT

1. Overview

The state government is actively engaged in comprehensive pollution abatement efforts across its major water bodies. A study by the Central Pollution Control Board (CPCB) initially identified 21 heavily polluted river stretches in Kerala, classifying them into Priority I to V based on the level of pollution (Biological Oxygen Demand - BOD). As per the Order of the NGT, action plan for the mitigation of Pollution in all the 21 stretches was prepared and submitted to CPCB to appraise the Hon'ble NGT. Due to concerted efforts by various departments, the situation has shown improvement.

- As per CPCB report on water quality 2022, 11 polluted river stretches (Mogral, Kuppam, Peruvarnba, Ramapuram, Kavvayi, Bharathapuzha, Bhavani, Kutiyadi, Kecheri, Karuvannur, and Puzhakkal) have been removed from the CPCB's polluted list due to improved water quality and 8 new stretches were added and hence the number of polluted river stretches is currently 18. Due to the timely interventions no rivers in the state are now in Priority I

2. Statement of Purpose

- Execute the Action Plan to ensure the water quality in the polluted river stretches is suitable for at least bathing purposes.

- Preventing the direct dumping of waste into water sources, especially from bridges, by installing protective barriers.

- Implement works to protect and rejuvenate ponds, small water bodies, and drainage channels to enhance water conservation and increase storage capacity.

- To amend the prevailing laws and rules so as to prevent pollution of waterbodies

3. Need for Action

- To mitigate health risks associated with heavily polluted water bodies and ensures good quality water to the public.

- To revive the health of Kerala's water ecosystems, which are currently suffering from high pollution loads

- To strictly enforce anti-pollution laws to prevent future contamination and instill civic responsibility among the public.

4. Expected Benefits

- The list of polluted river stretches has been updated with 8 new reaches in Priority IV and V namely Neyyar (IV), Vamanapuram (IV), Ayroor (V), Mamom (V), Chalakudy (V), Kalpathipuzha (V), Korayar (V), and Pullur (V)..Concerted efforts will be taken to clean up these river stretches and remove them from the polluted list.

- Increased water storage capacity in tanks, ponds, and small water bodies by removing silt, sediment, and clearing flow channels.

- To combat pollution in the Periyar River as mandated by the National Green Tribunal (NGT), the Department has taken the initiative to prepare a proposal for the construction of a Dyke Wall and Surveillance Road near the Pathalam Regulator-

cum-Bridge (RCB) and the Edayar Industrial Area in Ernakulam District. This essential project involves building a 1.20 km long, deep curtain wall along the right river bank, upstream of the Pathalam RCB, specifically designed to completely block all industrial effluents and chemical discharges

5. Implementing Strategy

- Removing silt and sediment from ponds and small water bodies.

- Removing silt, sediment, and sand accumulation near existing check dams/regulators in rivers and large streams to restore storage capacity.

- Carrying out side protection where necessary in streams.

- Construction of wire fences along bridge railings over rivers to prevent direct waste dumping

- Stored water from upstream check dams/regulators is strategically released during periods of acute pollution to dilute the pollutants in the river water.

- The Irrigation Department actively enforces the Kerala Irrigation and Water Conservation (Amendment) Act of 2018. Department officials are mandated to file criminal complaints with the concerned police stations against individuals found dumping waste into water sources. The police then conduct further investigations into the complaint and file cases in the First Class Magistrate Court.

- This amended Act enhances penalties, prescribing a punishment of up to three years imprisonment and a maximum fine of Rs. 2 Lakh upon conviction. The Department periodically initiates punitive action against offenders.

- Increased public participation and civic consciousness are essential for the long-term conservation and protection of water bodies

6.Infrastructure/Financial requirement

The Irrigation Department has made significant progress in restoring polluted river stretches across the state, adhering to the NGT mandate.

- The cumulative financial allocation for these specific restoration works over the three years (2022-2025) is approximately **₹6.00 Crores** (₹600.00 Lakhs).

- **2025-26** The Financial Sanction (FS) for the regular pollution abatement works in rivers an amount of **₹200.00 Lakhs (₹2.00 Crores)** is required upcoming fiscal year

- **For the implementation of the Dyke wall and surveillance road** at the upstream of the Pathalam RCB, specifically designed to completely block all industrial effluents and chemical discharges**, an amount of** 20 Crores id required for the upcoming Fiscal year

- **Total Requirement (2026-31):** A total of **₹30.00 Crores** is required for sustained river pollution abatement and restoration activities for the five-year period beyond 2026.

Vision:

Vision is to provide 100% sewer network with at least one STP in all the Municipal Corporations and one STP with minimum network/FSTP in Municipalities. It is also planned to provide tertiary treatment units in all the STPs functioning under KWA for the reuse of effluent from STPs.

Present Scenario: At present only Thiruvananthapuram and Kochi Corporations and Guruvayur Municipality have STPs and Sewer Networks. Number of sewer connections provided is 66,121 and the population benefitted is 8,45,000.

Implementation Programme:

Projects are proposed to be implemented by availing fund from sources like AMRUT, KIIFB, NRCD, SBM 2, UIDF, RKI, Urban Agglomeration, Deposit works etc. At present Administrative Sanction has been received under AMRUT 2.0 for Rs 625.79 Crores, UIDF 157.5 Crores, KIIFB/NRCD Rs 1386.68 Crores, RKI- Rs 63.9 Crores and Urban agglomeration 15 Crores. Action is being taken to implement these projects.

Financial Requirement:

For the full coverage of the six Municipal Corporations –Thiruvananthapuram, Kollam, Kochi, Thrissur, Kozhikkode and Kannur, amount proposed is Rs 6503 Crores. Sewage generated in 87 municipalities as per projected population upto 2050 is 854.8 MLD. It is proposed to construct atleast one STP with sewer network in the 87 municipalities and the cost comes to around Rs 19540 Crores required. If there is shortage of fund/land available for ULB for the construction of STPs, the projects to be replaced by FSTP projects.

Benefits/Advantages:

All cities and towns in Kerala become totally clean, sanitized, healthy, liveable, ensuring and sustaining good public health and environmental outcomes for all citizens, with a special focus on hygienic and affordable sanitation for the urban poor and women. The water bodies will be protected and pollution free thereby developing a healthy environment and creating a good atmosphere for all the living beings.

Measurable Deliverables:

Number of Sewer Connections that will be provided so as to ensure complete coverage and reduce pollution of water bodies.

Time Required for the Implementation:

The vision can be achieved by 2031 subject to the availability of funds and land.

Grey Water Treatment and Management Initiative by KRWSA

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The absence of proper wastewater collection, treatment, and disposal systems has emerged as a major challenge to public health in the State. Contamination of water sources and the proliferation of water-borne vectors are recognized as significant contributors to morbidity and mortality. Addressing this growing concern requires an integrated and sustainable approach to wastewater treatment, management and reuse. To establish a sustainable and community-responsive grey water management system that safeguards public health, enhances water security, and supports the States transition towards a circular water economy. To develop, implement, and scale up decentralized grey water collection, treatment, and reuse systems particularly in vulnerable colonies, institutions, hospitals, markets, and other identified hotspots and individual households by ensuring effective resource recovery and environmental sustainability.

Strategic Objectives
- **Public Health Protection:** Reduce risks of water-borne diseases by preventing contamination of drinking water sources.
- **Water Conservation:** Promote the reuse of treated grey water for gardening, landscaping, and other non-domestic purposes.
- **Community Empowerment:** Engage local communities and beneficiary groups in operation and maintenance of decentralized systems.
- **Financial Sustainability:** Reduce expenditure on fresh water procurement and wastewater disposal, contributing to long-term cost savings.
- **Environmental Management:** Enhance ecosystem health through responsible waste water management and reduced groundwater depletion.

Implementation Focus
- Identification of **priority areas** such as colonies of vulnerable groups, institutional campuses, hospitals, and public markets.
- Establishment of **decentralized treatment units** tailored to local conditions and water use patterns.
- Promotion of **reuse applications** including irrigation of green spaces, cleaning, and other non-potable purposes.
- Capacity building for **community-led maintenance and monitoring** of the systems.
- Integration with broader **State water management and sanitation programs**.

Expected Outcomes
- Improved public health through reduction in water-borne diseases.
- Increased availability of fresh water for essential domestic needs.
- Enhanced environmental resilience through efficient water recycling.
- Strengthened institutional and community capacity for sustainable water

management.

- Measurable contribution to the State's sustainable development and water economy goals.

By 2031 through this programme, KRWSA is proposed to install 250 Grey Water Management and Treatment Systems across the state with an overall budget allocation 37.50 Cr.

GROUNDWATER POLLUTION AND WATER QUALITY MONITORING

Untreated or improperly treated wastewater from industrial sites contain pollutants that are released directly into the environment and groundwater. Presently the drinking water quality is being monitored for limited parameters, but there are some serious challenges to human health due to pollution caused by industries and irrigation activities. As Monitoring of the drinking water quality with respect to industrial and irrigation pollutants are necessary. The drinking water quality testing laboratory in Kerala shall be modernized to test all micro-contaminants with ICP MS, GC MSMS, LCMSMS, FTIR, electron microscope, ion chromatograph, spectrophotometers, PCR machine etc. These laboratories are to be collaborated with research institutions having such facilities for validating the results and for further research. To develop cost effective technologies to *in-situ* elimination of persistent organic pollutants microbial and microplastic pollution are also necessary.

The presence of these following parameters needs to be identified and remedial action should be taken

1. **Heavy metals** like lead, mercury, cadmium, and chromium, arsenic, copper, zinc etc,
2. **Petroleum products :** Gasoline and other fuel components from leaking underground storage tanks
3. **Volatile organic compounds** (VOCs) from sources such as chemical manufacturing, mining, and waste disposal.
4. Industrial-related substances like solvents, paints, and chemicals leached from plastics.
5. **Leachate from waste disposal sites:** Hazardous substances that leach from industrial waste, such as dioxins and other micropollutants.

Action plan:

1. Identification and monitoring of the drinking water pollutants.

2. Mapping the intensity of pollution based on the toxicity of the pollutants.

3. Assessment of drinking water suitability asper BIS standard is10500:2017.

4. Monitoring the quality of drainage water from STP to environment.

5. Improve the infrastructure facilities of water testing laboratories to test all physical, chemical and micro-biological contaminants.

6. Acquire NABL (ISO/IEC 17025 :2017) for every testing parameters.

Manpower requirement: Each lab should have well trained and experienced lab staff such as, Chemist, Junior Chemist, Chemical Assistant, Lab attendant, Microbiologist, Lab Assistants.

Financial requirement: Since most of the modern sophisticated instruments are costly, state level laboratories may develop for handling microcontaminants and establish one microbiology lab for every district to handle this issue in future.

In such case each Regional Laboratories requires about **1000 Lakhs** to procure, install, manpower and maintenance of the equipment to tackle agricultural & industrial pollution in water sources.

Financial Year	Required Investment @ 5 Years in Lakhs
2026-27	200
2027-28	200
2028-29	200
2029-30	200
2030-31	200
Total	**1000**

CLIMATE CHANGE AND DISASTER MANAGEMENT

CLIMATE CHANGE AND DISASTER MANAGEMENT

Climate change is significantly impacting Kerala's water sector through increased temperature, extreme rainfall events, and changes in precipitation patterns, leading to both floods and water scarcity. This results in challenges like decreased groundwater levels, salt water intrusion, and complex reservoir operations, necessitating a focus on water conservation, improved water management strategies, and climate-resilient infrastructure.

Among the natural disasters, flood is the most frequent one. The State's geography of short, steep-gradient rivers, narrow floodplains, and dense urbanization presents unique challenges in flood management. While the high intensity rainfalls of short duration cause sudden surge of dam levels and carries huge silt load to canals, long drought spells create stress on water resources. The progress of a society is determined by the way it manages water and its disaster potential. Kerala has witnessed extreme flood events in 2018 and 2019. It is important to ensure that we, collectively as a society, take measures to mitigate disaster and reduce its impacts.

Irrigation department has steadfastly addressed the challenges posed by unexpected extreme weather events. All major and medium dams under the department have regularly updated operation & maintenance manual to ensure robustness and consistency in dam operations. Further, all dams are equipped to deal with any emergency situation and the emergency steps are well documented and circulated to all stakeholders through Emergency Action Plan. Provisions of the Dam Safety Act, 2021 are complied with in all dams in the State. During monsoon season, service of technical personnel from the department, under the supervision of an Assistant Executive Engineer, is provided at District Emergency Operation Centre (DEOC).

State Specific Action Plan

The State Specific Action Plan (SSAP) for the water sector represents Kerala's long-term strategic framework for integrated water resources management in the context of climate change. Conceived under Goal 5 of the National Water Mission (NWM), the SSAP

provides a definitive roadmap for ensuring that every future initiative, investment, and policy decision affecting the state's water sector up to 2031 and beyond will be grounded in scientific evidence, climate resilience, and sustainability principles. It serves as both a technical reference and a policy blueprint to guide the transformation of Kerala's water governance structure into a forward-looking, data-driven, and adaptive system. The final report of SSAP is expected to be completed by December 2025.

The SSAP includes scientific assessments, hydrological analyses, climate projections, and institutional reviews to formulate a set of specific, implementable actions tailored to Kerala's water resource conditions. It acts as the foundation for future project formulation, providing line departments with clear, evidence-based strategies that can be directly translated into field-level interventions. These include basin-specific water conservation and storage projects, climate-resilient irrigation modernization, rejuvenation of traditional water bodies, groundwater recharge enhancement, and development of urban flood management systems.

Beyond being a project compendium, the SSAP functions as a policy guide for integrated governance. It promotes convergence among agencies responsible for irrigation, groundwater, drinking water, energy, environment, and disaster management, fostering cross-sectoral coordination and accountability. The plan envisions continuous alignment with the State Action Plan on Climate Change (SAPCC), ensuring that adaptation and mitigation strategies in the water sector respond to Kerala's region-specific vulnerabilities, such as rainfall variability, changing temperature patterns, salinity intrusion, and increasing flood and drought frequency. Institutional arrangements defined in the SSAP ensure that agencies operate within a shared governance framework, with clear roles for planning, implementation, data sharing, and monitoring.

Going forward, the implementation of the SSAP up to 2031 will form the backbone of Kerala's water sector development. All new programmes—ranging from infrastructure creation to digital water management systems—will be anchored in the recommendations of the SSAP Final Report. It will serve as the guiding framework for initiatives like the next-generation Kerala Water Resources Information System (K-WRIS), the establishment of the State Water Informatics Centre (SWIC), basin-level master planning, and the expansion of flood early-

warning systems and drought-resilience measures. The SSAP also lays the foundation for the Kerala Water Vision 2031, promoting sustainable water budgeting, efficient allocation, and equitable distribution across basins and sectors.

In the coming years, SSAP-driven development will emphasize technological integration, predictive analytics, and automation. Future systems envisioned under its framework will incorporate artificial intelligence and machine-learning tools for forecasting river inflows, detecting anomalies in hydrological data, interpolating missing datasets, and modelling climate impacts on water demand and supply. These digital innovations will enhance the accuracy of decision-making and facilitate proactive management of water crises.

Ultimately, the SSAP establishes the strategic direction for Kerala's water sector up to 2031, ensuring that all future planning, investment, and policy frameworks are harmonized under a single, climate-resilient, and sustainability-oriented vision. It transforms the water sector from a reactive, fragmented system into a unified, adaptive framework capable of meeting the challenges of a changing climate while safeguarding the state's water security, ecological balance, and long-term resilience.

DAM TOURISM

DAM TOURISM

Dams in our State are blessed with lush greenery and scenic surroundings which make them ideal spots for tourism. However, they are not utilised to the fullest extent to tap the tourism potential. Many tourism destinations under the Water Resources Department have been successful as consistent income generating channels even with limited tourism facilities. Considering the above scenario, Government has formulated a policy intended to make maximum effort for tapping the tourism prospects of dams and other irrigation sites under Water Resources Department by establishing a unique brand of Irrigation Tourism through Public-Private Partnership investment and by utilizing the logistics and infrastructure available with the Irrigation Department without creating any additional expense to the Government. The agency will invest and implement the Irrigation Tourism project in the vacant land under the ownership of Water Resources Department, which excludes catchment area, dam structure, operational areas, office buildings etc. The agency will provide a revenue share to the Government and the revenue received will be utilized for the upkeep and repair of the dams and canal system.

Guidelines were issued by the Government for the implementation of Irrigation Tourism projects vide G.O. (Ms) No. 53/2023/WRD dated 19.09.2023. Local Self Government Organizations / Institutions or Other Government Organizations / Institutions or Private Organizations / Institutions or Individuals or Societies can become the part of the Irrigation Tourism projects. The first analysis of the Irrigation Tourism proposals is done by the Nodal Officer (Executive Engineer, Irrigation Department) and the same will be submitted to the Government along with the opinion of the Chief Executive Officer, Kerala Irrigation Infrastructure Development Corporation Ltd. the nodal agency for Irrigation Tourism projects.

Proposals having advanced and innovative tourism components that are not currently found in the local area or its vicinity will be implement through PPP model. This initiative will have the potential to draw tourists from distant locations and enhance the development of project location and its surrounding regions. Apart from that, this proposal has a potential to create more job opportunities both directly and indirectly.

INTER-STATE WATER

INTER-STATE WATER

In order to protect institutional memory pertaining to all Inter-State Water (ISW) issues, ISW wing in the Irrigation Department will be strengthened with adequate resources and manpower in addition to the existing institutional mechanism. As an initial step, Government has already appointed Advisor, Inter State Waters to advice and guide the Government on all issues of ISW. ISW will be strengthened with human resources from various fields. The position of the State in various Inter State Water issues are as follows:

I. Mullaperiyar

- ➤ As part of commitment towards life and properties of people of State of Kerala residing downstream of Mullaperiyar Dam, the Government will take all possible measures to construct a "**New Dam**" at Mullaperiyar to alley any fear regarding the threat posed by century old Mullaperiyar dam.
- ➤ State of Kerala will strongly put forward it's arguments to carry out the Comprehensive Dam Safety Evaluation (CDSE) with the Terms of Reference acceptable to the State as mandated by the Dam Safety Act, 2021. This will be vehemently argued before the Newly constituted Supervisory Committee.
- ➤ State of Kerala will strongly push to establish a continuous monitoring system of Mullaperiyar Dam by requesting Supervisory Committee to establish a permanent office where officers of both the States and Central Water Commission will be posted.
- ➤ Kerala will strongly place its need to have all the required soft measures as per Dam Safety Act, 2021 which shall include, Operation and Maintenenace Manual, Emergency Action Plans , Rapid Risk Assessment Reports etc.
- ➤ In the light of the findings of Survey of India in its report that "*the construction of the Mega Car Park is outside the Leased Area.*", all efforts will be continued to secure a favourable verdict from the Hon'ble Supreme Court of India in all the issues framed by the Hon: Supreme Court in Mega Car Parking case (OS 4 of 2014)
- ➤ Based on various demands from public as well as suggestions from Legislative committees, steps will be initiated to negotiate with Tamil Nadu to revise the lease rent and to enhance the royalty charges for power generation.

II. Parambikulam – Aliyar Project (PAP)

- ➤ Efforts will be continued to safeguard existing Kerala's water entitlements as stipulated in the existing PAP agreement by holding discussions with the State of Tamil Nadu as well as securing enhanced water entitlements for the State of Kerala as per present conditions.
- ➤ All efforts will be made to renew the PAP agreement which is already due
- ➤ Instances of illegal constructions and violations of the agreement by the State of Tamil Nadu will be appropriately brought to the notice of the appropriate legal authority.

> All possible measures will be initiated to halt actions towards the establishment of the project "Construction of a 1800 MW Pumped Storage Project (PSP) in Aliyar" which is completely detrimental to the interests of State of Kerala.

III. Cauvery Water Dispute

> Steps will be initiated to fully utilize the allotted 30 TMC (Thousand Million Cubic Feet) of Cauvery water, a major portion of which currently flows out of the State. This will be achieved through the formulation and implementation of new projects in the Kabini, Bhavani, and Pambar river basins by constructing dams and related infrastructure in Wayanad and other suitable areas. These initiatives aim to address water scarcity, enhance irrigation potential, and generate hydropower.
> Efforts to obtain approval for the Attappady Irrigation Project will be further strengthened.
> The construction of ongoing projects such as Pattissery will be expedited towards early completion, and steps will be initiated for the implementation of new projects such as Kadamanthodu, Thondar, and others.

IV-Neyyar Irrigation Project Dispute

> Considering the increasing drinking water demand in the rapidly developing capital city of Thiruvananthapuram and irrigation requirements from Neyyar Irrigation Project, utmost efforts will be taken to protect the interest of State of Kerala in the case OS 2 of 2012 (*wherein Tamil Nadu has raised the ckaim of Neyyar river as an Inter State Rive*r) pending before the Hon'ble Supreme Court.
> Any intervention in Neyyar irrigation project would be as per the provisions of Kerala Irrigation and Water Conservation Act, 2003.

V-Pamba-Achenkovil-Vaippar Link Project.

> The Pamba and Achenkovil rivers are entirely intrastate rivers. Hence, the State of Kerala firmly opposed the Pamba–Achenkovil–Vaippar (PAV) Link proposed by Tamil Nadu and studied by NWDA. The State has repeatedly conveyed its strong objections and reservations against the projects and would continue to do so before the National Water Development Agency (NWDA) who has been entrusted with studies on Inter Linking of rivers in India.
> Based on the assurance already recieved from NWDA that "the proposal will not be taken up without the consent of the State", Kerala will not entertain this subject to be discussed/negotiated in any platform.

E-GOVERNANCE IN WATER RESOURCES

E-GOVERNANCE IN WATER RESOURCES

E-governance is crucial for water resources because it improves transparency, efficiency, and sustainability through digital tools for real-time monitoring, data-driven decision-making, and enhanced stakeholder engagement. This approach helps in better managing water scarcity, pollution, and allocation, and facilitates equitable service delivery to diverse users like households, farmers, and industries. Digitalization has the potential to offer useful tools for managing, governing, and conserving water resources in a more efficient, effective, and participatory manner.

e-Office in Irrigation Department

The Irrigation Department aims to achieve comprehensive, department-wide integration of the e-Office system. This involves strengthening the existing IT infrastructure, ensuring its adequacy across all levels, and completing the rollout to all remaining subdivisions and section offices. The ultimate goal is to establish a fully digital platform that underpins administrative functions, ensuring seamless operation and accessibility for all departmental personnel.

This initiative is a strategic imperative to align with the Government's Vision 2031, which targets a digitally empowered and efficient administration. By fully implementing e-Office, the department seeks to significantly enhance operational efficiency, drastically expedite file processing, and cultivate a truly paperless working environment. These advancements are crucial for modernizing governance and improving service delivery.

The successful full-scale implementation of e-Office will yield substantial benefits. To date, 1.6 million receipts have been processed and 17,500 files created electronically, demonstrating its existing impact. Further integration will ensure even faster and more transparent file movements, robust inter/intra and public mail communication via the Central Registry Unit (CRU), and a reduction in administrative overheads associated with physical documentation. These deliverables will directly contribute to realizing the efficiency goals outlined in Vision 2031.

Achieving complete e-Office integration requires addressing critical challenges, primarily the lack of adequate IT infrastructure and a shortage of trained staff. The department has already engaged two CDIT project engineers for a year to support this effort.

PRICE (Project Information & Cost Estimation)

The Irrigation Department aims to ensure the continued robust utilization of the PRICE software, specifically its advanced version, PRICE 3.0, for all aspects of project

management. This involves fully leveraging its capabilities for preparing project estimates, Detailed Project Reports (DPRs), facilitating administrative and technical sanctions, and streamlining the entire process up to e-Bill submission.

This initiative is critical for advancing the digital transformation envisioned by Vision 2031. By embracing PRICE, the department seeks to achieve streamlined, efficient, and transparent execution of public works. It directly aligns with the broader objectives of accountability and good governance, which is fundamental to Vision 2031's digitally, empowered administration.

The benefits of PRICE 3.0 are extensive, enhancing integrity, efficiency, and transparency in project execution. Key deliverables include the simplified and paperless preparation of project estimates and DPRs, expedited administrative and technical sanctions, and efficient bill submissions. The integration with the e-tendering system ensures a completely paperless and transparent workflow from DPR preparation to e-Bill submission, thereby significantly improving project management.

The department has already successfully evolved from PRICE 1.0 to the advanced PRICE 3.0, introduced in 2022. This version enables comprehensive functionalities including DPR preparation and bill submissions. The process is further streamlined by coupling PRICE 3.0 with the pre-tender and post-tender module. The department owns the official website of PRICE 3.0 in CMF (Content Management Framework) which ensure customization and consistent application across all projects, guaranteeing its effective and continuous utilization.

Other e-Governance Initiatives and Future Website Enhancement

The Irrigation Department aims to significantly enhance its public-facing website, transforming it into a dynamic, user-friendly, and comprehensive digital interface. This involves integrating all departmental functions and incorporating a wide range of public-centric and employee-focused services to create a unified online platform.

This initiative is driven by the need to align with Vision 2031's goal of an integrated digital ecosystem and to meet the objectives of the Digital Kerala Initiative. By improving the website, the department seeks to boost transparency, enhance user experience, and ultimately consolidate its position at the forefront of the state's comprehensive digital governance agenda.

The revamped website will serve as a single point of access for information and services, significantly enhancing citizen engagement and internal efficiencies. Deliverables include essential public services like real-time dam warning alerts, E-File system access, and E-RTI functionalities. For employees, it will offer dedicated services such as E-Asset

management, a robust file tracking system, an 'Employees' Corner', and 'Know Your Office' functionalities, all contributing to a seamless user experience.

The department will achieve this by actively leveraging its existing suite of e-Governance systems, including SCORE, SPARK, BIMS, BAMS, GEM, PRISM, VEELS, and MEDISEP, integrating them into the new platform. The development will focus on creating a dynamic and user-friendly application that encompasses all departmental functions, thereby providing seamless access to information and services for both citizens and employees.

RTI ONLINE PORTAL

The Irrigation Department aims to achieve complete integration of all its offices, including currently exempted Sub Division offices, into the RTI Online Portal. This involves expanding the portal's functionality across the entire departmental structure to ensure that information sought under the Right to Information Act 2005 is consistently available for all public authorities within the department.

This initiative is in direct response to the directives of the Hon'ble Supreme Court of India and the Kerala State Government, mandating the establishment and operationalization of online web portals for RTI. Implementing the portal fully is crucial for enhancing transparency, promoting accountability, and aligning with the overarching goals of digital governance and a digitally empowered administration as envisioned by Vision 2031.

The full implementation of the RTI Online Portal will provide seamless and centralized access to information for citizens, ensuring greater transparency in departmental operations. With 198 offices already enabled, the expansion will further streamline the processing and uploading of RTI replies, making it easier for the public to exercise their right to information and fostering a more open and responsive administration.

The phased implementation has successfully brought Chief Engineer's offices, Circle offices, Division offices, and 111 Sub Division Offices into the Portal. To achieve full integration, the department will focus on implementing e-Office in the remaining Sub Division offices and section offices, as the Portal functions primarily through e-Office. This strategic approach will ensure that as these offices become e-Office enabled, they can be seamlessly incorporated into the RTI Online Portal.

In alignment with the initiatives of the Government to enhance e-Governance activities in accordance with the State IT Policy, and to support Kerala's vision of complete digital governance, it is imperative to strengthen the IT infrastructure of the our Department. To fully realize the ambitious goals of Vision 2031 for comprehensive digital governance, an amount of ₹12 Crores is essential for a complete IT infrastructure upgrade within the Irrigation

Department. This crucial financial commitment will facilitate the full-scale implementation of all e-Governance initiatives. This upgrade will ensure that the department possesses the resilient and advanced technological foundation necessary to support a digitally empowered, efficient, and transparent administration, ultimately enhancing public service delivery and operational effectiveness as envisioned for 2031.

KERALA WATER AUTHORITY

Kerala Water Authority envisions to transform the organisation into a digitally empowered, consumer- centric organization that ensures efficient, transparent and technology-driven service delivery at the doorstep of every citizen through innovative e-Governance, GIS integration and IT-enabled solutions.

Present Scenario:
The Information Technology Wing of KWA has evolved into a core enabler of e-Governance and digital transformation across the organization. It now plays a central role in automating services, improving transparency, enhancing consumer experience, and ensuring operational efficiency through integrated IT systems.

1. *Strengthened Digital Infrastructure:*
   - Fully functional **e-Office system** up to Section Office level has replaced paper-based file movement, improving internal efficiency.
   - Network upgrades include **KFON integration**, network load balancing, VPN registration portal, and secured **MPLS connectivity for the 1916 Call Centre**.
   - Implementation of the **GSPARK** system has been successfully completed.
   - The **e-Service Book** module is being used for all new employees since 2022, ensuring accurate and paperless employee record management.
   - For the past three years, **Confidential Reports (CRs)** have been accepted and processed **online through the GSCORE platform**, ensuring transparency, timely submission, and ease of monitoring.

2. *Major IT Systems in Active Use:*
   - **PRAVAHAK** – Real-time project monitoring platform for all schemes (JJM, NABARD, KIIFB, etc.).
   - **AQUALOOM** – Comprehensive complaint management system handling over 3.6 lakh complaints annually with a 99.8% resolution rate.
   - **e-TAPP** – Online application for water and sewerage connections, now integrated with K-SWIFT.
   - **QuickPay** – Enhanced consumer payment portal with UPI/BBPS, SMS integration, and multiple payment gateways.

- **BPL Application** – New online application launched for inviting BPL applications from eligible consumers
- **E-Abacus** – Enhanced billing platform linked with K-Meter app, now supporting over 45 lakh live connections.
- **Contractor License Management System** and **Material Management System (MMS)** introduced.

3. *GIS and Data-Driven Management:*
   - 90% of pipelines under JJM tracked through GIS Mapping.
   - Integration with PM Gati Shakti portal for national-level infrastructure visibility.
   - GIS module under development in PRAVAHAK for thematic and spatial visualization of assets.

4. *Consumer Services & Accessibility:*
   - 24x7 Call Centre (1916) operational, handling around 7.5 lakh calls annually.
   - Multi-channel grievance redressal through portal, phone, email, WhatsApp, and field CUG numbers.
   - Strong consumer engagement through transparent dashboards and online tracking tools.

5. *IT Security & Governance:*
   - Designation of a Chief Information Security Officer (CISO) and initiation of security audits for all major applications.
   - CERT-In compliance measures in place for cybersecurity awareness and incident response.

6. *Capacity Building:*
   - Regular training programs for staff on biometric systems, e-Abacus, VPN usage, GIS data collection, and mobile applications.
   - Distribution of new laptops and palm-held devices for field-level digitization.

Implementation Program:

1. ***PRAVAHAK (Project Analysis and Evaluation in a Holistic Approach for KWA)***
PRAVAHAK is a centralized software platform developed for the Kerala Water Authority (KWA) to efficiently manage and evaluate all projects implemented through various Water Supply Schemes, under multiple funding heads such as JJM, NABARD, KIIFB, and others.

2. ***LSGD Tracking System***

The LSGD Deposit Work Tracking System is a web-based full-stack application designed for the Local Self Government Department (LSGD) to efficiently manage and monitor deposit works. These works typically involve funds deposited by other departments or agencies and executed by the LSGD. It also generates reports for effective decision-making. It helps to streamline the process of assigning, updating, and tracking the progress of deposit works by providing a centralized platform with role-based access for different users, Enhanced transparency in fund utilization, Reduced manual errors in work tracking, Faster approvals and status updates, Easy performance analysis and audit.

3. ***Contractor License Management system module***

KWA has developed a Contractor License Management system module for submitting applications for contractor's registration, upgradation and renewal for all classes of Licenses. The dashboard for Contractor License Management system displays the count of total applications, license issued, applications in process and incomplete applications. Applicant can pay the application fees online and after the completion of the payment, the applicant can view the status of the application through this portal.

During this period, 806 applications received and 645 licences were issued.

4. ***Material Management System (MMS)***

The Material Management System (MMS) is a comprehensive full stack web application designed to handle the procurement, distribution and tracking of materials across departments or work sites. The system ensures that materials are requested, approved, issued and monitored in a systematic and transparent way.

To streamline the management of materials in government or organizational projects by providing a digital solution for tracking stock levels, processing requests and maintaining accountability..

    a. Centralized and transparent material tracking.
    b. Reduces material misuse and improves accountability.
    c. Speeds up approvals and material issue process.
    d. Accurate stock management reduces delays in project work.

The development is under progress.

5. ***ASKME***

AskMe is a scalable and dynamic internal management system designed for the technical staff of the Kerala Water Authority. It enables seamless internal

communication, day-to-day workflow automation and can accommodate multiple internal projects within a single platform.

6. ***New Applications Software***

A tender has been published and as per the request of proposal the work has been awarded to M/S Inventive Solution for a tenure of 9 months. The information regarding the billing system is being collected by the team and the development work is under progress.

For the analysis of the progress on work two internal committees are formed (technical & Monitoring committee) for the continuity of work and updates. New billing software is approaching the User Acceptance Testing stage.

Provident fund is handling in traditional manner. Employees are not able to generate credit card. And there is no provision to apply PF NRA and closure through online. Gain PF developed by NIC can adopt for the same, without any cost

Pension book processing is in traditional manner. Gprism developed by finance IT wing of finance department GoK may adopt for the same.
KWA have no financial IT solutions to handle it's accounting system. A complete fin solution is essential for KWA. Either KWA can collaborate with ksmart of lsgd for the same or can go for an open tender. The solution should incorporate through API with all other IT solutions of KWA including eabacus, gspark, price pfms, bima etc.

Financial Requirement:

New billing software	– 2.36 Cr
Customization of ksmart/new application softwares	– 1.5 Cr
Desktop/Laptop/Server Network infrastructure revamping	– 2 Cr
Improving Local Area Network connectivity	– 10 Cr
Biometric punching system	– 2.2 Cr
Total Financial Requirement	**– 18.06 Cr**

Benefits/Advantages:
 ➤ Improved consumer satisfaction through faster and transparent services. Strengthened internal efficiency via automation and integration.
 ➤ Enhanced accountability through dashboards and analytics.

➤ Cost savings through digital transformation and reduced manual workload.
Better decision support using GIS and real-time data visualization tools.

Time required for implementation:

Time required for implementation – 10 to 12 months

Groundwater Department

By 2031, the Department will establish a robust digital ecosystem encompassing a modern e-Office platform and an interactive, service-oriented public website. This will enable seamless online access to groundwater-related services, applications, and information, fostering transparency and accountability.

All official files, correspondence, approvals, and personnel records will be fully migrated to a secure, integrated e-Office environment by eliminating paper-based processes and ensuring real-time monitoring and workflow efficiency. Simultaneously, all legacy technical records including Groundwater investigation reports, Tube well lithology and well logs and groundwater monitoring data will be digitized and integrated into a centralized **Geospatial Information System** database, providing a unified digital repository for data analysis, policy planning, and public awareness.

This digital transformation will strengthen institutional efficiency, and promote sustainable management of groundwater resources through innovation, accessibility, and transparency.

i. **Mission**

- To promote **transparency, efficiency, and accountability** in groundwater administration through digital transformation.

- To implement and operationalize **e-Office and e-RTI systems** for seamless internal workflow and public information access.

- To develop an **interactive, user-friendly website** offering integrated e-services for citizens,

- To adopt **data-driven decision-making tools** and digital databases for effective monitoring and sustainable groundwater management.

- To empower citizens through **accessible digital platforms** that enhance participation, feedback, and awareness on groundwater issues.

Phase I – Foundational Phase (By 2026): 25 Lakhs

1. Implementation of **e-Office** in Groundwater Department all over Kerala for internal and inter-departmental correspondence.

2. Develop an **interactive website integrated with e-services** for the Department providing essential groundwater services and data.

3. Enabling online submission, payment and tracking for all services in the Department.

4. Implementation of online grievance redressal and feedback systems.

Phase II – Advanced Integration Phase (2026 -2028): 600 Lakhs

1. Digitization of existing records, registers and service data across District offices and Directorate.

2. Achieve **paperless operations** and fully digital workflow across all offices.

3. Development of **mobile app** for citizens and field officers for Service requests, data collection and monitoring.

4. Implementation of Digital tamper proof flow meter to monitor effective groundwater extraction for Industrial and infrastructure projects.

5. Development of centralised Management Information System to integrate the entire data related to Groundwater management.

6. Integration of the e-Governance platform with GIS and Groundwater database for spatial management.

7. Enable end-to-end online service delivery such as permit applications, water-use approvals etc into the e-Services portal.

8. Implement **AI-assisted decision tools** for groundwater resource planning and sustainability.

Phase III – Advanced Integration Phase (2028 -2031): 300 Lakhs

1. Establishment of real-time groundwater monitoring and water quality dashboards and integrate into the department website.
2. AI based decision support for Groundwater Management, Predictive analysis and sustainable planning.

Hence a total INR 925 lakhs proposed for e-Governance Initiatives.

Outcome

The State Groundwater Department will demonstrate

- Departmental services accessible online to the citizen
- Transparent, trackable and faster service delivery to the citizen
- Accountability and efficiency significantly improving both the sustainability of the state's groundwater resources and the quality of citizen engagement
- Creation of a comprehensive digital database for Groundwater Management

NEW INITIATIVES

NEW INITIATIVES

As the world move forward at a faster pace, it is imperative that the Governance systems also explore avenues for multi-dimensional use of its resources. The Government conceives certain new initiatives with citizen engagement and use of technology to reinforce the value of water and to recollect its deep-rooted local heritage, to be implemented in the next five year (2026-2031)

CITIZEN ENGAGEMENT THROUGH IRRIGATION TOURISM

Overview

Water has always been at the heart of Kerala's identity — shaping its landscape, agriculture, livelihoods, and culture. Every dam, regulator, and canal built over the decades carries not only engineering significance but also a story of human effort, community partnership, and hope.

Under *Vision 2031*, the Water Resources Department seeks to **reconnect citizens with their water heritage**, transforming irrigation infrastructure into shared spaces of learning, recreation, and stewardship. This mission envisions irrigation not merely as an engineering system, but as a **living network of culture, education, and collective care** — where every canal, pond, and thodu becomes a symbol of Kerala's bond with nature.

Statement of Purpose

- Develop **Irrigation Heritage Trails and Canal Beautification Corridors** — blending recreation, heritage appreciation, and environmental consciousness.

- Launch a **Citizen Science and Water Stewardship Programme**, training 5,000 "Water Champions" to monitor, protect, and rejuvenate local water assets.

- Promote a **Clean Canal, Clean Panchayat Mission** — combining awareness campaigns, enforcement, and community-driven cleanliness actions.

- Recognize and reward individuals and groups who voluntarily restore or protect water bodies.

- Build a state-wide movement of shared responsibility where **"a river or canal that belongs to everyone will be cared for by everyone."**

Need for Action

- **Cultural & Educational Value:** Kerala's irrigation history — from traditional bunds to modern dams — represents a century of water wisdom. Making these accessible to the public will inspire awareness, learning, and appreciation.
- **Collective Ownership:** True water security depends not only on infrastructure but also on public participation. Engaged citizens are the best guardians against pollution, encroachment, and neglect.
- **Eco-Recreation & Well-being:** Revitalised canals and reservoirs can provide safe, green spaces for communities, encouraging outdoor activities and environmental pride.
- **Citizen Science for Real-Time Data:** Volunteers can play a vital role in reporting canal conditions, rainfall, and pollution — supporting better planning and rapid response.

    Recognition of Social Commitment: Acknowledging voluntary water champions nurtures pride, empathy, and community spirit — turning conservation into a shared social movement.

Implementation Strategy

1. Irrigation Heritage Trails and Canal Beautification

(a) Heritage Corridors

- Develop **20 heritage sites** highlighting Kerala's irrigation achievements
- Create **interpretive centres, signage, and educational trails** explaining the science, engineering, and history of each structure.
- Include **photo galleries, scale models, and interactive exhibits** to connect young learners with water heritage.
- Partner with the Tourism Department and LSGD to manage sites sustainably, ensuring local benefit and ecological protection.

(b) Canal Beautification Corridors

- Identify **50 km of canal stretches** near urban and semi-urban areas (e.g., Kole Canal in Thrissur, Parvathi Puthanar in Thiruvananthapuram, AC Canal in Alappuzha) for aesthetic improvement.

- Create **walkways, cycling tracks, resting shelters, benches, solar lighting, green landscaping, and viewing decks.**
- Integrate **interpretive panels** showcasing water management practices, flora, and fauna along the canal ecosystem.
- Allow **controlled community recreation** — boating, angling, and eco-markets — managed by local self-government institutions and cooperatives.

(c) Eco-Design and Inclusivity

- Use **eco-friendly materials**, **bioengineered banks**, and **native vegetation** for stability and aesthetics.
- Ensure **universal accessibility**, lighting for safety, and maintenance systems under local Water User Associations (WUAs).

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2. Citizen Science and the "Water Champions" Programme

(a) Water Champions Network

- Mobilise and train **5,000 citizen volunteers** — students, farmers, youth, and women — as *Water Champions* in all districts.
- Provide basic tools and training through WRD, KERI, and academic partners to record rainfall, canal water levels, groundwater levels, and pollution indicators using mobile applications.
- Build a **digital reporting platform under SWIC**, where citizen data complements official hydrological records.

(b) Volunteer Water Action

- Engage volunteers in activities like **canal cleaning, tree planting, bund strengthening, minor pond restoration**, and **greywater reuse demonstrations**.

- Conduct school and college outreach campaigns — "Every Drop Counts" — connecting youth to local water bodies.
- Encourage citizens to adopt the principle of *"using every litre of water twice"* — through reuse, recycling, and sustainable domestic practices.

(c) Recognition and Incentives

- Government to introduce **"Water Stewardship Awards"** for exemplary individuals, schools, and panchayats engaged in voluntary water restoration.

- Recognition through **State-level awards, digital certificates, media coverage, and grants** for continuing work.
- These recognitions are **not financial employment**, but **social honours** for environmental commitment — celebrating Kerala's "citizens of the rivers."

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3. Clean Canal, Clean Panchayat Mission

(a) Mission Framework

- Launch a **statewide campaign (2026–2031)** called *"Clean Canal, Clean Panchayat"*, linking canal maintenance, solid waste management, and public awareness.

- Combine **mass campaigns, student drives, social media messaging, and strict enforcement** against dumping, encroachment, and sewage inflows.

(b) Panchayat & WUA Partnership

- Each **panchayat with a canal or thodu** will prepare an *Action Plan* for cleanliness, desilting, and community maintenance drives.
- WUAs and Kudumbashree units will coordinate cleaning and awareness events with support from WRD and LSGD.

(c) Enforcement & Accountability

- Strengthen surveillance through **drone monitoring, citizen reporting apps, and local vigilance teams.**
- Coordinate with Pollution Control Board and Local Bodies to ensure swift penal action against repeat offenders.

(d) Education & Behavioural Change

- Develop a **statewide school-level curriculum supplement** on "Kerala's Water Heritage and Canal Care".
- Organise annual *Water Stewardship Week* across districts with exhibitions, rallies, competitions, and restoration camps.

Expected Benefits (Deliverables)

Deliverable	Target (2031)	Impact
Heritage sites developed	10 key locations	Water heritage education and public awareness
Canal beautification corridors	50 km	Enhanced public spaces, aesthetics, and water quality
Trained Water Champions	5,000 volunteers	Citizen science, data support, and community vigilance
Clean Canal, Clean Panchayat campaigns	500 panchayats	Cleaner water bodies, reduced dumping and pollution
Public water-awareness programmes	1,000 events	Strengthened citizen responsibility & behavioural change
Recognised Water Stewards	500 individuals/groups	Incentivised social participation & voluntary conservation

Infrastructure and Resource Requirements

Component	Scope / Unit	Estimated Cost (₹ crore)
Canal beautification and heritage corridor works	50 km @ ₹1.50 crore/km	**75**
Heritage interpretation centres and displays	10 sites @ ₹5 crore avg.	**50**
Water Champions training and digital platform	5,000 volunteers	**5**
Awards, IEC, and school engagement programmes	Statewide	**10**

Total Estimated Outlay (2026–2031)   **140 crore**

The financial investment need not necessarily be done by Government. Scope of leasing land to attract private investment could also be explored.

Phasing Plan (2026–2031)

Phase		Period	Key Activities
Phase (2026–2027)	I	Identify 10 heritage sites, 10 canal beautification stretches, develop Water Champions training module, and pilot Clean Canal campaign in 50 panchayats.	
Phase (2028–2029)	II	Expand beautification to 30 km, 250 panchayats under Clean Canal Mission, and 3,000 volunteers trained; develop digital reporting tools.	
Phase (2030–2031)	III	Complete 50 km beautification, 20 heritage centres, 5,000 Water Champions trained, and Clean Canal Mission operational in all 500 panchayats.	

Citizen-Impact Statement

By 2031, Kerala's irrigation network will not just irrigate fields — it will **inspire citizens**. Canals will be clean, green and people-friendly; students will measure rainfall and groundwater with pride; local youth will lead restoration drives; and families will walk along rejuvenated canal walkways that tell stories of Kerala's water heritage.

The *Water Champions* and *Clean Canal, Clean Panchayat* movements will awaken a sense of ownership that no law can enforce — only love for nature can. Every litre saved, every canal protected, and every act of care will move Kerala closer to a future where **water belongs to everyone, and everyone belongs to water.**

In this new era, the State's irrigation system will not just distribute water — it will distribute **awareness, unity, and hope**.

HARNESSING SOLAR ENERGY FOR IRRIGATION

Overview

Kerala's irrigation infrastructure — comprising reservoirs, regulators, lift irrigation networks and canal systems — depends significantly on grid electricity for operation and control. The **Solarisation Programme under Vision 2031** aims to make the irrigation sector progressively **energy-neutral** by generating renewable power from its own assets.

This transformation will convert dams, canals, and pump houses into **distributed solar generation nodes**, while simultaneously reducing operational costs, conserving water, and contributing to the State's climate and energy goals.

By 2031, the Water Resources Department (WRD) targets **50 MW of solar generation capacity**, enough to meet the electricity needs of major pump houses, SCADA systems, and field offices, while substantially lowering Kerala's irrigation-sector carbon footprint.

Statement of Purpose

- Achieve **energy self-sufficiency** in the irrigation sector through solarisation of pump houses, canal corridors, and reservoir surfaces.

- Generate **50 MW of clean, renewable energy** by 2031, reducing dependence on the grid and achieving near-zero carbon irrigation operations.

- Integrate solar power generation with WRD's operational requirements — powering automation, telemetry, offices, and control systems.

- Reduce **evaporation losses by 20–25%** on covered canal stretches through canal-top solar canopies.

- Establish WRD as a leading model for **green infrastructure and sustainable energy-water management** in India.

Need for Action

- **Energy Cost Optimisation:** Irrigation pumping and automation consume significant grid electricity; in-house renewable generation will reduce recurring expenditure.

- **Climate Resilience:** Solarisation contributes to Kerala's Carbon-Neutral Mission, lowering emissions while ensuring reliable power supply for irrigation assets.

- **Efficient Land Use:** Canals, reservoirs, pumphouses and dam campuses provide ideal non-agricultural surfaces for solar installations without competing for land.

- **Technology Integration:** Coupling solar power with automation, SCADA, and telemetry enhances the reliability and intelligence of irrigation systems.

- **Water Conservation:** Canal-top solar panels reduce direct evaporation and improve water quality by shading and limiting weed growth.

Implementation Strategy

1. Canal-Top and Canal-Side Solar Power Programme

(a) Pilot Phase (2026–2027)

- Implement **five canal-top solar pilots** under major irrigation schemes
- Cover approximately **15 km of canal length**, generating **5 MW** of renewable energy. Use **lightweight aluminium truss structures** and **walkable panel designs** suitable for Kerala's canal widths.
- Integrate with automated regulator gates for on-site energy use and grid connection.

(b) Expansion Phase (2028–2031)

- Extend to **60 km of canals** across major irrigation basins, achieving a cumulative capacity of **35 MW**.
- Combine **canal-top and canal-side arrays**, depending on alignment and terrain.
- Connect systems through smart inverters for load balancing and SCADA compatibility.
- Introduce **hybrid models** combining canal-top and floating solar units where canals widen into balancing tanks or reservoirs.

(c) Performance Outcomes

- Generate ~**70–80 million units (MU)** of electricity annually.
- Offset 60–70% of irrigation-sector power consumption.
- Reduce evaporation by **20–25%** on shaded stretches.
- Cut annual carbon emissions by **70,000 tonnes of CO_2 equivalent**.

2. Solarisation of Pump Houses and Lift Irrigation Schemes

(a) Lift Irrigation Solar Mission (LISM)

- Solarise **100 lift irrigation schemes** (existing and new) across Kerala.
- Promote **daytime pumping schedules** to align with solar availability and optimise grid usage.

(b) Pump House Solar Canopies

- Install **rooftop or ground-mounted solar systems** (10–200 kWp) at 250+ pump houses and regulator sites.
- Integrate these units with telemetry, lighting, and water-quality monitoring stations. Expected generation: ~**10 MW cumulative capacity** by 2031.

3. Floating Solar on Reservoirs

- Deploy **floating solar plants** on calm surfaces of irrigation reservoirs
- Cumulative capacity: **5 MW**.
- Co-benefits: reduced algal growth, reduced evaporation, and cleaner water intake for irrigation and drinking supply.
- Floating platforms made of HDPE pontoons with anti-slip walkways and corrosion-proof anchoring.

4. Energy Integration & Digital Management

- **SWIC Energy Dashboard:** Develop a real-time dashboard for monitoring energy generation, usage, and savings across WRD assets.
- **SCADA Synchronisation:** Integrate solar data streams into irrigation automation centres to manage power supply to gates, pumps, and sensors.
- **Energy Accounting:** Implement annual energy audits for all WRD divisions to track solar utilisation, grid draw, and carbon offset.

Expected Benefits (Deliverables)

Deliverable	Target (2031)	Impact
Canal-top and canal-side solar capacity installed	35 MW	Energy-neutral operation of canals; 25% evaporation reduction

Solarised lift irrigation schemes	100 nos.	Reliable power for 20000 ha irrigation; reduced O&M costs
Pump house & rooftop solar systems	10 MW	Self-powered automation and telemetry systems
Floating solar on reservoirs	5 MW	Reduced evaporation and cleaner water quality
Total solar generation capacity	50 MW	70–80 MU/year; ₹60 crore annual energy savings
Carbon reduction	70,000 tCO_2e/year	Contribution to Kerala's Carbon-Neutral Mission

Infrastructure and Resource Requirements

Component	Scope / Unit	Estimated Cost (₹ crore)
Canal-top / canal-side solar	35 MW @ ₹8 crore/MW	**280**
Solarisation of LI schemes	100 schemes @ ₹0.70 crore avg.	**70**
Pump house rooftop solar	250 sites @ ₹0.04 crore avg.	**100**
Floating solar on reservoirs	5 MW @ ₹9 crore/MW	**45**
Energy storage & smart control systems	Key automation stations	**50**
Training, IEC, & digital integration	Statewide	**30**
Total Estimated Outlay (2026–2031)		**575 crore**

Sustainability & Financing

- **Funding   Sources:**

    ○ State Plan funds under WRD Vision 2031.
    ○ NABARD RIDF loans
    ○ MNRE subsidies for canal-top and floating solar (where eligible).
    ○ PPP models for large-scale canal solar stretches.

- **Revenue & O&M Model:**
    ○ Sale of surplus power to KSEB via net metering.
    ○ Carbon credit revenues reinvested in maintenance and scaling.
    ○ Performance-based contracts with EPC partners for 10-year O&M.
- **Environmental Sustainability:**
    ○ Solarisation avoids approximately **70,000 tonnes CO$_2$** emissions per year.
    ○ Improves water quality, micro-climate stability, and biodiversity near canal corridors.

Citizen-Impact Statement

By 2031, Kerala's irrigation network will operate as a self-sustaining, low-carbon system powered by the sun. Canals will not only carry water but also generate energy; lift irrigation stations will run on solar clusters; and control centres will function independent of the grid.

The Solarisation Mission will mark a paradigm shift — turning the irrigation sector from an energy consumer into an energy producer. This integrated green transformation will save public expenditure, reduce emissions, strengthen climate resilience, and exemplify Kerala's leadership in sustainable water–energy management.

CENTRALIZED ASSET MANAGEMENT SYSTEM (AMS)

The Irrigation Department of Kerala holds a vast and diverse portfolio of public assets critical to the State's water security, agriculture, and infrastructure. These assets include major and minor irrigation schemes, vital civil structures, extensive land parcels, and operational machinery. The current distributed and manual asset management approach in the Kerala Irrigation Department suffers from fragmentation, poor data quality, and underutilization of assets, leading to increased vulnerability to encroachment and ineffective planning. The proposed **Asset Management System (AMS)** is a centralized digital platform designed to resolve these issues. It will integrate all asset records, leverage geospatial technology (including polygon and 3D data), secure critical documents via a Distributed Ledger Technology (DLT) layer, and provide advanced MIS capabilities. This comprehensive system is estimated to cost **₹600 Lakhs** and is planned for phased

implementation over **10 to 14 months**, promising vast improvements in efficiency, asset security, and sustainable, technology-enabled irrigation management.

Current Asset Portfolio

The Department's assets fall under several critical categories:

- Water Management Schemes: Water diversion schemes, large-scale storage schemes, and various Lift Irrigation Schemes.
- Major Structures: Dams, barrages, breakwaters, and regulator-cum-bridges.
- Infrastructure: Extensive canal systems, associated land and buildings related to irrigation projects.
- Equipment: Machinery, plants, and departmental vehicles.
- Data Infrastructure: Various weather stations and river gauging stations.

Proposed Centralized Asset Management System (AMS)

The proposed system is a modern, web-based digital platform designed to address the above challenges through comprehensive data centralization and advanced technological features.

Key System Features:

- Central Digital Database: Creation of a single, authoritative database storing records for all asset categories.

- Geospatial Integration: All assets, particularly land, water bodies, and canal networks, will be mapped and stored with geospatial data. This includes polygon data for land boundaries and water bodies, and the ability to incorporate 3D profiles for catchment areas and large structures.

- Digital Ownership Records: The system will store authenticated digital records of ownership and title documents for all land and properties.

- Asset-Specific Details: The system will capture all details specific to each asset category (e.g., maintenance schedules for machinery, structural integrity data for dams, and flow capacity for canals).

POLICIES

POLICIES

Policies in water sector is vital in determining long term strategic planning of water resources. Kerala State has always focused on integrated water resources management (IWRM) and micro water shed based planning to ensure water sustainability. It is guided by an integrated and multi-sectoral approach to address challenges like water scarcity, pollution, and climate change impacts, while ensuring sustainable and equitable water management for all citizens.

State Water Policy

The Climatic changes viz, change in precipitation patterns, increase in extreme weather events like floods and droughts, raising sea levels, and accelerating evaporation especially in the last decade across the State affected the water resources in the State. These climatic changes have reduced the availability of fresh water, contaminating coastal aquifers with saltwater, and leading to water scarcity in some areas while causing excess runoff in others. Impacts on water quality include increased sediment and nutrient runoff from heavy rains. To address the said issues and to ensure **sustainable and equitable management of water resources**, which includes providing safe drinking water for all citizens, meeting agricultural and industrial needs, preserving water quality and protecting ecosystems the Water Resources Department has taken steps to revisit the Present Water Policy published in the year 2008. The Draft of revised State Water Policy has been prepared after thorough deliberations among the Stake holder departments under Water Sector with the Guidelines and support of the Drafting Committee constituted by the Government. ***Some of the main points considered for the revision of SWP are***,

- Recognizes that water is a shared resource, and its management requires the active participation of Government agencies, local bodies, communities, private sector entities, and civil society.

- Advocates for the adoption of Integrated Water Resources Management (IWRM) Principles that promote a holistic, inclusive, and coordinated approach to managing Kerala's Water resources

- Intends to address the growing challenges by fostering sustainable water use practices, improving governance structures, protecting ecosystems and enhancing resilience to climate change impacts.

- Aims to address the challenges of sustainable water resource management in the state.

- Envision a future where water is efficiently managed,conserved, and shared equitably among all sectors of society while safeguarding ecologicalhealth.

- Also provides a framework for water governance, resource management, andservice delivery, emphasizing the need for innovation, inclusivity, and resilience to climate related impacts.

Once the revised State Water Policy is approved and implemented the following outcomes are expected within the next five years

- A paradigm shift from a supply-centric approach to integrated and sustainable water management promoting water conservation, and ensuring water security and sustainability through integrated management

- Focus on integrated water resource management and addressing challenges unique to the state, such as climate variability and water security

- Strive towards providing safe drinking water for all citizens, meeting agricultural and industrial needs, preserving water quality protecting ecosystems

River Basin Conservation and Management Framework

Managing water resources effectively is a challenge, especially in areas like Kerala where river systems are under more strain. The conditions for floods like those happened in August 2018 are created in Kerala by the combination of heavy rainfall in the upper ranges, a sharp elevation difference over a short distance that causes peak runoffs, and flat topography along the western shore. Effective and integrated water management is more important than ever, due to mounting pressures from population growth, and climate change. To handle this, an authoritative guide for implementing Integrated Water Resources Management (IWRM) across river basins has become essential. So, the Government has formulated a frame for River Basin Conservation and Management.

This framework, which is created to act as a guide for IWRM, describes key elements such as financial management, planning techniques, governance structures, and community participation tactics. To ensure that all parties collaborate towards sustainable river basin management, it places a strong emphasis on cooperation between governmental organizations, local communities, civil society, and the commercial sector. This framework seeks to better coordinated action across departments and increase the effectiveness and impact of river basin management activities by clearly outlining roles and responsibilities.

Amendments proposed to Kerala Irrigation and Water Conservation Act

The **Kerala Irrigation and Water Conservation Act, 2003**, serves as the primary legal framework in the state for regulating the construction of irrigation works, managing the conservation and distribution of water, and levying charges for lands benefiting from these works. The amendment of the **Water Conservation Act is essential** to address modern challenges related to water scarcity, pollution, financial sustainability, and environmental.

The focus of amending water conservation act is to establish strict regulatory control over water abstraction, implement an economically viable water-use charging model, and mandate modern environmental protection practices like water recycling and maintaining environmental flow. This shift treats water as a critical, finite resource that must be regulated and charged for to ensure state exchequer neutrality and environmental sustainability.

The following points will be covered broadly:

1. Mandate permission for all types of water abstraction, regardless of the quantity.

2. Require sanction from a competent authority for all water abstraction, and levy appropriate charges accordingly (excluding domestic use and agriculture).

3. Fix commercial water charges to guarantee that the state exchequer incurs no loss from water provisioning.

4. Establish a legal framework that prioritizes the processes of Recycle-Treatment-Discharge for water protection.

5. Ensure the Environmental Flow (E-flow) of all river bodies is maintained and actively manage industrial pollution to control the Biological Oxygen Demand (BOD) level.

Kerala State Micro Irrigation Policy

The Government of Kerala has taken a major step towards improving agricultural water-use efficiency and ensuring long-term sustainability through the formulation of the State Micro Irrigation Policy (SMIP). Recognizing Kerala's unique topography, fragmented landholdings, and increasing water stress, the policy aims to promote the widespread adoption of **micro-irrigation systems (MIS)** such as **drip and sprinkler irrigation** across the State. A Drafting Committee was constituted vide **G.O. (Rt) No. 253/2022/WRD dated 30.03.2022**, chaired by the **Chief (Agriculture), State Planning Board**, with the **Chief Engineer (Irrigation & Administration)** as Convenor. The Committee, with support from **CWRDM**, **KIIDC**, and other stakeholder departments such as Agriculture, Local Self Government, Groundwater, and Finance, developed the **Terms of Reference** and coordinated a series of consultations and collaborative reviews to prepare the draft policy. Based on these deliberations and expert inputs, a comprehensive **base draft** was prepared by the Irrigation Department,

refined through stakeholder workshops at **Kerala Agricultural University, Mannuthy**, and finalised incorporating inter-departmental feedback and technical recommendations.

The SMIP envisions transforming Kerala's irrigation landscape through the widespread adoption of **micro-irrigation systems (MIS)** such as drip and sprinkler irrigation. Anchored in the principles of **water-use efficiency, climate resilience, and farmer empowerment**, the policy seeks to raise the net irrigated area from the current 20% to optimal levels. It aligns directly with **SDG 6 (Clean Water and Sanitation)**, **SDG 11 (Sustainable Cities and Communities)**, and **SDG 13 (Climate Action)**, and complements the objectives of the **Kerala State Water Policy**.

The policy identifies that only **0.33 lakh ha (12.22%)** of Kerala's total irrigated area presently uses micro irrigation, against an estimated potential of **2.7 lakh ha**, and aims to bridge this gap through strategic interventions. It outlines a comprehensive framework covering **source identification and augmentation**, **beneficiary selection**, **implementation protocols**, and **monitoring mechanisms**, while promoting circular economy concepts like the use of treated wastewater and fertigation.

Implementation will be coordinated through a **Micro Irrigation Implementation and Coordination Committee (MIICC)** at the State level, supported by **State and District Level Implementation Committees**. The institutional framework integrates departments of Agriculture, Water Resources, Groundwater, Cooperation, Local Self Government, and Finance, with technical support from **CWRDM, KIIDC, and KAU**. A transparent system of beneficiary selection, third-party inspections, digital monitoring tools, and direct benefit transfers will ensure accountability and efficiency.

The funding structure follows the **RKVY model**, with **55% subsidy for small and marginal farmers and 45% for others**, along with enhanced incentives for women, SC/ST, transgender, and young farmers. For community irrigation projects, the **Water User Associations (WUAs)** will co-finance 50% of costs, supported by subsidized loans from cooperative and scheduled banks. A strong **Public–Private Partnership (PPP)** component encourages private investment, technology transfer, and capacity building.

After multi-stage review and inter-departmental consultations, the **final draft of the Kerala State Micro Irrigation Policy** is being examined by **State Planning Board**. Once approved, it will serve as the State's guiding framework for promoting **sustainable, water-efficient, and climate-resilient agriculture**, supporting farmers' income growth while ensuring optimal use of Kerala's precious water resources.

Data Dissemination Policy

The Hydro-Geo-Meteorological Data Dissemination Policy represents the Government of Kerala's emerging framework for modernizing the management and sharing of water-related

data across the state. The draft policy seeks to consolidate the collection, validation, and dissemination of hydrological, groundwater, and meteorological information through a unified and transparent mechanism. It reflects Kerala's intent to align with the national Hydro-Meteorological Data Dissemination Policy of 2018, issued by the Ministry of Jal Shakti, while addressing state-specific concerns such as interstate river management, groundwater depletion, and climate variability.

The draft policy recognizes that Kerala has long invested substantial public resources in developing hydrological and meteorological monitoring networks. However, the absence of a structured dissemination framework has limited the wider use of this data in research, policy planning, and disaster management. The proposed policy, therefore, introduces clear custodianship roles, while laying down transparent procedures for data requests, pricing, and sensitivity classification. In doing so, the policy moves toward a single digital data infrastructure that would serve the government, academia, industry, and the public.

Although still in draft form, the policy outlines a forward-looking vision extending to the end of the decade. Central to its future plan is the full development and operationalization of the **Kerala Water Resources Information System (Kerala-WRIS)**. Envisioned as a web-enabled, integrated platform, Kerala-WRIS will eventually become the sole medium for data submission, approval, and dissemination. By 2031, it is expected that all departments contributing to or using hydro-geo-meteorological data—including the Irrigation Department, GWD, Kerala State Electricity Board, Kerala State Disaster Management Authority, and other line agencies—will be seamlessly connected through this system. Once operational, Kerala-WRIS will provide real-time data visualization, analytics, and authorized downloads, making it a comprehensive decision-support system for water management.

The draft policy further envisions a gradual **transition toward open-data practices**, particularly for non-sensitive datasets. By streamlining the approval process and making non-classified data freely accessible to government departments and recognized research institutions, Kerala aims to foster scientific research, innovation, and public participation in water-resource planning. The pricing structure outlined in the draft document reflects this intent—offering minimal charges for academic and non-profit users while maintaining cost recovery for commercial and foreign entities. Once digital dissemination reduces administrative costs, future revisions of the policy may introduce even more open access, promoting transparency and evidence-based governance.

Between 2025 and 2031, the state's roadmap, involves three broad phases. The **initial phase (2024–2026)** would focus on institutional readiness: data standardization, integration of legacy datasets, and upgrading of field monitoring infrastructure. The **middle phase (2026–2029)** would see the expansion of the real-time monitoring network and the gradual rollout of Kerala-WRIS as the central data portal. By the **final phase (2029–2031)**, the platform is expected to operate as a fully functional, live system, supporting dynamic data exchange among departments, researchers, and citizens. During this period, the Water

Resources Department is likely to review the policy periodically through the Principal Secretary to incorporate emerging technologies such as artificial intelligence, remote sensing, and predictive analytics.

In summary, the Hydro-Geo-Meteorological Data Dissemination Policy, once approved, will be a forward-looking document that lays the groundwork for a digital transformation in Kerala's water-data ecosystem. While its provisions are yet to receive final government approval, the draft articulates a clear vision for the coming decade: a transparent, technology-driven, and integrated system that will unify hydrological, geological, and meteorological information under one digital roof. The policy can position Kerala among the few Indian states with a fully automated, publicly accessible, and institutionally coordinated water-information system—one capable of supporting climate adaptation, sustainable resource management, and data-driven policymaking in an era of growing environmental uncertainty.

Standard Operating Procedure (SOP) on Desiltation

Various scientific studies carried out to assess the sediment accumulation in Dams/reservoirs, rivers, ponds and in irrigation structures revealed that there has been a considerable reduction in the water holding capacity of Dams/reservoirs/ponds and other Irrigation structures from their envisaged capacity and also in the carrying capacity of rivers. The silt accumulation in rivers affected the streamline flow and also became one of the reasons for local riverine flooding.

To address the issue the Water Resources Department has taken an earnest effort to revise the present Standard Operating Procedure on Desiltation in line with present requirement. On approval of the revised Standard Operating Procedure it is expected that the entire Stake holder departments would be able to carry out the desiltation work effectively and in a time bound manner so as to address the said problems effectively and more scientifically. It is also expected that the said activities fetch commendable revenue to the Government of Kerala in the coming years.

Some of the Key out comes expected within the next five years

- ✓ To enhance the storage in Dams, irrigation structures and water bodies.
- ✓ Conservation of rain water
- ✓ Reduce local riverine flooding
- ✓ Revenue generation for the State by the reuse of sediments
- ✓ Supply of building material
- ✓ Ensure more employment.

Kerala Groundwater (Control and Regulation) Act, 2002, **and Rules, 2005** (amendment)

A comprehensive review and amendment of the **Kerala Groundwater (Control and Regulation) Act, 2002**, and the associated **Rules, 2005** will be undertaken during **2025–26** and notified by **2026–27**. The review aims to align the Act and its rules with the **Central Groundwater Authority (CGA) guidelines** to strengthen the management of groundwater resources in the state which focusing on ensuring both **qualitative and quantitative water security** through more robust and effective groundwater governance. The key amendments proposed include Stronger Penal Provisions to regulate illegal extraction and ensure compliance with sustainable groundwater usage practices, Clear regulation to Industrial and infrastructural sector to regulate the uncontrolled large scale extraction and ensure efficient water usage. , Levy of Groundwater extraction charges to discourages excessive extraction and generates revenue, Mandated Groundwater recharge provisions to replenish depleted aquifers, Private drilling rig registration to ensure proper regulation and monitoring of groundwater drilling activities etc, Bulk Groundwater supply to ensure sustainable extraction and equitable supply. The penal provisions to the above will prevent illegal groundwater development and also provide additional revenue to the department

Realtime Digital Groundwater extraction monitoring mechanism

The **Department** is planning to develop a **Realtime Digital Groundwater Extraction Monitoring Mechanism**, which will include development of sophisticated software and centralized database system for groundwater abstraction data management of establishments (NOC holders of SGWA) to track, analyze, and manage groundwater usage, potentially including a pricing component for abstraction. **This system will allow automated and continuous groundwater data acquisition using digital tamper-proof flow meters with telemetry, data analytics, and pricing integration to promote sustainable use and effective governance and** streamline the process of managing groundwater NOCs for different category of groundwater users. (public/ private enterprises). The procedures are initiated in 2025**–26**, with completion expected by **2026–27**.

Levy of Groundwater Abstraction / Restoration Charges

Introduction of a fee system for Industrial/ infrastructural/ commercial groundwater extraction users for the volume of groundwater being extracted. **The charges could vary based on the volume of water extracted and the area categorization as per Groundwater Resource estimation. Such levy shall** Discourages excessive extraction and generate revenue that could be reinvested in groundwater recharge programs and sustainable water management efforts. The provision aligns with the **Central Groundwater Authority (CGWA) guidelines 2023** with expected implementation in 2026-27.

Activities Proposed	Time Frame
Enforcement of Amended **Kerala Groundwater (Control and Regulation) Act, 2002**	2026-27
Reframing of Guidelines for effective groundwater management	2026-27
Levy of Groundwater Abstraction / Restoration Charges & Penalties	2026-27

CONCLUSION

VISION 2031 articulates the long-term strategic ambition of the Water Resources Sector of Kerala to adapt, modernise and sustainably manage water infrastructure and water resources by the year 2031. It is not merely about build-and-forget approach but about integrated operations, intersectoral coordination, climate resilience, real-time information systems, participatory governance, and aligning ourselves with the principles of Integrated Water Resource Management.

75 വയസ്സിലെ കേരളം

കേരള സർക്കാർ

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വിഷൻ 2031

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