WATER BUDGETING

in Aspirational Blocks

NITI Aayog

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Disclaimer

The document has been prepared based on the data available from the respective Ministry/ Department/ Organisation and data shared by the States through the Varuni web-based application.

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Message

Water, as both natural and a socio-economic resource, occupies the heart of India's developmental discourse. In recent years, water policy has gained traction and there has been nudge to make data informed water management decisions. The Hon'ble Prime Minister's call for Viksit Bharat@2047, articulated on multiple national platforms, reflects a clear recognition that the challenges of the present and the future must be addressed through a sustained commitment to long-term, integrated water resource management (IWRM).

This report, **Water Budgeting in Aspirational Blocks**, represents an important intervention within this evolving policy landscape. It seeks to operationalise the idea of Block-level water security planning through the lens of water budgeting—a concept that, while not entirely new, continues to demand recalibration in light of mounting environmental stresses and developmental aspirations.

The selection of 18 Aspirational Blocks across diverse agro-ecological regions offers a window into the heterogeneity of India's water resource challenges. The report highlights the need for context-specific, adaptive strategies - particularly in regions marked by competing demands, ecological vulnerability, and infrastructural limitations.

As policy shifts towards convergence, digital governance, and outcome-based planning, initiatives like water budgeting hold the potential to become cornerstone in India's broader transition towards climate resilience and sustainable development. Water budgeting is not merely a technical protocol, but is a dynamic, geography-sensitive process that can help to achieve sustainable outcomes.

On the one hand, this report may serve as a catalyst for localised water management grounded in evidence, and on the other, its methodology can be a basis to do water budgeting exercise at State and National level.

(Vinod Paul)

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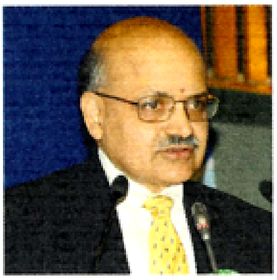

FOREWORD

Water is intrinsically linked not only to life but also to economic growth and development. The journey towards *Amrit Kaal* necessitates comprehensive management, highlighted by the Honourable Prime Minister's call for an integrated Water Vision@2047. Water budgeting is crucial for ensuring India's sustainable development by shifting to proactive water management aided by a data-driven approach that systematically accounts for availability and access.

The water budget is a vital diagnostic tool for estimating the gap between demand and supply. It estimates the level of water demand-supply gap. This helps in taking informed decision-making enabling functionaries to plan location-specific interventions. The adoption of such a structured approach would enhance water security, resilience, and sustainability at the local level.

NITI Aayog piloted this water budgeting exercise in 18 selected aspirational blocks across varied agro-climatic zones. Data and inputs received from the states have been used in preparation of this report, and the report has been improvised after receiving comments from related ministries and institutes.

The success of this exercise relies fundamentally on the principle of people's participation. I congratulate the team in the Water Division of NITI Aayog led by Shri Yugal Joshi, Program Director for this exercise. I am confident that adoption of concept of water budgeting will significantly contribute to informed planning and sustainable water management.

21/10

Dated: 21st October, 2025 **[B.V.R. Subrahmanyam]**

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Preface

Water forms the backbone of environmental health, human well-being, and economic development. In India, availability, distribution, and management of water resources are crucial for sustainable growth across various sectors. Despite annual water availability of about 3,880 BCM, its distribution in space and time is highly uneven, and the pressures from population growth, economic development, climate change, reactive approach to water management etc. are significantly impacting the sustainable availability.

To address these, a more proactive and scientific approach for judicious usage of water is required with a thorough understanding water resources availability, its location, quantity, usage, and how it is changing over time. A key element of this understanding is the creation of a water budget, which systematically accounts for all water inflows, outflows, usages and storage changes. The water budget provides a comprehensive view of quantum available from different sources, its utilisation, and shortages that might arise. Preparing a water budget is essential to navigate these complex challenges effectively, ensuring water resources are used wisely while paving the way for a more resilient and prosperous future.

A robust water budget can lead to several positive outcomes: enhanced water security by identifying areas with water scarcity early on, allowing policymakers to implement measures to manage resources before critical levels are reached; optimizing the use of available water, ensuring efficient allocation across different sectors and communities; climate resilience by understanding water dynamics; supports planning for future climate scenarios and necessary adjustments to adapt and mitigate impacts; and sustainable development by supporting the practices that balance economic growth with environmental sustainability.

Varuni – a Web based Water budgeting Application developed together with the GIZ India is an automated web application which will help to quantify the gap between water demand and supply and identify the hotspots in water consumed across sectors. Developing and continually improving this water budgeting application may prove to be an important tool for India's long term water management.

This document outlines the concept of the Web based Water budgeting Application and Block level water budgeting briefs for 18 Blocks selected as pilots for this water budgeting exercise. The exercise would be improved further for creating water budgets at State and National levels.

[Yugal Joshi]

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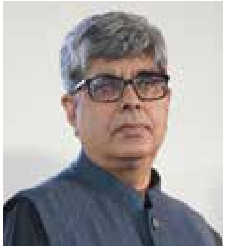

Message

Water is intrinsic not only to life but also to economic growth and development. The honourable Prime Minister of India has highlighted the need for comprehensive and integrated Water Vision@2047, including adaption and mitigation strategies with timelines. He has emphasised on the need for water budgeting and management (both supply and demand sides) at gram panchayat and village as well as town/city level to be taken up universally with people's participation and under leadership of rural and urban local bodies. In rural areas agriculture uses 80-90% of water, therefore appropriate cropping patterns, crop varieties, efficient water utilization need to be promoted with a 'whole of Government' approach.

The Green and Sustainable Development Partnership (GSDP), signed at the highest levels in May 2022 between India and Germany, aims at aligning bilateral, triangular, and multilateral cooperation on climate policy and SDG implementation, particularly focusing on the 2030 Agenda and the Paris Agreement. In the spirit of GSDP, the Indo-German Bilateral Project "Water Security and Climate Adaptation in Rural India (WASCA)" implemented by GIZ in partnership with Ministry of Rural Development and Ministry of Jal Shakti, Government of India, has been instrumental in piloting innovative approaches, strengthening capacity development measures and facilitating knowledge exchange.

Water budgeting is crucial for India's sustainable development, especially in water stressed areas, where resource scarcity and uneven distribution threatens economic stability, food security and climate resilience. Proactive water management needs to shift towards a data-driven approach that systematically accounts for inflows, outflows, and water availability and access. The Jalagam web-based water budgeting application, developed in partnership with NITI Aayog, is instrumental in identifying contextual measures for bridging the gap between water demand and supply, identifying hotspots of consumption, and enabling efficient resource allocation. It's piloting across 18 blocks has demonstrated that a structured water management approach enhances water security, resilience, and sustainability. Its national level uptake will strengthen informed decision-making, ensuring equitable access and robust planning in the face of climate change and growing and competing water demands, ultimately safeguarding India's water future.

I congratulate NITI Aayog and Indo-German Bilateral Project "Water Security and Climate Adaptation in Rural India (WASCA)" project team for successful piloting and documenting the joint efforts in this report. I wish to thank all the primary stakeholders for providing relevant inputs and contributions to this pilot assessment and helping finalise this report for wider dissemination for contributing to India's Water Vison @2047.

[Rajeev Ahal]

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List of Abbreviations

ABP	Aspirational Block Programme
AU	Assessment Units
BCM	Billion Cubic Metre
CGWB	Central Groundwater Board
CWR	Crop Water Requirement
DAHD	Department of Animal Husbandry and Dairying
DIP	District Irrigation Plan
GP	Gram Panchayat
GSDP	Green and Sustainable Development Partnership
GIZ India	Deutsche Gesellschaft für Internationale Zusammenarbeit (GIZ) GmbH
ha.m	Hectare.metre
ICAR	Indian Council of Agricultural Research
IIT-H	Indian Institute of Technology-Hyderabad
IN-GRES	INDIA-Groundwater Resource Estimation System
IWMP	Integrated Watershed Management Programme
JJM	Jal Jeevan Mission
lpcd	Litres per Capita per Day
MI Census	Minor Irrigation Census
MoJS	Ministry of Jal Shakti
MVS	Multi Village Scheme
NCIWRD	National Commission on Integrated Water Resources Development
PIB	Press Information Bureau
PMKSYWDC	Pradhan Mantri Krishi Sinchayee Yojana - Watershed Development Component
PWS	Piped Water Supply
SDG	Sustainable Development Goals
SoE	Stage of Groundwater Extraction
SVS	Single Village Scheme
TGA	Total Geographical Area
T.ha	Thousand Hectares
WASCA	Water Security and Climate Adaptation in Rural India
WCS	Water Conservation Schemes/Structures

Glossary

1. **Aspirational Block Programme (ABP)**: A government initiative that focuses on improving governance to enhance the quality of life and service delivery in India's remotest and less developed blocks.
2. **Crop Water Requirement (CWR)**: The amount of water needed by a crop to meet its needs for optimal growth and yield. It is a key pillar in understanding the water requirements of the agriculture sector.
3. **INDIA-Groundwater Resource Estimation System (IN-GRES)**: A web-based application developed by CGWB and IIT-Hyderabad for the assessment of Groundwater resources. It provides critical information for water budgeting at the block level, including annual Groundwater extraction and Groundwater development status.
4. **Multi Village Scheme (MVS)**: A scheme where water is sourced from a common, often distant, water body (such as a river, reservoir, or large surface water source) and supplied in bulk to multiple villages through a network of pipelines or channels. The scheme is connected to a water-grid or regional supply system.
5. **Sustainable Development Goals (SDG)**: A collection of 17 interlinked global goals designed to be a "blueprint to achieve a better and more sustainable future for all." Collaborative action is seen as key to achieving these goals.
6. **Single Village Scheme (SVS)**: A water supply scheme planned and managed for a single village, using local water sources such as Groundwater, springs, or surface water. The Gram Panchayat or its sub-committees (like Village Water and Sanitation Committee, Paani Samiti, or User Group) are responsible for the planning, implementation, management, operation, and maintenance of the in-village water supply system.
7. **Stage of Groundwater Development:** The stage of Groundwater development is a ratio of Annual Groundwater Draft to the Net Annual Groundwater Availability in percentage.
8. **Stage of Groundwater Extraction (SoE)**: An indicator that reflects the Groundwater situation in a particular block. It is calculated as the ratio of total Groundwater extraction for all uses to the annual extractable Groundwater. Blocks are categorised based on their SoE as 'Safe' (< 70%), 'Semi-critical' (> 70% and <= 90%), 'Critical' (> 90% and <= 100%), or 'Over-exploited' (> 100%).
9. **Strange's Table Method**: An empirical hydrological modelling technique widely used to provide percentages for converting rainfall into runoff based on the classification of catchments as Good, Average, or Poor.
10. **Surface Runoff**: The portion of rainfall that flows over the ground surface, generated from precipitation, and is a primary component of the water supply side. Its quantity at the block level is calculated based on land use classification and average rainfall data using methods like Strange's Table.
11. **Varuni**: A web-based water budgeting application developed for undertaking water budget exercise. It automates the process of quantifying water demand and supply, identifying deficits or surpluses, and providing insights for planning water conservation and management interventions at the block level.
12. **Water Budget**: A crucial tool for water management planning. It provides a comprehensive view of how much water is available from different sources, how it is utilised, and where shortages or surpluses might arise. It systematically accounts for all water inflows, outflows, and storage changes within a specific geographic area.

Executive Summary

1. PROLOGUE

The Hon'ble Prime Minister Shri Narendra Modi has reiterated India's commitment to water conservation and sustainable development, emphasizing water's vital role throughout human history. He called for collaborative efforts with community participation to protect this precious resource for generations to come, and highlighted the importance of a comprehensive Water Vision@2047 as a key element of India's *Amrit Kaal* journey over the next 25 years.

The India's Water Vision 2047 will be a major step towards improving the people's ease of living and meeting their aspirations of a New India. The Second All-India State Water Ministers' Conference, organized by the Ministry of Jal Shakti, Government of India in Udaipur, Rajasthan from 18-19th February 2025 emphasized on water budgeting to optimize demand and availability and the importance of leveraging data, technology, and innovation to improve efficiency and sustainability.

2. WATER BUDGET

For ensuring water security in a specific geographic region, it is essential to have an estimation for water inflow and outflow and demand-supply gap based on water availability and water requirements of that region. The Water budget is an important element for water management planning and adopts a data-driven estimation technique for water availability and water requirements of the region and assesses the gap between them. It can be a vital facilitator for integrated water resources management.

Internationally, water budgeting has been attempted in many countries and it is done either for a region/ watershed/ river basin using precipitation, evapotranspiration, runoff, surface storage, groundwater recharge, soil moisture etc. and using information gathered from remote sensing/ other available data. Countries namely Australia, Brazil Canada, Italy, UAE, United States have prepared the water budgets for specific regions/ river basins/ area.

There are various water budgeting methods available, and practitioners have difficulty in identifying suitable methods for preparing water budget at ground level. Most of these methods are research oriented and require multiple primary information/ inputs, satellite data/ remote sensing data, and hence, difficult to use these complex methods based on manual input feeding, calculations and synchronization for deriving results. Considering these aspects, it was important to develop a simple method automated in the form of a web application for water budgeting for applied purposes. Similar to the assessment of groundwater availability, Block has been adopted as a suitable administrative unit to get ready to use data inputs for water budgeting. It must be noted that the objective of the exercise is to keep the water budgeting estimate simple and use the publically available sources of data for water. The exercise can further be upgraded using advanced methods.

Indo-German Bilateral project implemented by GIZ India in partnership with Ministry of Jal Shakti, and Ministry of Rural Development, Government of India, "Water Security and Climate Adaptation in Rural India (WASCA) has developed a user-friendly scientific methodology to prepare water budget at Block level. This further led to the development of *Varuni* - web application for water budgeting.

This report prepared using the web app, emphasizes the importance of water budgeting - on quantifying water demand & supply. It outlines the methodology for estimating water demand across various sectors viz. human consumption, livestock consumption, agricultural use and industrial use. The report also assesses the water supply by evaluating various sources like run-off and hydrologic modelling, surface supply sources, groundwater supplies and water transfers.

3. ABOUT VARUNI APP

The Varuni Web Application has the potential to assist planning at the intermediate level by informing functionaries about the current water scenario at the Block level. It can alert them about water deficiency or surplus along with potential intervention areas. These insights will help practitioners employ scientific methods to understand Block characteristics through appropriate use of spatial and non-spatial datasets for preparing location-specific development plans. The application enhances accessibility to required datasets and has potential for raising awareness among stakeholders about water management, serving as a valuable tool for addressing India's water security challenges through informed, data-driven planning. It can be concluded that there is large scope for improvement of this exercise in future, which at present serves more as a prime-facie diagnostic tool that can help for immediate water management interventions.

4. COMPONENTS OF WATER DEMAND

4.1 Domestic Water Demand: Domestic water requirements vary between rural and urban areas. In rural areas, the per capita daily requirement, as per the Jal Jeevan Mission guidelines is taken as 55 litres per capita per day (lpcd), while urban areas it is taken as 150 lpcd as per the CPHEEO norms. Water conveyance losses are estimated at 20 percent, though CPHEEO manual mentions the optimal losses to be considered at design stage at 15%. The population data are taken from the Census of India 2011, and estimate for current population is arrived at after applying appropriate decadal growth factor. Annual domestic water requirements are calculated by multiplying the total population by the daily per capita requirement, considering the rural-urban differentiation.

4.2 Livestock Water Demand: The water requirements for livestock are calculated based on the latest livestock census data and daily water requirement coefficients established by ICAR for different animal types. The livestock population is taken from 2019 census report published by the Department of Animal Husbandry and Dairying. Annual domestic water requirements are calculated by multiplying the livestock population by the daily per capita requirement, considering the type of livestock.

4.3 Agricultural Water Demand: Agriculture is the prime water consumer hence it is important to understand the water requirement of the sector. The key parameter is cropping water requirement (CWR). Water requirement of the country for irrigation in high demand scenario for 2025 and 2050 was assessed by National Commission on Integrated Water Resources Development-1999 as 611 BCM (Billion Cubic Metre) and 807 BCM respectively. As per the Land Use statistics, the Gross Irrigated Area is 122.3 million hectares (refer table 3). Accordingly, the crop water requirement is estimated to be 0.50 meters (Total irrigation water demands/Gross Irrigated Area). The crop water requirement is calculated by considering the gross irrigated area of the Block with appropriate growth factor and irrigated water requirement co-efficient of 0.5 m per hectare. Comments were received from multiple sources about the use of 0.5 m for estimation. However, considering the available data, it has decided to use this average value.

4.4 Industrial Water Demand: For the purpose of Block level budgeting, Block and District officials provided inputs about industrial water requirements.

5. COMPONENTS OF WATER SUPPLY

5.1 Surface Runoff: Strange's Table method is a hydrological modelling technique, widely used by CGWB and IWMP (PMKSY-WDC), provides an empirical approach for calculating runoff based on catchment classification. The runoff quantity at Block level is calculated based on land use classification (forest area, non-agricultural uses, barren land, pastures, tree crops, culturable waste land, fallows, and irrigated land) and average rainfall data, applying the Strange's table percentage factors to determine runoff volumes.

5.2 Surface Water Supply: The storage capacity of the surface water structures is an essential component in water supply estimation. The First Census of Water Bodies, conducted alongside the 6th MI Census provides the necessary details of surface water structures in the Block.

5.3 Groundwater Supply: The INDIA-Groundwater Resource Estimation System (IN-GRES) is a web-based application developed by CGWB in collaboration with IIT-Hyderabad for ground water resource assessment, providing essential information for water budgeting at the Block level. The ground water profiling of the Block is sourced from IN-GRES.

5.4 Water Sourced from Outside Geography: Post-independence irrigation projects and water transfers have become major contributors to improving water supplies. Recent drinking water projects, including Jal Jeevan Mission, and industrial projects also rely on long distance water transfers. This aspect must be considered in water supply estimation and budgeting. The required inputs include information about the extent of command areas of irrigation projects located inside/ outside the Block, drinking water schemes, and industries depending on external water sources. Since this information is not readily available in the public domain, Block and District officials provided these inputs for water budgeting.

The above methodology and consideration led to the development of algorithms for *Varuni*- Web Based Water Budgeting Application which pulls data automatically from relevant authentic portals and feeds in for processing to determine water demand and supply side. This application allows evaluation of water availability, ensuring accurate assessments of water budget (deficits or surpluses) at the Block level, and providing key insights for planning water conservation and management interventions.

6. MAJOR OUTCOMES OF THE EXERCISE

The Application for Water Budgeting has been piloted in 18 aspirational Blocks across varied state/ agro-climatic zones in India. Using Varuni App, this report provides Block-level water budget briefs for each of these Blocks, offering insights into their specific water demand-supply scenarios, challenges, and recommendations related to water resource management and facilitates, identifying suitable measures for enhancing water security in the Block. A comparative analysis of the water budgets across the 18 Blocks is also presented.

The Block-level analysis across various regions reveals significant diversity in water resource availability, usage patterns, and associated challenges. Broadly, Blocks can be categorized based on their geographical and climatic contexts such as coastal, Gangetic plains, Himalayan, arid/semi-arid, and plateau regions—each with unique water management concerns.

6.1 Coastal Regions: Blocks like Gangavaram (Andhra Pradesh) and Andimadam (Tamil Nadu) are marked by low irrigation coverage and a high dependency on surface water due to salinity issues. These areas face risks of sea water intrusion and require improved water use efficiency and protection of groundwater quality.

6.2 Gangetic Plains: Blocks such as Fatehpur, Gangiri, Nindaura, and Kotwali show extensive agricultural land use and moderate to high water harvesting capacities. However, Blocks like Gangiri and Kotwali face substantial water deficits and heavy reliance on groundwater, placing them in semi-critical categories. Surface water from canal systems supplements local water needs, especially in Nindaura and Kotwali, but increasing external dependence raises sustainability concerns.

6.3 Himalayan and Cold Desert Regions: Blocks including Nirmand, Rupsho, and Namchi exhibit unique characteristics, with spring and glacier-fed irrigation systems. Nirmand and Rupsho are water surplus due to low local demand and high-altitude water availability, while Namchi, despite its spring-shed management (Dhara Vikas), is water deficit, emphasizing the need for better spring conservation.

6.4 Arid and Semi-Arid Regions (Rajasthan and Bundelkhand): Water scarcity is acute in the following Blocks: Kotri, Abu Road, Bhim, Baldeogargh, and Buxwaha. Blocks like Kotri and Abu Road are overexploited with groundwater development stages exceeding 100%. Despite irrigation infrastructure, utilization remains low, indicating inefficiencies in surface water usage. Baldeogarh shows the highest deficit (-11,237.5 ha.m), needing catchment area treatments, surface storages and groundwater recharge strategies.

6.5 Plateau and Central India: Chhaigon Makan and Narva Blocks demonstrate contrasting scenarios. While Chhaigon Makan Block has high groundwater reliance and is semi-critical, Narva is water surplus, supported by small and medium irrigation projects. The Vijaypur Block in Madhya Pradesh stands out as surplus despite high irrigation demands, observed largely due to conjunctive use of surface and groundwater.

6.6 Reservoir-Dominated Blocks: Kukarmunda Block in Gujarat, despite having the Ukai dam with substantial surface water storage, heavily relies on groundwater (96%). This over-dependence poses future sustainability risks, despite the current “safe” groundwater status.

7. KEY ACTION POINTS

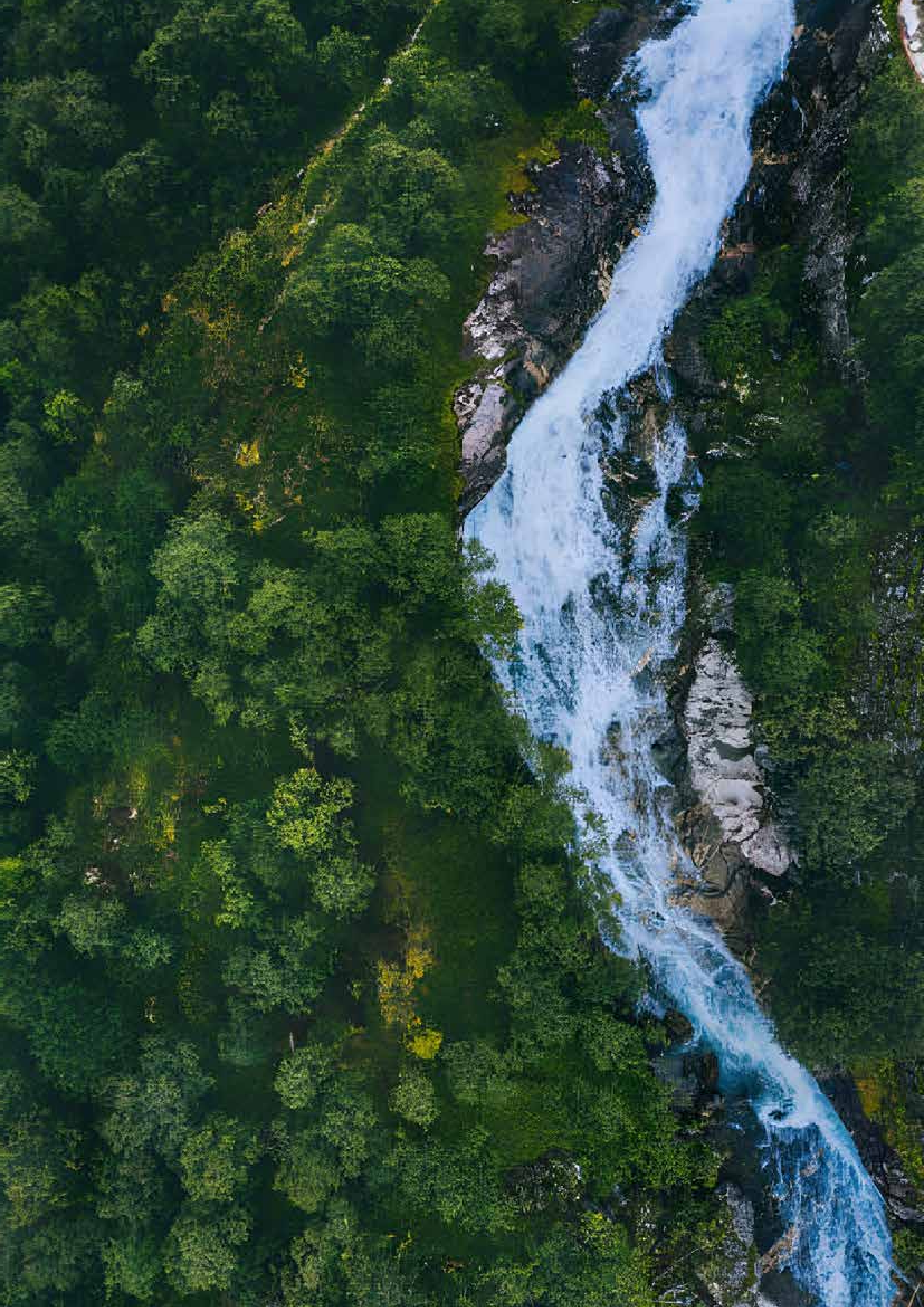
This assessment clearly highlights the needs for integrated water resource planning, incorporating region-specific strategies to enhance water security and resilience across diverse agro-ecological zones:

7.1 Water Deficits: Water deficits are a significant concern in several Blocks. Namchi Block (94%), Gangiri Block (60%), Baldeogargh Block (53%) Andimadam Block (42%), Abu Road Block (41%), Kukarmunda Block (37%), Kotri Block (21%), Chhaigon Makan Block (14%), and Kotwali Block (11%). These deficits highlight the urgent need for improved water management strategies tailored to each region’s specific context.

7.2 Overexploitation: A few Blocks (e.g., Kotri, Abu Road) exceed 100% groundwater development.

7.3 Underutilization: Surface water resources are underutilized in Blocks like Fatehpur, Buxwaha, and Abu Road, highlighting potential for better infrastructure and management.

7.4 Regional Priorities: Tailored interventions needed, coastal Blocks should focus on salinity management, Bundelkhand on groundwater recharge and surface storage creation and Himalayan areas on spring protection.



CHAPTER I

Introduction and the Methodology

1. Introduction

Water budgeting is an essential tool in modern hydrology and water resources management, providing a systematic framework for understanding, quantifying, and managing the flow and storage of water within a defined area or system. Analogous to a financial budget, a water budget tracks all inflows and outflows of water, as well as changes in storage, to ensure a comprehensive understanding of water availability and use. This process is fundamental for sustainable water management, environmental protection, and the effective planning of water resources for various sectors including agriculture, industry, and domestic use.

At its core, water budgeting involves the calculation of all water inputs, such as precipitation, surface water inflow, and Groundwater recharge—against all outputs, including evapotranspiration, runoff, and Groundwater discharge.

Water budgeting is not limited to simple accounting; it also provides insights into the dynamics of water movement within the natural environment, including the interactions between surface water and Groundwater, and the impact of human activities on these systems. By considering both spatial and temporal variations, water budgets can be applied at various scales—from individual farms to entire watersheds or river basins. This flexibility allows for tailored water management strategies that address local needs and challenges, such as water scarcity, flooding, or the effects of climate change.

The importance of water budgeting extends beyond technical calculations. It serves as a foundation for evaluating water use in relation to ecological, social, and economic factors. For example, water budgets help communities determine how much water is available for drinking, agriculture, and livestock, and whether current usage is sustainable. When deficits are identified, action plans can be developed to address shortages through conservation, improved irrigation practices, or the development of alternative water sources.

Historically, water budgeting was primarily used in agriculture for irrigation scheduling and crop water requirements. However, as global populations have grown and water scarcity has become more pronounced, the scope of water budgeting has expanded to include urban water supply, flood control, and environmental protection. Today, water budgeting is a critical component of water resource planning, drought and flood risk mitigation, and the implementation of water conservation strategies.

1.1 **Developing accurate water budgets is a complex task due to several key challenges:**

1.1.1 **Data Availability and Quality:** Reliable water budgeting requires comprehensive and high-quality data on inflows, outflows, and storage changes. Often, data are incomplete, inconsistent, or unavailable, especially in regions with limited monitoring infrastructure.

1.1.2 **Complexity of Hydrologic Systems:** Natural water systems are dynamic and interconnected, making it difficult to accurately account for all components such as surface water, Groundwater, and inter-basin transfers. The complexity increases with scale and varying land use.

1.1.3 **Measurement and Estimation Uncertainties:** There are inherent uncertainties in measuring precipitation, evaporation, runoff, and Groundwater fluxes. These uncertainties can accumulate and significantly affect the accuracy of water budget calculations.

1.1.4 **Inconsistent Definitions and Methods:** Different agencies or regions may use varying definitions for water budget components and employ non-standard accounting techniques, leading to inconsistencies and difficulties in comparison and integration.

1.1.5 **Stakeholder Engagement and Institutional Frameworks:** Effective water budgeting requires coordination among diverse stakeholders and robust institutional support. Lack of engagement or weak policy frameworks can hinder implementation and accuracy.

1.1.6 **Climate Change and Variability:** Changing climate patterns introduce additional uncertainty, affecting precipitation, evaporation, and the overall hydrologic cycle, which complicates long-term water budget projections.

1.1.7 **Inter-basin Fluxes and Omitted Components:** Water budgets often fail to account for all fluxes, such as inter-basin Groundwater flow or irrigation transfers, leading to residuals and errors in closure.

Addressing these challenges requires improved data collection and sharing, standardised methods, enhanced stakeholder collaboration, and the integration of climate change considerations into water budget frameworks.

The idea of water budgeting is quite frequently referred in to terms of understanding water scenarios specifically for watershed management and at times for domestic water supply. However, the preparation of water budget is seldom done. In practice, this exercise is seldom considered in assessment and planning. Another challenge is that there are various water budgeting methods, and practitioners struggle to identify water budgeting methods suitable for their planning and implementation level.

The situation exacerbates because most of these methods are complex and research-oriented; and require multiple inputs, including primary information. Therefore, practitioners find them difficult to use. Further, most of the water budgeting methods are based on manual input feeding, calculations and synchronisation for deriving results.

Looking at these crucial aspects, it is important to identify a simple yet efficient method for applied purpose and to automate publicly available data and input what is not available, manually in the form of a web application for water budgeting.

1.2 Picking up Aspirational Blocks for Water Budgeting:

Internationally, water budgeting has been attempted in many countries and it is done either for a region/ watershed/ river basin using precipitation, evapotranspiration, runoff, surface storage, Groundwater recharge, soil moisture etc. and using information gathered from remote sensing/ other available data. Countries, namely Australia, Brazil Canada, Italy, UAE, United States have prepared the water budgets for specific regions/ river basins/ area.

The Central Groundwater Board does Groundwater assessment at block level. Further the Centre for Water Resources Development and Management, Kozhikode, under the Government of Kerala carried out the water budgeting exercise at the Gram/ Village Panchayat (GP) level. At the national level, as per the Local Government directory website, there are 2,55,337 Village Panchayats and 7,309 developmental blocks. Hence considering the large number of village panchayats, it was decided to take up the water budgeting at the block level. Also, this exercise can be scaled up to the State/ national level after incorporating improvements.

NITI Aayog is spearheading the development of Aspirational Districts and Blocks. Therefore, it was thought desirable to begin this exercise in select aspirational blocks. Secondly, a localised approach offers several key benefits in preparing an accurate water budget, such as:

1.2.1 **Precision in Data and Management:** Block water budgets use site-specific data on rainfall, soil type, Groundwater levels, and land use, resulting in more accurate assessments of available water and actual demand. This precision helps communities and block/ district to make informed decisions about water allocation and conservation.

1.2.2 **Enhanced Community Engagement:** By involving local stakeholders—farmers, residents, and water user associations—the approach fosters a sense of ownership and responsibility. This leads to better compliance with water-saving practices and more equitable distribution, reducing conflicts and overuse.

1.2.3 **Adaptability to Local Conditions:** Block-based strategies can be tailored to address unique climatic, geographic, and socio-economic challenges. For example, communities can prioritise water-efficient crops or implement rainwater harvesting systems suited to their specific environment.

1.2.4 **Efficient Demand Management:** With a clear understanding of local water use patterns, interventions such as metering, progressive tariffs, and education campaigns become more effective. This can reduce wasteful consumption and ensure that water is allocated to its highest-value uses.

1.2.5 **Improved Resilience:** Localised approaches allow for rapid response to changing conditions, such as droughts or floods, by adjusting water use and infrastructure investments at the community level. This agility is crucial for adapting to climate variability and ensuring long-term water security.

1.3 Water Budgeting Efforts in India

1.3.1 **Atal Bhujal Yojana:** Under Atal Bhujal Yojana, the programme of Department of Water Resources River Development and Ganga Rejuvenation, preparation of Water Budget and its regular updation is one of the key activities by involving local community through participatory approach to ensure sustainability of Groundwater. Participation of women in this planning process is a pre-requisite. To sensitise and aware community at Gram Panchayat level, intensive IEC and capacity building activities have been carried out in all the Gram Panchayats under Atal Jal. The Water Budget prepared by the community thus indicates whether the Gram Panchayat is "Water Surplus" or "Water Deficit". The water budget thus helps the community with regard to utilisation of water judiciously and futuristic planning.

1.3.2 **Centre for Water Resources Development and Management:** In Kerala, water budgeting is carried out by the Centre for Water Resources Development and Management (CWRDM), in collaboration with the Haritha Keralam Mission, the State Irrigation Department, the Groundwater Department, the Soil Conservation and Survey Departments, Local Self Government Institutions (LSGIs), and MGNREGS. Water availability is calculated based on rainfall, land use, and runoff coefficients, while accounting for inter-LSGI water transfers. Demand is estimated for domestic, agricultural, livestock, industrial, and tourism needs, based on population and land use data. Given Kerala's climatic pattern, water budgets are prepared using 10-day units across a water year (June–May), rather than on an annual basis. The process is participatory, led by local bodies with support from technical departments ensuring data integrity.

2. Understanding Water Demand Side

The availability of water is limited but the demand for water is increasing rapidly due to growing population, rapid urbanisation, industrialisation and economic development. Availability of water for utilisation needs to be augmented to meet increasing demands of water.

Water is required for domestic, agricultural, hydropower, thermal power, navigation, recreation, etc. Utilisation in all these sectors should be optimised through creating awareness of water as a scarce resource. Agriculture consumes maximum water followed by sectors like industry, drinking, energy and others. The Centre, the States and the local bodies are ensuring access to a minimum quantity and quality of potable water for essential health and hygiene to all its citizens, through a tap water connection to each household. Community based water management is being institutionalised and strengthened. Systematic efforts to be taken to benchmark water use efficiency of existing water supply systems and to incentivise efficient use of water. The 'project' and the 'basin' water use efficiencies need to be improved through continuous water budgeting and water accounting studies.[1]

2.1 Water Requirements for Human Consumption

The water requirements for human population are differentially determined for rural and urban areas in India. For the rural areas, the rural population needs are fixed at a minimum provision of 55 litres per capita daily (lpcd).[2] whereas for urban areas it is 150 lpcd.[3] The estimation of water demand side is generally derived based on these provisions. So far, the human water demands are calculated manually hence, it remains challenging for practitioners to source correct datasets from various sources and do manual calculations. To make this process user-friendly it is important to automate the process of human water demand calculation and make it available for water budgeting.

To estimate the human water requirement, the key input is human population. Currently, the most authentic information about human population is available in the form of Census of India 2011. The decadal population growth rate is 17.70% between 2001 and 2021.[4]

Additionally, 7.3% is taken for 2021- 2025, totalling to 25% population growth. In addition, 20% of water conveyance losses are also considered. The formula used for automating annual human water requirement estimating is as below.

1 National Water Policy (2012)
2 JJM norms
3 Daily water requirements as recommended by CPHEEO
4 https://pib.gov.in/PressReleasePage.aspx?PRID=1602755

Equation 2.1.1 Calculation of Annual Human Water Requirements.

Annual human water requirement (ha. m) = (Population + decadal growth) * (LPCD + loses@20%) *(annual days) / (1,00,00,000)

Table 2.1.1 Water Requirements for Human Consumption

Total Population (Census 2011)	Current Population of a block (with growth)	Daily Water requirement (in litre)	Annual Water Requirements (in ha.m)
Rural		55	
Urban		150	

2.2 Water Requirements for Livestock Consumption

India has a large and rising animal livestock population comprising of cow/cattle, buffaloes, goats, sheep, camels, etc. Draught power for agriculture, animal products (meat, leather, wool, etc.) and dairy are the main purposes for rearing large ruminants while small ruminants are reared in a low-input intensity manner taking advantage of the forest and common lands. Livestock contributes significantly to the household economy of the poor. Therefore, the water requirement of livestock has an important dimension of social equity.

The Department of Animal Husbandry and Dairying (DAHD) released a census report on livestock population for 2019. The data revealed that the livestock population in India has grown by 4.6% from 51.2 crore in 2012 to about 53.6 crore in 2019. The population of cows showed an increase of 18% over the previous census. The number of other cattle have marginally increased, but cows account for one-fourth of the total livestock population of India.

Livestock needs water for three purposes - for mere survival, water for growing feed & fodder for the livestock, and water for cleaning, etc. The presence of open-water bodies for buffaloes to bathe in the summer is helpful for a proper reproductive cycle. Some of these needs (e.g. in the case of open-grazing livestock that grazes or browses on wastelands and forests) are met with green water while stored (blue) water must be deliberately diverted to meet the other needs. Water is used in the cleaning or bathing of livestock non-consumptively.

The estimation of water requirements of livestock is derived based on the latest livestock census 2019 datasets of the block and the co-efficient arrived at by Indian Council of Agricultural Research (ICAR) about per day water requirements of the different types of livestock. The formula used for the estimating annual water requirements for livestock is given below.

Equation 2.2.1 Calculation of Water Requirements for Livestock

Annual livestock water requirement (ha. m) = Population * Water requirement per livestock unit in LPCD * annual days/1,00,00,000

Table 2.2.1 Livestock Drinking Requirements

Type of Animal	Numbers in a block	Daily Water requirement[5] (in litre)	Annual Water Requirement (in ha.m)
Cow/Cattle		67	
Buffaloes		67	
Sheep		7	
Goat		7	
Horses		44	
Camels		21	
Pigs		22	
Total			

2.3 Water Requirements for Agricultural Use

Water requirement of the country for irrigation in high-demand scenario for 2025 and 2050 has been assessed by the National Commission on Integrated Water Resources Development-1999 as 611 BCM (Billion Cubic Metre) and 807 BCM respectively[6]. As mentioned in the report of the National Commission for Integrated Water Resources Development (NCIWRD), the percentage of water used for irrigation out of the total water use for 1997-98 was 83.30%. Further, as per NCIWRD report, the percentage of water used for irrigation out of the total water use for 2025 under the high demand scenario was estimated as 72.48%[7]. Therefore, improving water use efficiency is the key priority of Indian agriculture.

On the other hand, inefficient and dilapidated canal irrigation systems have led to a spurt in Groundwater development. As per the latest Dynamic Groundwater Resources assessment (2024) by Central Groundwater Board (CGWB)[8], the Annual Extractable Groundwater Resource is 406.19 BCM. The Annual Groundwater Extraction for all uses is 245.64 BCM. The average stage of Groundwater extraction for the country as a whole works out to be about 60.47 %. The water need of a crop is expressed in mm/day, mm/month or mm/season. Suppose the water need of a certain crop in a very hot dry climate is 10 mm/day. This means that each day, the crop needs a water layer of 10 mm over the whole area on which the crop is grown.

Agriculture is the prime water consumer hence it is important to understand the water requirement of the agriculture sector. The key pillar is crop water requirement (CWR). ICAR has conducted research studies and determined CWR for different rainfed and irrigated crops. The Agriculture Department releases crop census periodically which is a critical input for getting crop acreage to estimate the agriculture water requirement of the area of interest (Block)[9].

5 https://doi.org/10.56093/ijans.v84i10.44302
6 https://pib.gov.in/PressReleaseIframePage.aspx?PRID=1914353
7 https://pib.gov.in/PressReleasePage.aspx?PRID=1604871#:~:text=by%20PIB%20Delhi-,Water%20availability%20per%20person%20is%20dependent%20on%20population%20of%20the,reply%20in%20Rajya%20Sabha%20today
8 https://cgwb.gov.in/cgwbpnm/public/uploads/documents/17357182991031590738file.pdf
9 District Irrigation Plan (2015-23)

As per Land Use statistics, the Gross Irrigated Area is 122.3 million hectares (refer table 2.3.1). Accordingly, the crop water requirement is estimated to be 0.50 metres (Total irrigation water demands/Gross Irrigated Area). **As per Land Use statistics for 2011-12, cropping intensity was 138.9%[10] and as per Land Use statistics 2022-23, the cropping intensity was 155.9%, which is showing a growth of 17%[11] (*for 2011-12 to 2022-23*) (refer table 2.3.1 for details).** The detailed note on methodology followed for crop water calculation is at **Annexure-2.**

Table 2.3.1 Irrigation Intensity and Cropping Intensity Calculation[12]

Year	Net Irrigated Area (T.ha)	Gross Irrigated Area (T.ha)	Net Un- Irrigated Area (T.ha)	Net area Sown (T.ha)	Total Cropped Area (T. ha)	Cropping Intensity (% of col.6 over col.5)
1	**2**	**3**	**4**	**5**	**6**	**7**
2011-12	66,009	91,931	74,783	1,40,792	1,95,546	138.9
2012-13	66,589	92,780	73,157	1,39,746	1,94,455	139.1
2013-14	68,419	96,270	72,819	1,41,238	2,01,300	142.5
2014-15	68,582	97,846	70,863	1,39,445	1,98,285	142.2
2015-16	67,772	97,754	71,202	1,38,974	1,98,122	142.6
2016-17	69,270	99,620	69,730	1,39,000	2,01,158	144.7
2017-18	70,164	1,01,467	68,606	1,38,770	2,00,876	144.8
2018-19	72,244	1,04,711	66,195	1,38,439	2,01,179	145.3
2019-20	75,469	1,12,443	64,433	1,39,901	2,11,359	151.1
2020-21	77,729	1,18,934	63,815	1,41,544	2,16,107	152.7
2021-22	77,916	1,20,380	63,091	1,41,007	2,19,158	155.4
2022-23	79,312	1,22,294	61,393	1,40,705	2,19,357	155.9

As per land use statistics for 2022-23, the geographical area of our country is 328.7 million hectares, of which around 55.8% is agricultural land, 140.705 million hectares is the reported net sown area, and 219.357 million hectares is the gross cropped area with a cropping intensity of 155.9[13].

The water requirement for agriculture is calculated based on the formula below.

Equation 2.3.1 Calculation of Irrigation Water Requirements

Irrigation Water Requirement = Gross Irrigated Area (Ha)* Growth Factor (17% for the period of 2011-12 to 2022-23) * Irrigation Requirements (0.50 metres)

10 Land Use Statistics at A Glance: 2021-22, Government of India Ministry of Agriculture & Farmers Welfare Department Of Agriculture & Farmers Welfare Economics, Statistics and Evaluation Division New Delhi, 2023

11 Land Use Statistics at A Glance: 2022-23, Government of India Ministry of Agriculture & Farmers Welfare Department Of Agriculture & Farmers Welfare Economics, Statistics and Evaluation Division New Delhi, 2024

12 Ibid 6&7

13 Ibid 7

Table 2.3.2 Irrigation Water Requirement

Irrigated Area[14] (in ha)	Area with Growth Factor	Water required (ha.m)	Irrigation Water Requirement (ha.m)
1	2	3	4 = (2*3)

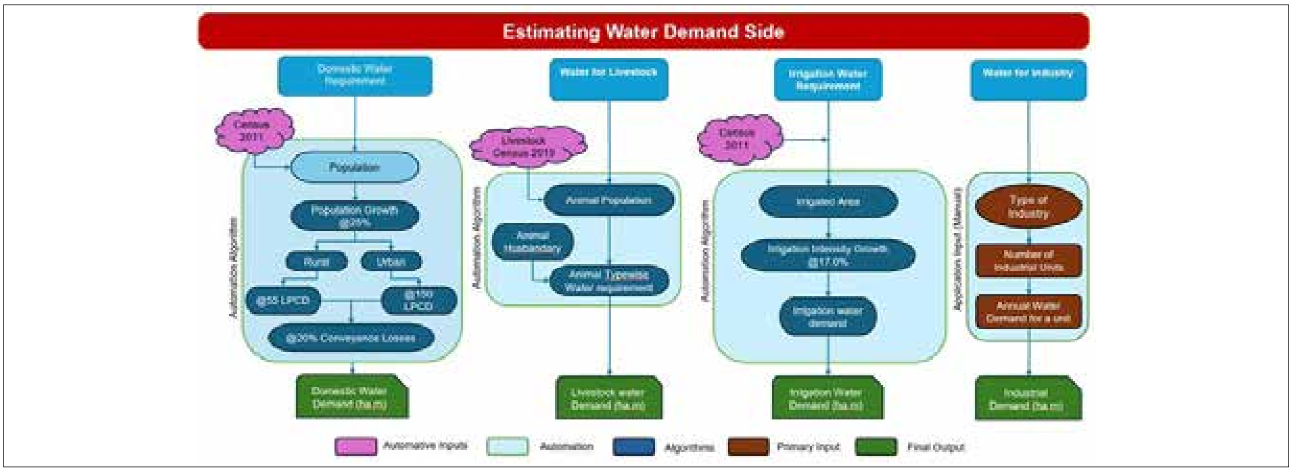
2.4 Water Requirements for Industry

Water demand of industries has been growing exponentially in the recent decade hence; it is important to consider water requirements for various types of industries operational in the block to have the correct estimation of industrial water demand and prepare a reliable water budget. Information about the type of industries, scale, and water requirements is not available in the public domain, so it is difficult to develop any algorithm to automate the water demand estimation in the web application for water budgeting at block the level. Here inputs need to be provided by the block/district officials to factor in industrial water requirements for the water budgeting.

Table 2.4.1 Industrial Water Requirement (to be collected at block level)

Type of Industry	Number of Industrial Units	Annual Water Demand for the industry (ha.m)
1	2	3

Figure 2.4.1 Schematic Representation of Demand Side Estimation



3. Understanding Water Supply Side

The water supply side primarily depends on precipitation and subsequently generates runoff. In terms of the key supply sources, three types of sources are important i.e.

(i) Surface water sources i.e., tanks, ponds, reservoirs, streams, etc.

(ii) Groundwater sources i.e., open well, tube well, springs, etc.

(iii) Water transfer (Net transfer = inwards-outwards) i.e., irrigation projects (canals), drinking water schemes, etc.

Surface water refers to the collection of water on the ground or in a stream, river, lake, wetland, or ocean. It is naturally replenished by precipitation and lost through evaporation and sub-surface seepage into Groundwater. The availability of surface water in a geography de-

14 Census, 2011

pends upon the precipitation within the geography, storage capacity (lakes, wetlands and artificial reservoirs), permeability of the soil, runoff characteristics of the land, precipitation intensity and the local evaporation rates, etc.

3.1 Run-off and Hydrologic Modelling

The rainfall–run-off models are commonly used for calculating the runoff. Basic components of rainfall-runoff modelling are:

3.1.1 Precipitation
3.1.2 Interception, evapotranspiration, accumulation in depression, infiltration, percolation
3.1.3 Channel flow run-off
3.1.4 Watershed geometry, drainage network, and other map-type information
3.1.5 Soil moisture
3.1.6 Delineated land use classes

3.2 Estimation of Surface Runoff by Strange's Table Method

The Strange table (**refer Annexure-1**) is an empirical method for calculating runoff based on observations. The Strange table is widely used by CGWB[15] and IWMP (PMKSY-WDC) for its simplicity and ease of use to calculate the runoff. This standardised table gives percentages for converting rainfall into runoff. For use of these tables, catchments have been classified as Good, Average and Poor as follows:

Good catchment: These areas are represented by hills or uplands with little cultivation and moderately absorbent soil. The slope of this catchment is more than 20% and it is known as a high run-off potential catchment or run-off zone in the region. Hence, the interventions to regulate the run-off and to check soil erosion can be planned on the basis of watershed approaches such as CCTs, gully plugs, etc.

Average catchment: These areas have moderate slopes partly cultivated, stiff, gravely/sandy absorbent soil and belong to the uniform topography of the plateau region. The slope of this catchment is between 5% and 20% respectively. It is known as a moderate potential catchment area or recharge zone of the region. Hence, water recharge measures, such as check dams and gabions can be planned in this zone.

Poor catchment: These areas comprise plains and cultivated sandy soil and mostly lie in downstream areas near river courses. The slope of the catchment is below 5%. It is classified as the low potential catchment or storage zone of the region. Hence, water storage structures such as farm ponds, earthen bunds, etc., can be planned in this zone.

Equation 3.2.1 Calculation of Run-off from Strange's Table

Calculation of Run-off from Strange's Table
Annual Rainfall in mm (x) / 1000 = Annual Rainfall in metre (y)
Actual runoff (z) = y * area (hectare) * %age of run-off as per Strange's table /100

To calculate the run-off quantity in a particular region, it is essential to identify the land use of that region along with the area as per table 3.2.1.

15 Master plan for artificial recharge to Groundwater in India – 2020

***Table 3.2.1 Information on Land Use*[16]**

S. No	Classification	Area (in ha)
1	Forest Area	
2	Area under Non-Agricultural Uses	
3	Barren & Un-cultivable Land Area	
4	Permanent Pastures and Other Grazing Land Area	
5	Land Under Miscellaneous Tree Crops etc. Area	
6	Culturable Waste Land Area	
7	Fallows Land other than Current Fallows Area	
8	Current Fallows Area	
9	Total Unirrigated Land Area	
10	Area Irrigated by Source	

Table 3.2.2 Volume of Run-off Generated

Average Rainfall data[17]: ____ mm

Types of Run-offs	Area (in ha)[18]	Run-off (cu.m per ha)	Run-off (in (ha.m)
1	2	3	4=(2*3*Rain-fall)/10,00,000
Good Catchment Area	Forest + Area under Non-Agricultural Uses + Barren & Un-cultivable Land		
Average Catchment Area	Permanent Pastures and Other Grazing Land Area + Land Under Miscellaneous Tree Crops etc. Area + Culturable Waste Land Area		
Poor Catchment Area	Fallows Land other than Current Fallows Area + Current Fallows Area + Total Unirrigated Land Area + Area Irrigated by Source		
Total			

3.3 Surface Water Bodies

The First Census of Water Bodies[19] conducted in convergence with the 6th Minor Irrigation Census resulted in substantial savings in planning, training of field staff, security, data entry, validation, etc., because the coverage area of the Census in rural area and covered urban areas considering all types of uses of water bodies like irrigation, industry, pisciculture, human, recreation, religious purpose, Groundwater recharge and other purposes. 24,24,540 water bodies have been enumerated in the country, out of which 97.1% (23,55,055) are in rural areas and only 2.9% (69,485) are in urban areas. 59.5%

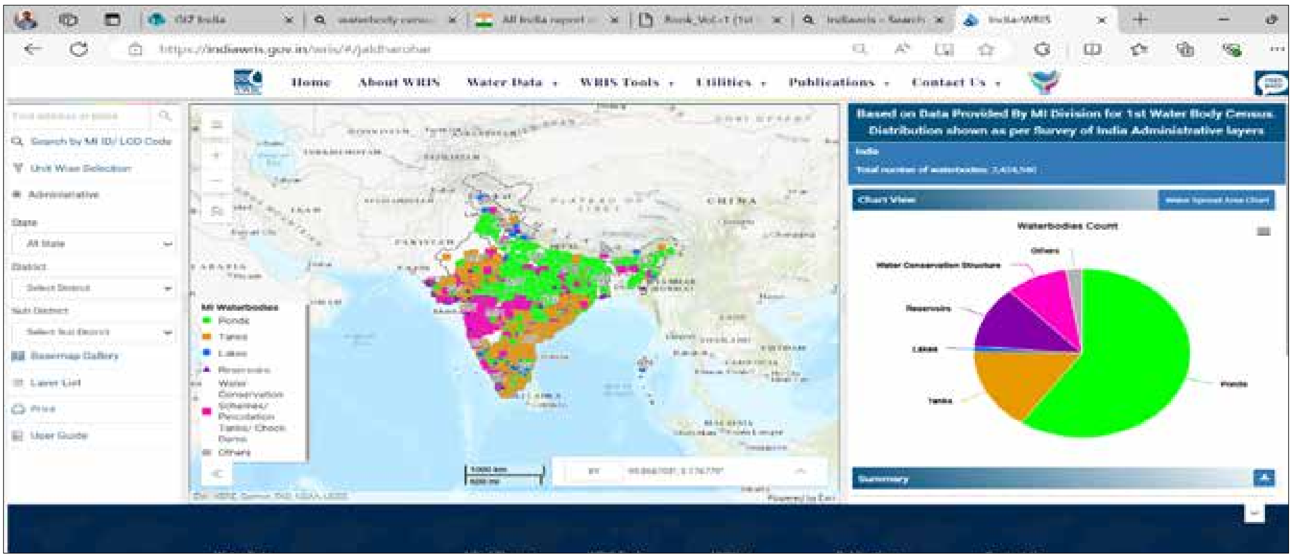
16 Census 2011
17 Average rainfall data GecDashboard (iith.ac.in)
18 Census 2011
19 Waterbody census, 2023, India-WRIS (indiawris.gov.in)

(14,42,993) of water bodies are ponds, followed by tanks (15.7%, i.e., 3,81,805), reservoirs (12.1%, i.e., 2,92,280), Water conservation schemes/percolation tanks/check dams (9.3%, i.e 2,26,217), lakes (0.9%, i.e., 22,361) and others (2.5%, i.e. 58,884).

Table 3.3.1 Water storage in Water Bodies[20]

S. No	Names of Structures	Existing Structures	
		No.	**Storage Capacity (in ha.m)**
1	Ponds		
2	Tanks		
3	Lakes		
4	Reservoir		
5	Water Conservation Structure		
6	Other		
Total			

Figure 3.3.1 MI Census Data from INDIWRIS



3.4 Surface Water Supply Sources

The surface water supply sources include canal networks, minor irrigation projects, tank-based irrigation, diversion-based irrigation, lift irrigation projects, multi village scheme (MVS) for drinking water, other sources i.e., springs, streams, etc. The land use census provides information about irrigation by different sources including surface water sources, hence, information about water supplies from surface sources is referred from land use census as described in the table below:

20 Ibid

Table 3.4.1 Surface Water Supplies for Irrigation (Source: Land Use Census 2011)

Type	Area Irrigated (ha)	Water Supply (ha.m)
Canals Area		
Tanks/Lakes Area		
Waterfall Area		
Other Source Area (Water from outside)		
Total		

3.5 Groundwater Supply Sources

As per the latest Dynamic Groundwater Resource Assessment done by CGWB, 2023[21], the Stage of Groundwater Extraction (SOE), i.e. the ratio of total Groundwater extraction for all uses to the annual extractable Groundwater, for the country stands at 59.26%. Out of the total 6553 Assessment Units (AUs) in the country, which are generally blocks/*taluks/tehsils*, 736 units (11.23%) have been categorised as 'Over-exploited where the SOE is more than 100%. Further, 199 units (3.04%) have been categorised under 'Critical' and 698 units (10.65%) as 'Semi-critical'. Overall, 4793 units (73.14%) were under 'Safe' category, and 127 units (1.94%) were 'Saline'. The SOE acts as an indicator for understanding the Groundwater situation in a particular block that will have further use in regulation and management of Groundwater. The overexploited and critical units need attention and strategies for sustainable supply of drinking water.

3.5.1 INDIA-Groundwater Resource Estimation System (IN-GRES)

Assessment of 'Dynamic Groundwater Resources of India' is carried out at periodical intervals jointly by the CGWB and State/UT Groundwater Departments under the guidance of State Level Committee at State levels and under the overall supervision of Central Level Expert Group. Last assessment was carried out in 2017 and re-assessment of Dynamic Groundwater Resources of India, 2020 has been carried out based on the norms and guidelines of Groundwater Resource Estimation Committee (GEC-2015) methodology.

The assessment involves computation of Annual Groundwater Recharge and Annual Extractable Groundwater Resources, Total Annual Groundwater Extraction (utilisation) and the percentage of utilisation with respect to Annual Extractable Groundwater Resources (Stage of Extraction). The assessment units (blocks/*taluks/mandals/tehsil/firkas*, etc.) are categorised based on the Stage of Extraction (SoE) i.e 'Safe' if SoE < 70 %; 'Semi-critical if SoE> 70 and <= 90 %; 'Critical' if SoE>90 and <=100 % and 'Over-exploited' if SoE> 100 %.

INDIA-Groundwater Resource Estimation System (IN-GRES)[22] is a software/web-based application developed by CGWB in collaboration with Indian Institute of Technology-Hyderabad (IIT-H) for assessment of Groundwater resources.

This portal offers Groundwater related information required for Groundwater supply estimation at block level. The critical information required for water budgeting is the annual Groundwater extraction in the block supplemented by information about Groundwater development status.

Table 3.5.1 Groundwater Supply

S.No	Annual Groundwater Extractable (ha.m)	Annual Groundwater extraction (ha.m)	Stage of Ground-water extraction (in %)	Groundwater extraction category

Figure 3.5.1 Groundwater profile of India as shown in IN-GRES application

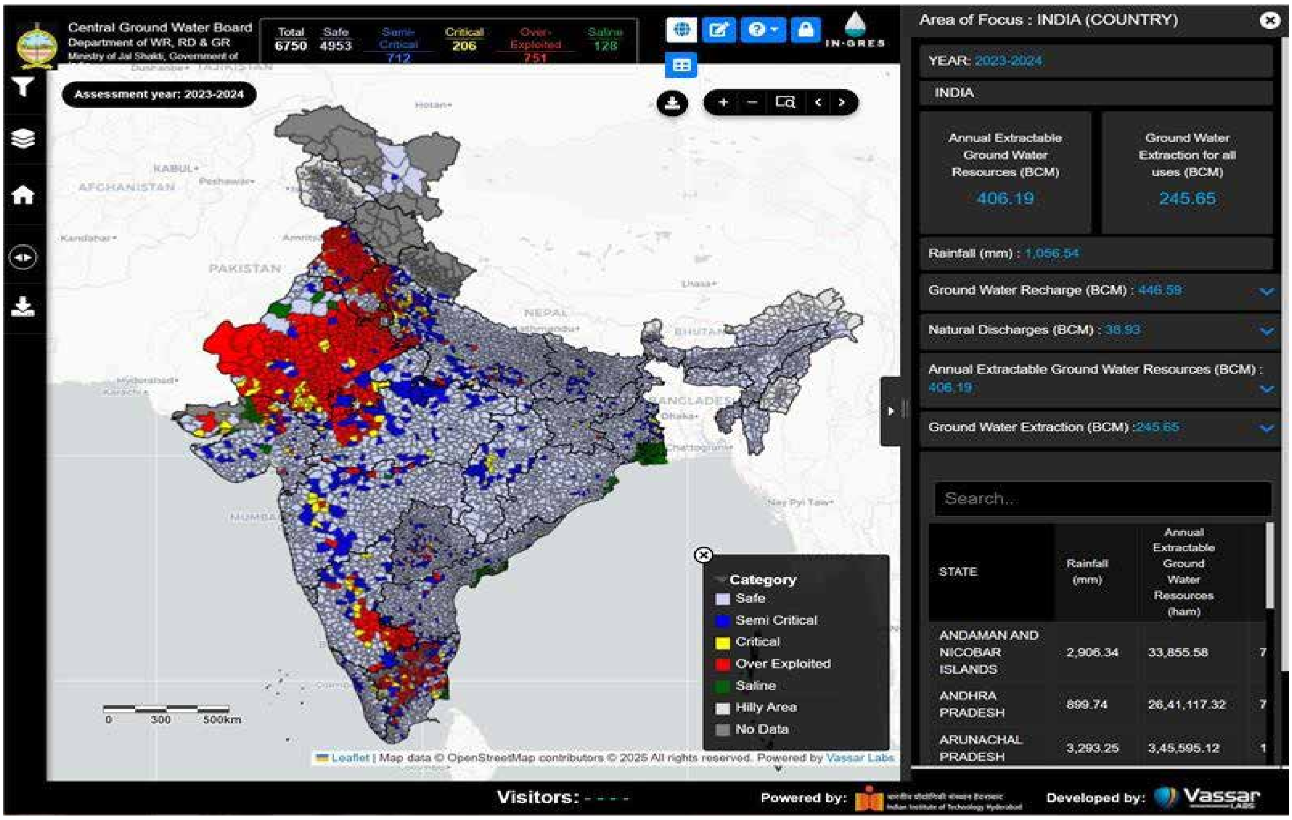


Figure 3.5.2 Groundwater profile of a block as shown in IN-GRES application

3.6 Water Transfer (Net Transfer = Inwards-Outwards)

Post-independence, the emergence of irrigation projects and introduction of water transfers became a major player in improving water supplies for different purposes and in recent years, drinking water projects including JJM and industrial projects relied on water transfers. Looking at the importance and contribution of water transfers among geographies, it is pertinent to consider this aspect in water supply side estimation and budgeting.

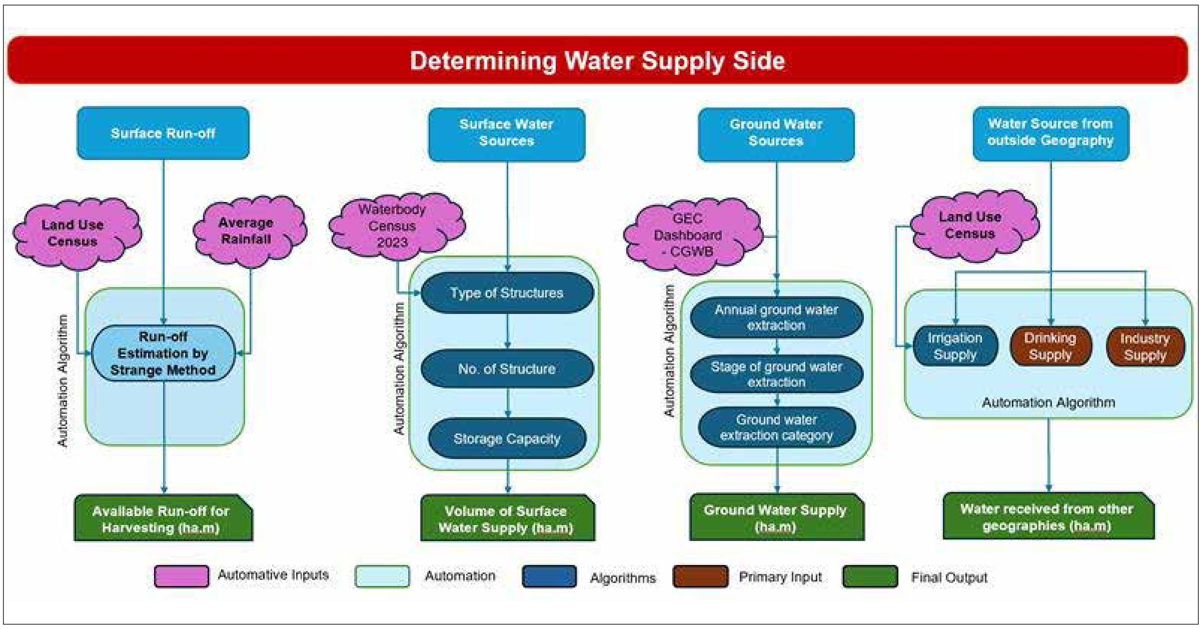
The required inputs for estimation of water transfer (Net transfer = inwards - outwards) are the extent of command area of irrigation projects, water transfer for drinking water scheme and industries.

These critical inputs are not available in the public domain, so it is difficult to develop any algorithm to automate the estimation of water sourced from outside of the geography through the web application for water budgeting at the block level. Here inputs need to be provided by block/district officials to factor in these inputs for the water budgeting. The Census 2011 provides authentic information about areas under irrigation by different sources as depicted in table 3.6.1. The areas under irrigation through other sources as shown in the Census 2011 represent water transfer (in sourced) for irrigation purposes.

Table 3.6.1 Water Transfer

Water Use	Water Received from Outside Geography-Inwards (ha.m)	Water Transfer to other Geography-Outwards (ha.m)	Net Transfer (Inwards-Outwards) (in ha.m)
Domestic			
Agriculture			
Industry			

Figure 3.6.1 Schematic Representation of Water Supply Side Estimation



4. Water Budgeting

4.1 Water budgeting at Block Level

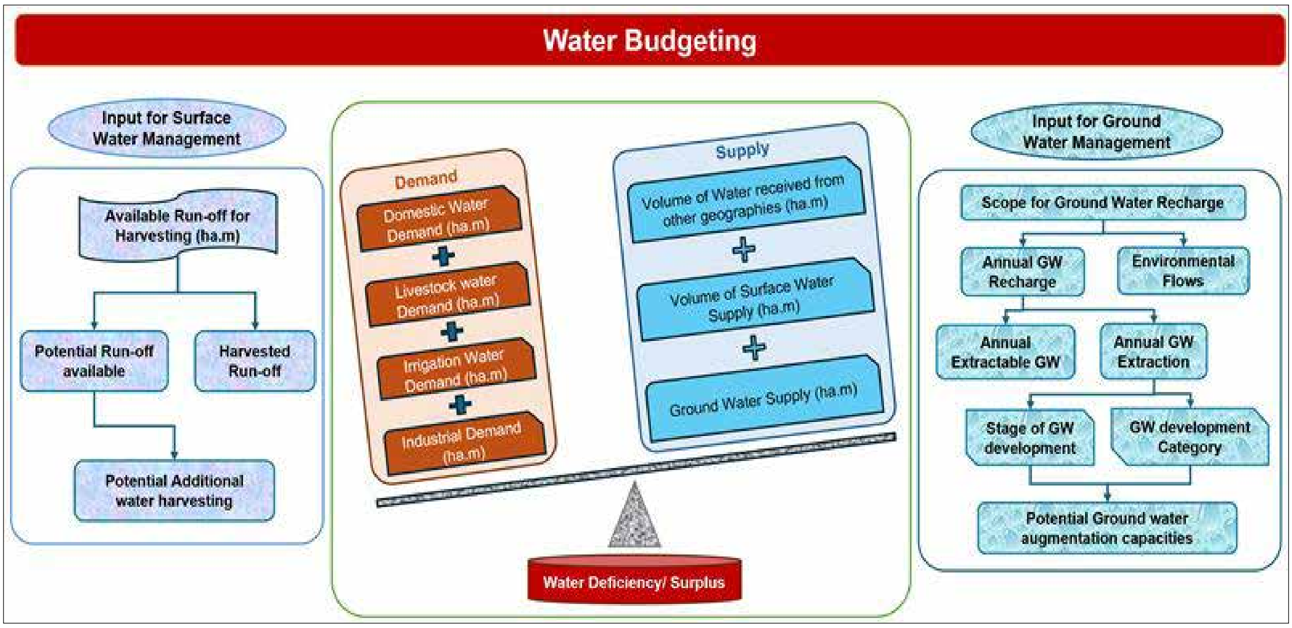
The overall water budgeting is shown in table 4.1.1, where the demand and supply side provide information about water deficit/surplus to plan location specific interventions for addressing the water challenges in the village.

Table 4.1.1 Water Budget at Block Level

S. No	Descriptions	Volume (ha.m)
A. Water Demand		
1	Water for human consumption (Result of Table-2.1.1)	
2	Water for Animal consumption (Result of Table-2.2.1)	
3	Water for Irrigation (Result of Table-2.3.2)	
4	Water for Industry (Result of Table-2.4.1)	
5	Block wise water required (1+2+3+4)	
B. Water Supply		
6	Requirement Met-Out by Local Surface Water Sources (Result of Table 3.4.1)	
7	Requirement Met out by Groundwater Sources (Result of Table 3.5.1)	
8	Net Water Transfer (Result of Table-3.6.1)	
9	Total Supply (6+7+8)	
C. Water Budgeting		
10	Water Deficit/Surplus (9-5)	
D. Potential for rainwater harvesting/ GW augmentation (in ha.m)		
11	Available run-off from rainwater (Result of Table-3.2.2)	
12	Harvested run-off (Result of Table-3.3.1)	
13	Potential run-off available for harvesting/GW augmentation (75% of 11 - 12)	
E. Potential for Groundwater development		
14	Stage of Groundwater Development (from IN-GRES portal)	
15	Groundwater Development Category (from IN-GRES portal)	

It is important to note that the water budgeting exercise provides insights into water deficit or surplus levels for an average year but does not have predictive value for any specific year. However, it serves as a useful indicator of the degree of water stress in a particular block and offers valuable inputs for identifying and planning appropriate measures. These may include enhancing surface water harvesting capacities, implementing demand-side management strategies, and introducing interventions to improve Groundwater recharge. Based on the assessment of water demand side and supply side, one can get information about water deficit or surplus in the unit of planning and gain insights into appropriate strategies to address these imbalances effectively. Accordingly, planners can do scoping and identify suitable location-specific interventions to be implemented under central/state flagship schemes and other developmental programmes. The options may include enhancing surface water harvesting capacities, improving soil moisture, Groundwater augmentation and interventions for the demand side management including measures for improving water use efficiency and to curtail water losses.

Figure 4.1.1 Schematic Representation of Water Budgeting



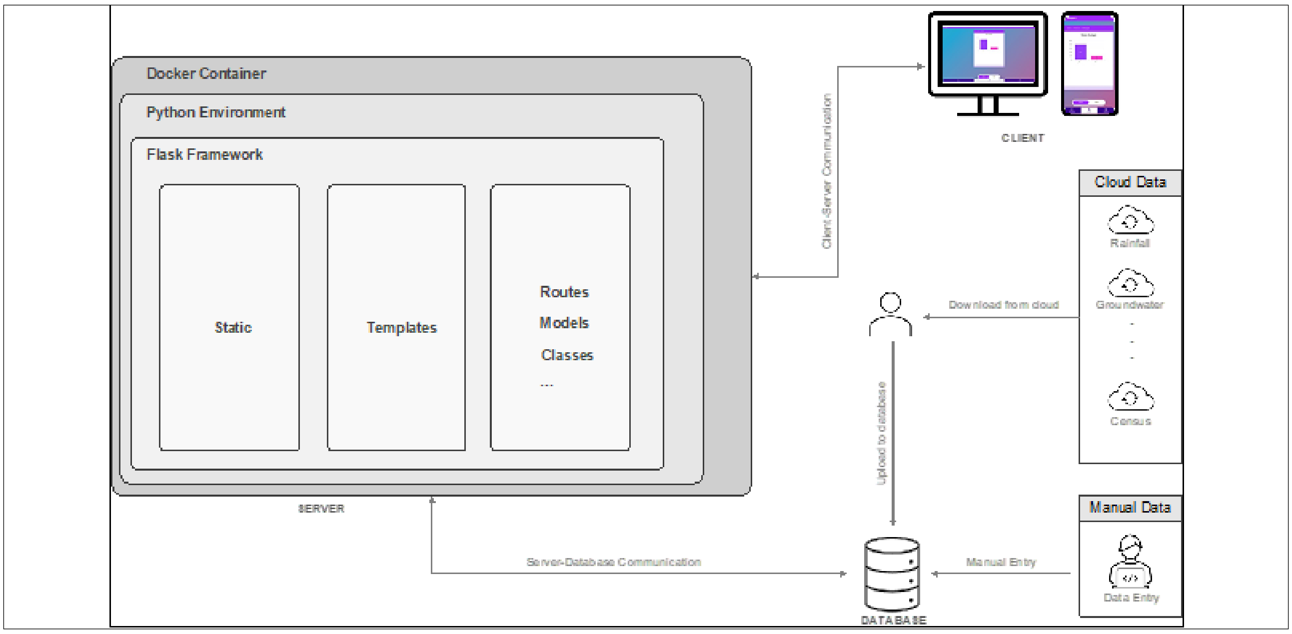
5. Web-based Water Budgeting Application – Varuni

Indo-German Bilateral project implemented by GIZ India in cooperation with Ministry of Jal Shakti, and Ministry of Rural Development, Government of India, "Water Security and Climate Adaptation in Rural India (WASCA) has developed a user-friendly scientific methodology jointly with NITI Aayog to prepare the water budget at the block level.

5.1 Architecture of Varuni

The ***Varuni*** web application pulls data automatically from relevant authentic portals and feeds in for processing to determine water demand and supply side followed by in-built algorithm to provide outputs in the form of water budget along with the required other critical information for the assessment of geography and scoping for identifying suitable location-specific interventions to address the key concerns related to water resource management in the block. A front-end application retrieves this data and performs the calculations, thus automating the water budgeting exercise. This integrated approach allows evaluation of water availability, ensuring accurate assessments of water deficits or surpluses at the local level, and providing key insights for planning water conservation and management interventions.

Figure 5.1.1 System Architecture - Varuni Web-Application



The ***Varuni*** application is available as a web application for improved accessibility to required datasets. The application has the potential for raising awareness and sensitizing stakeholders about water management, and there is scope for further enhancement. The link for the web application is https://wasca.in/ijalagam/

The web application is designed in a manner where most of the required inputs are automatically pulled from official sources and made available in the background for deriving the water budget. The data inputs pulled by the web application from available sources and primary collection are depicted in the following table.

Table 5.1.1 Required Data inputs, Sources and Formats

Features	Data Description	Portals	Concerned Ministry/ Depts	Data Type/ Format
Demand Side	Population	Census 2011	https://censusindia.gov.in/nada/index.php	API (JSON)
	Livestock data	Livestock Census 2019	https://dahd.gov.in/schemes/programmes/animal-husbandry-statistics	API (JSON)
	Crop Information	PMKSY	https://pmksy.gov.in/mis/rptDIPDocConsolidate.aspx	API (JSON)
	Industrial Information	-	DIC	Primary
Supply Side	Surface Water Sources	IndiaWRIS	https://indiawris.gov.in/wris/#/jaldharohar	API (JSON)
	Groundwater Availability	CGWB	https://ingres.iith.ac.in/home	API (JSON)
	Water Transfer (Inwards & Outwards)	-	District & Block administration	Primary
Water Budgeting	Available Surface Runoff	Land Use Census 2011	https://censusindia.gov.in/nada/index.php	API (JSON)
	Rainfall data	IndiaWRIS	https://indiawris.gov.in/wris/#/jaldharohar	API (JSON)

Table 5.1.2 Algorithms Applied for Automation of Water Budgeting Methodology

Features	Calculations	Algorithms
Demand Side	Human Water Requirement	$H_d = \frac{\sum_{k=0}^{n} \binom{n}{k} x \times D_w \times D_f \times 365}{10000000}$ *Hectare Meters* H_d = Human Water Demand x = Human Population as per Census 2011 D_w= Daily Water Requirement D_f = Decadal Factor
	Livestock Water Requirement	$L_d = \frac{\sum_{k=0}^{n} \binom{n}{k} x \times D_t \times 365}{10000000}$ *Hectare Meters* H_d = Livestock Water Demand x = Livestock Population as per Census 2019 D_t= Daily Water Requirement of each type of live-stock
	Irrigation Water Requirement	$\mathrm{I}_d = I_g \times (1 + G_f) \times I_r$ *Hectare Meters* I_d = Irrigation Water Requirement I_g = Gross Irrigated Area G_f= Growth Factor (17% for the period of 2011-2023) I_r = Irrigation Water Requirement (0.50 metres)
	Industrial Water Requirement	Direct calculation from Input
Supply Side	Surface Water Sources	Direct Inputs from Web services
	Groundwater Availability	Direct Inputs from Web services
	Source from outside geography	Direct inputs from Primary Sources
Surface runoff from rainfall	Available Surface Run-off in Good/ Average and Poor Catch-ment	$R_g = \left(\sum_{k=0}^{n} A_g * S_g * r \right) / 100000$ *Hectare Meters* R_g = Good/Ave/Poor Catchment Runoff in Hectare Metres A_g = Good/Ave/Poor Catchment Area in Hectares S_g= Strange Table Good Runoff Percentage r = rainfall in mm
	Rainfall data	Direct inputs from Web service

6. Piloting in Aspirational Blocks

The Aspirational Block Programme (ABP) focuses on improving governance to enhance the quality of life of citizens and service delivery in the remotest and less developed blocks of India. This is done through converging existing schemes, defining outcomes, and monitoring them to bridge gaps. Agriculture and Allied Services are one of the themes in ABP where water resources management plays a major role[23].

6.1 Selected Aspirational blocks

The *Varuni* web application is piloted in select 18 Aspirational Blocks across 11 states and 1 UT covering all agroclimatic zones of India. The selection of blocks was done by NITI Aayog. The criteria for selection are i.) safe and water-stressed blocks based on the 2023 CGWB Report of the National Compilation on Dynamic Groundwater Resources of India (water stressed blocks - that are classified as over-exploited, critical and semi-critical as defined in the CGWB report ii.) actual tap water coverage under Jal Jeevan Mission & blocks with dependency on Groundwater for Jal Jeevan Mission household connections iii.) where GIZ can deploy its resources with ease.

Table 6.1.1 List of Aspirational Blocks chosen for Piloting

S. No	State	District	Block
1	Andhra Pradesh	Alluri Sitharama Raju	Gangavaram
2	Bihar	Gaya	Fatehpur
3	Gujarat	Tapi	Kukarmunda
4	Himachal Pradesh	Kullu	Nirmand
5	Ladakh	Leh Ladakh	Rupsho
6	Madhya Pradesh	Chhatarpur	Buxwaha
7	Madhya Pradesh	Khandwa (East Nimar)	Chhaigaon Makhan
8	Madhya Pradesh	Sheopur	Vijaypur
9	Madhya Pradesh	Tikamgarh	Baldeogarh
10	Rajasthan	Bhilwara	Kotri
11	Rajasthan	Rajsamand	Bhim
12	Rajasthan	Sirohi	Abu Road
13	Sikkim	Namchi	Namchi
14	Tamil Nadu	Ariyalur	Andimadam
15	Telangana	Narayanpet	Narva
16	Uttar Pradesh	Aligarh	Gangiri
17	Uttar Pradesh	Bara Banki	Nindaura
18	Uttar Pradesh	Bijnor	Kotwali

Based on learning from pilots, the web application is fine-tuned and ready for block level functionaries to prepare water budgets. The *Varuni* Web Application for Water Budgeting has the potential to reform planning modalities at the intermediate level by informing planning and implementation functionaries about the current water scenario at block level and alert them about water deficit/surplus in the block. The block level water budgeting briefs for 18 blocks are prepared based on inputs gathered through "*Varuni* Web Application for Water Budgeting" is available in the following section of the report.

23 Aspirational Blocks Programme (ABP)

7. Way Forward

The current Varuni Web Application for water budgeting has been developed for block-level assessment; however, results can be aggregated to district and state level, and it has the potential to be scaled down to GP and village level. Data availability and quality remain significant challenges. While remote sensing technologies and improved monitoring networks provide more data, many regions still suffer from data scarcity or poor data quality. Scaling up and mainstreaming of water budgeting requires a concentrated effort to improve data management practices across all sectors and governance levels. This includes investing in automated data collection systems that include in-situ and remotely sensed data, developing quality control protocols, and creating accessible data repositories in a bottom-up manner. The transition from primarily relying on observed data to incorporate predictive models – incorporating climate change scenarios, for example – will also be crucial.

Beyond technical aspects, **fostering stakeholder engagement and building trust** is critical for the long-term success of scaled-up water budgeting. Water is inherently a social issue, and any attempt to manage it effectively must involve all relevant stakeholders – farmers, local body functionaries, industry representatives, indigenous communities, and the general public. This requires transparent communication, participatory decision-making processes, and a commitment to addressing the concerns of all parties.

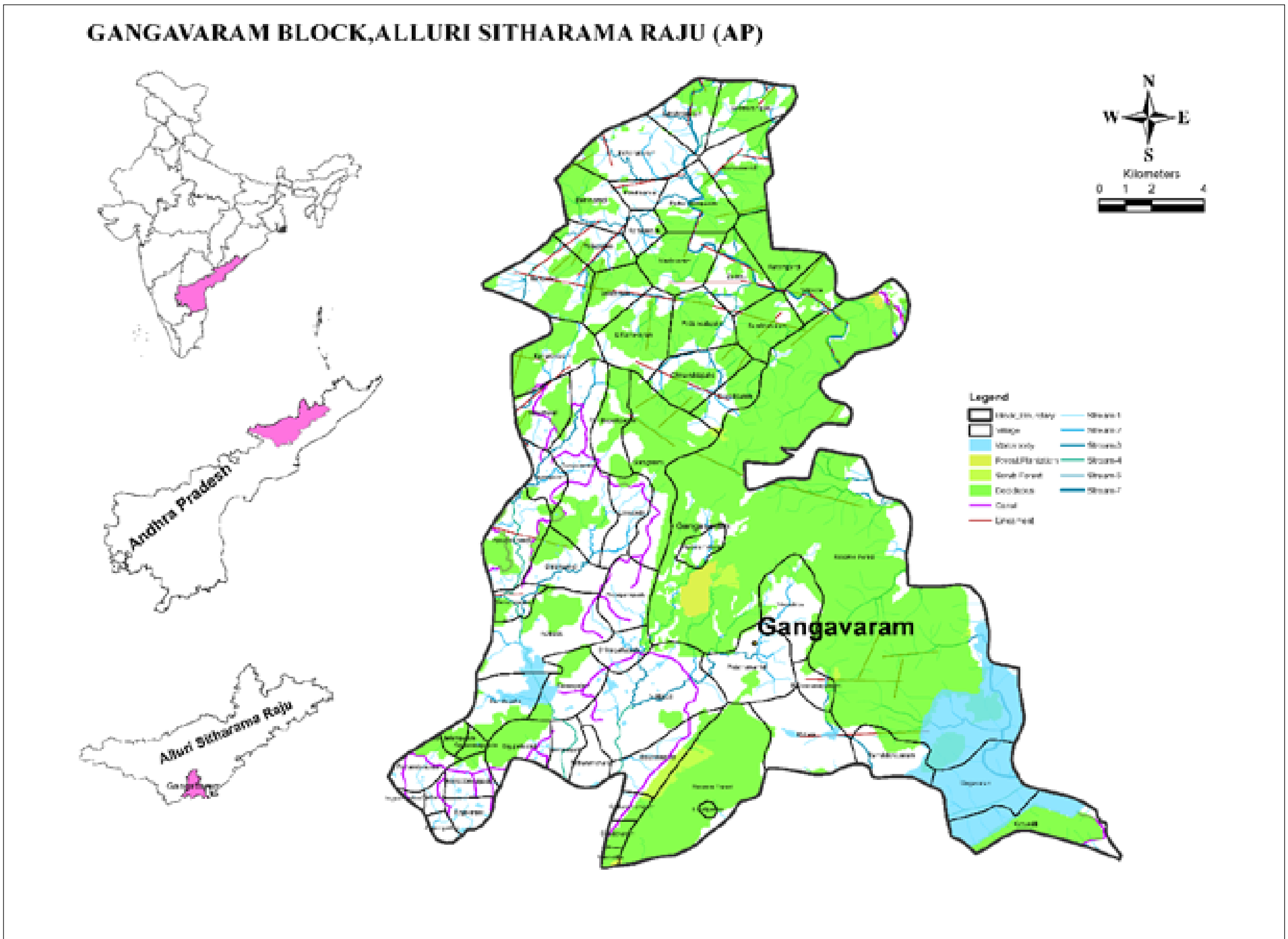
CHAPTER II

Block-wise Analysis

1. Gangavaram Block, Alluri Sitaramaraju District, Andhra Pradesh

1.1 Introduction

State	District	Block	Number of villages	Number of urban centres
Andhra Pradesh	Alluri Sitaramaraju	Gangavaram	60	0



1.2 Demand Side Management

1.2.1 Water Requirements for Human Consumption

#	Total Population			Population	Water demand (lpcd)	Annual Water Requirements (ha.m)
	Female	Male	Total			
Rural	13,519	12,393	25,912	32,390	55	78.0
Urban	0	0	0	0	150	0.0
Total	13,519	12,393	25,912	32,390		78.0

1.2.2 Water Requirements for Livestock Consumption

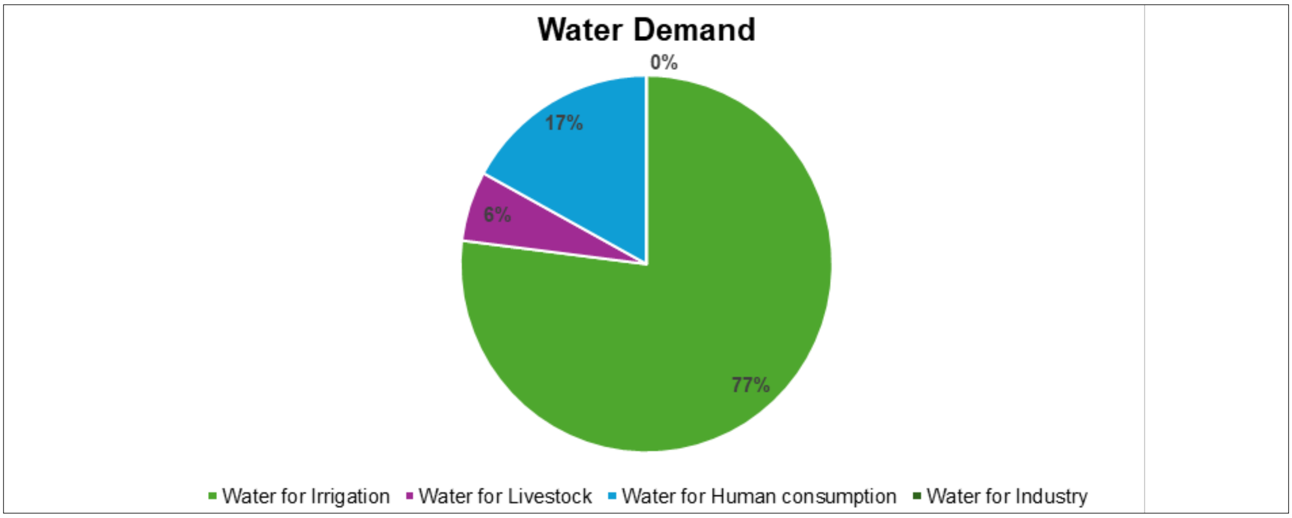
S. No	Type of Animal	Number of Animals	Water Req. (ha.m)
1	Cow/Cattles	8,329	20.4
2	Buffaloes	1,627	4
3	Goat	6,274	1.6
4	Sheep	1,977	0.5
5	Poultry	18,995	0.2
6	Pigs	28	0.02
7	Camels	0	0
8	Horses	28	0
Total		28,929	26.5

1.2.3 Irrigation Water Requirement

Irrigated Area (in ha)	Water required per hectare (ha.m)	Irrigation Water Requirement (ha.m)
1	2	3 = (1*2)
710.9	0.5	355.5

1.2.4 Industrial Water Requirement

There are no industries in this block



1.3 Supply Side Management

1.3.1 Information on Land Use

As per census 2011, the Gangavaram block has 18,965.7 hectares areas for various uses.

S. No	Classification	Area in ha	Area in %
1	Total Unirrigated Land Area	8,972.2	47
2	Area under Non-Agricultural Uses (Rural +Urban)	4,659.3	25
3	Culturable Waste Land Area	2,783.9	15
4	Forest Area	1,930.7	10
5	Area Irrigated by Source	607.6	2.9
6	Barren & Un-cultivable Land Area	12	0.1
7	Permanent Pastures and Other Grazing Land Area	0	0
8	Land Under Miscellaneous Tree Crops etc. Area	0	0
9	Fallows Land other than Current Fallows Area	0	0
10	Current Fallows Area	0	0
Total		18,965.7	100

1.3.2 Surface Water Bodies

The Gangavaram block is part of the Southern Plateau and Hills region of India.

S. No	Names of Structures	Number of structures	Storage Capacity	
			In ha.m	In %
1	Other	4	1,79,432.0	99.79
2	Lakes	8	190.1	0.11
3	Reservoir	1	80.5	0.04
4	Ponds	64	77.3	0.04
5	Tanks/WCS	48	32.8	0.02
6	Water harvesting Structure	10	1.2	0.002
Total		135	1,79,814.3	100

1.3.3 Surface Water Supply

S. No	Type	Area Irrigated (ha)	Water Supply	
			In ha.m	In %
1	Canals Area	363.7	212.8	87
2	Tanks/Lakes Area	43.0	25.2	10
3	Waterfall Area	11.5	6.7	3
4	Other Source (Water from outside)	0.0	0.0	0
Total		418.2	244.6	100

1.3.4 Groundwater Supply

Annual Groundwater Extractable (ha.m)	Annual Groundwater extraction (ha.m)	Stage of Ground-water extraction	Groundwater extraction category
5,993	48	0.80 %	Safe

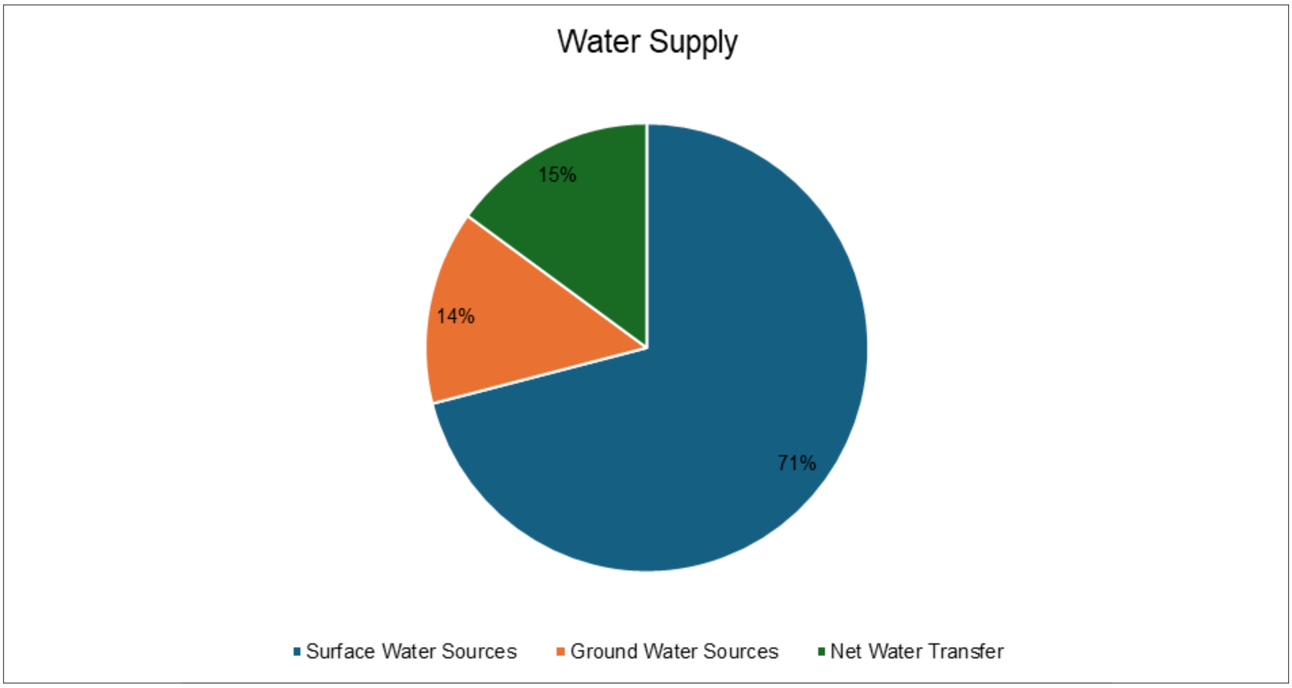
1.3.5 Water Transfer

Water Use	Inward Transfer (ha.m)	Outward Transfer (ha.m)	Net Transfer (Inwards-Outwards) ha.m
Domestic	52.0	0	52.0
Agriculture	0	0	0
Industry	0	0	0
Total	52.0	0	52.0

1.3.6 Amount of Run-off

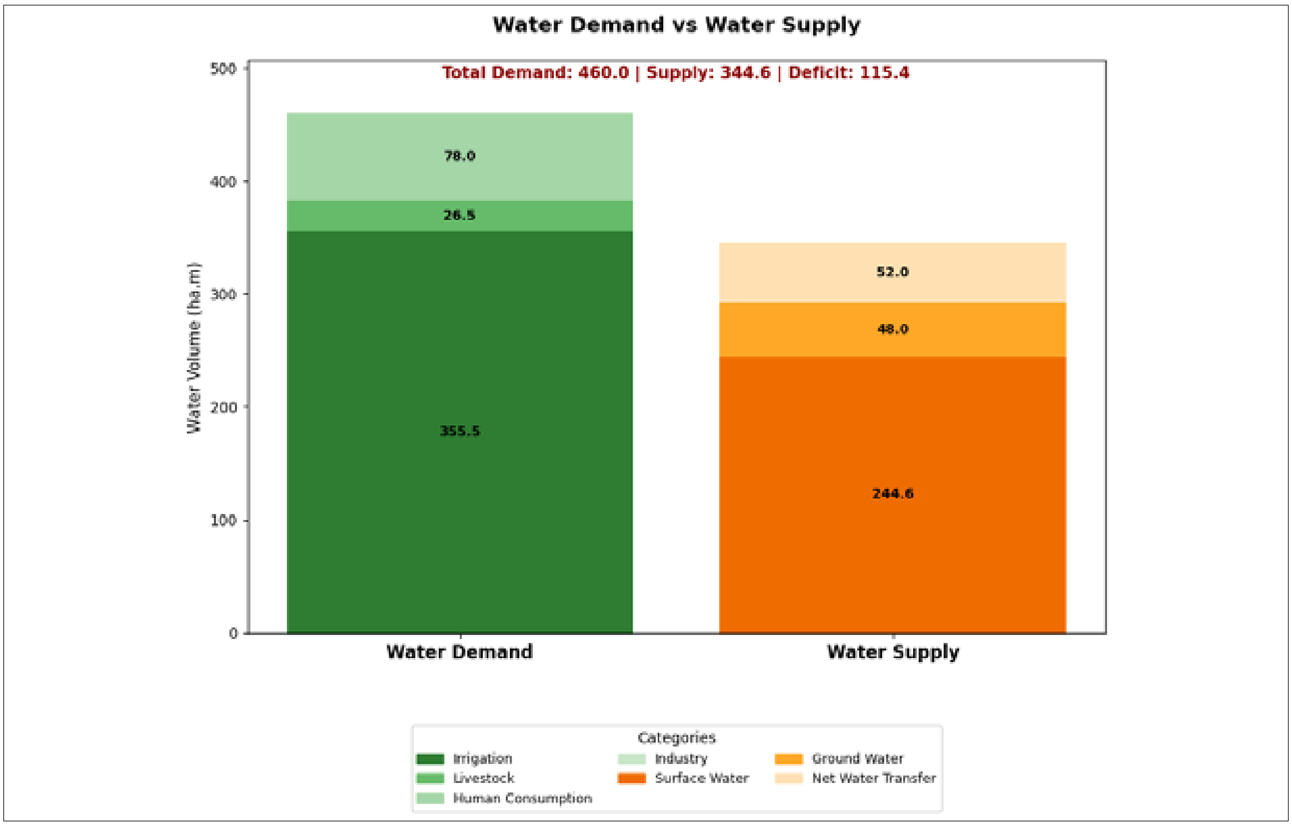
The Gangavaram block belongs to the Southern Plateau and Hills Region of India and vthe land use pattern data reveals that major parts of the block geography are undulating and under non-cultivation uses. The block has an average of 1,103 mm rainfall and has the potential for harvesting 5,049.4 ha.m run-off annually.

Types of Run-offs	Area (ha)	Run-off (cu.m per ha)	Run-off	
			In ha.m	In %
Good Catchment Area	6,602.0	3,750	2,475.8	50
Average Catchment Area	2,783.9	2,810	782.3	15
Poor Catchment Area	9,579.8	1,870	1,791.4	35
Total	18,965.7		5,049.4	100



1.4 Water Budgeting at Block Level

S. No	Descriptions	Volume	
		In ha.m	In %
A. Water Demand			
1	Water for Irrigation (ref section 1.2.3)	355.5	77
2	Water for Livestock (ref section 1.2.2)	26.5	6
3	Water for Human consumption (ref section 1.2.1)	78	17
4	Water for Industry (ref section 1.2.4)	0	0
5	Block wise water required (1+2+3+4)	460.0	100
B. Water Supply			
6	Surface Water Sources (ref section 1.3.3)	244.6	71
7	Groundwater Sources (ref section 1.3.4)	48.0	14
8	Net Water Transfer (ref section 1.3.5)	52.0	15
9	Total Supply (6+7+8)	344.7	100
C. Water Budgeting			
10	Water deficit/Surplus (9-5)	-115.3	25
D. Potential for Rainwater Harvesting/ GW Augmentation (in ha.m)			
11	Available run-off from rainwater (ref section 1.3.6)	5,049.4	
12	Harvested run off (ref section 1.3.2)	1,79,814.30	
13	Potential Runoff available for harvesting/ GW augmentation (75% of 11-12)	Nil	
E. Potential for Groundwater Development			
14	Stage of Groundwater Development (from IN-GRES portal)	0.80%	
15	Groundwater Development Category (from IN-GRES portal)	Safe	



1.4.1 Annotations

(i) The Gangavaram block of Alluri Sitaramaraju District is dominated by rainfed farming and the area under irrigation is only 2.9% of the total geographical area (TGA).

(ii) As the block belongs to the coastal region, salinity is a major concern, this has led to more dependence on surface water sources (86%).

(iii) The Stage of Groundwater development is in the safe category (0.80 %).

(iv) The block has **460.0** ha.m water requirements for all purposes, out of this 77% is for irrigation only.

(v) The block has **344.7** ha.m (71% surface water + 14% Groundwater + 15% outside the block) of supply from all sources.

(vi) The block is water deficit by 25% (115.3 ha.m)

(vii) The block is in a low-lying area and has generated less runoff within its geography. Whereas it has received water from the surrounding catchment, leading to enhanced water storage (1,79,432 ha.m) within the block. This storage is not only catering to the local demand but also serving the water needs of other areas.

(viii) The block has 5,049.4 ha.m run-off from rainwater available for harvesting, but the large surface water storage available in the block limits creating additional storage structures.

1.4.2 Recommendations

(i) There is a need to examine the planning process for the scope of utilising potential runoff generated within the block for harvesting/GW augmentation.

(ii) Being a part of the coastal region, the block needs to focus more on improving water footprints and dealing with salinity concerns to optimised efficient use of Groundwater.

1.4.3 Takeaways for Rural Drinking Water Supply

(i) The total JJM coverage is 83.72% as on March 2025.

(ii) Of the 307 PWS schemes in the block, 289 (94%) are based on SVS and 18 (6%) are based on MVS. Hence, the block is heavily dependent on Groundwater for the rural drinking water supply.

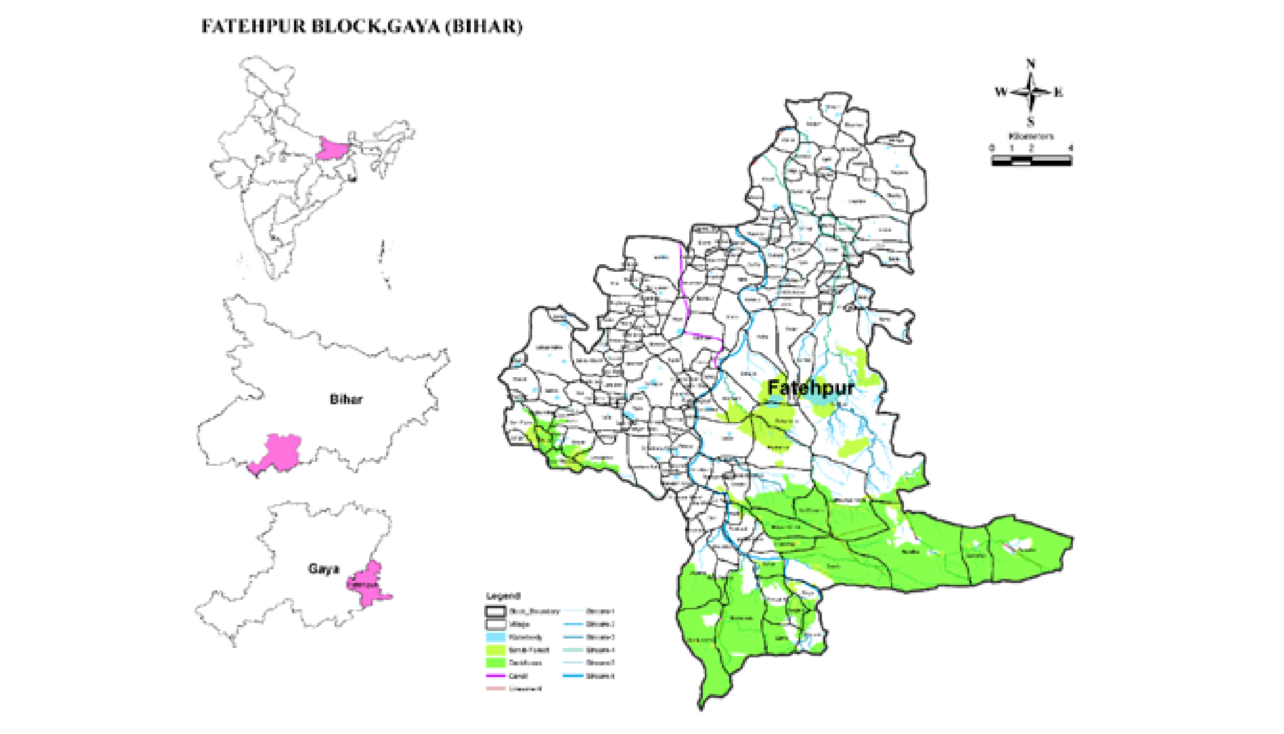
(iii) Sufficient Groundwater is available for future drinking needs.

(iv) Measures to be taken to protect the Groundwater quality.

2. Fatehpur Block, Gaya District, Bihar

2.1 Introduction

State	District	Block	Number of villages	Number of Urban centres
Bihar	Gaya	Fatehpur	175	0



2.2 Demand Side Management

2.2.1 Water Requirements for Human Consumption

#	Total Population			Population Growth	Water demand (lpcd)	Annual Water Requirements (ha.m)
	Female	Male	Total			
Rural	1,14,728	1,20,884	2,35,612	2,94,515	55	709.5
Urban	0	0	0	0	150	0.0
Total	1,14,728	1,20,884	2,35,612	2,94,515		709.5

2.2.2 Water Requirements for Livestock Consumption

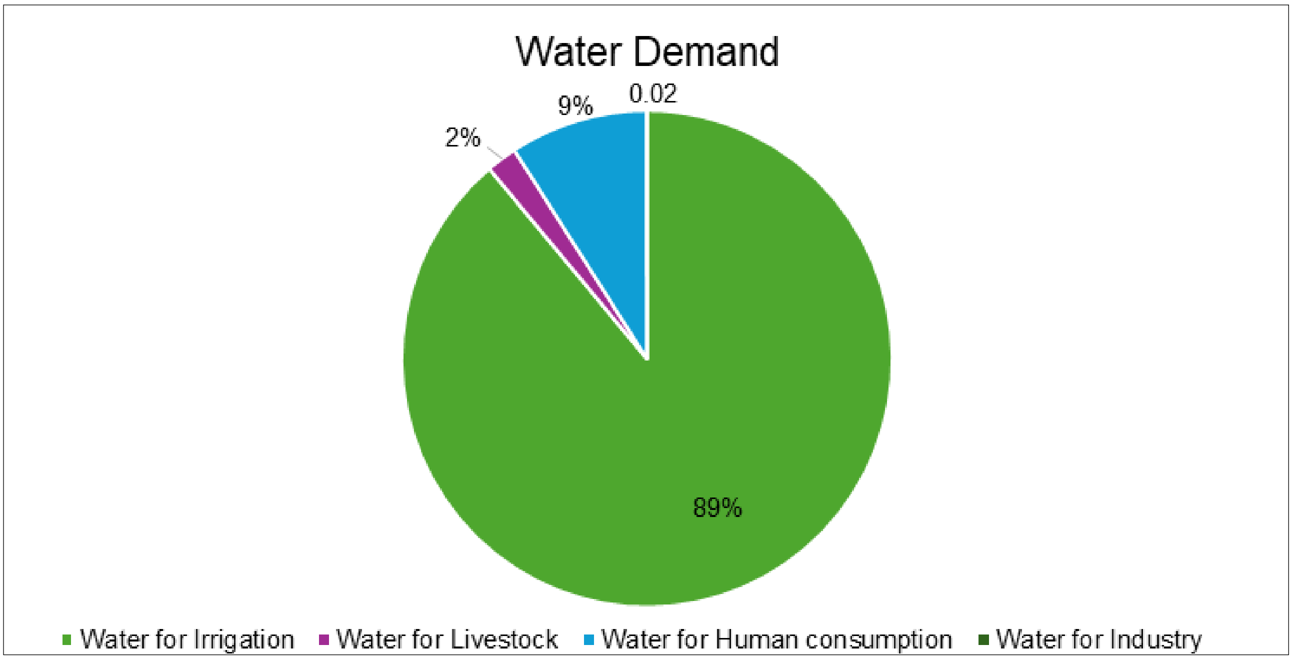
S. No	Type of Animal	Number of Animals	Water Req. (ha.m)
1	Cow/Cattle	59,250	144.9
2	Buffaloes	14,338	35.1
3	Pigs	3,761	3.0
4	Goat	3,609	0.9
5	Sheep	0	0
6	Horses	0	0
7	Camels	0	0
8	Poultry	0	0
Total		80,958	183.9

2.2.3 Irrigation Water Requirement

Irrigated Area (in ha)	Water required per hectare (ha.m)	Irrigation Water Requirement (ha.m)
1	2	3 = (1*2)
13,422.8	0.5	6,711.4

2.2.4 Industrial Water Requirement

Type of Industry	Number of Industrial Units	Annual Water Demand for the industry (ha.m)
Construction	6	0.6
Food Industry	40	0.5
Agriculture	3	0.3
Textile	12	0.1
IT-ITeS	7	0.02
Total	68	1.52



2.3 Supply Side Management

2.3.1 Information on Land Use

As per census 2011, the Fatehpur block has 33,432.9 hectares areas for various uses.

S. No	Classification	Area	
		In ha	In %
1	Area Irrigated by Source	11,472.5	34
2	Total Unirrigated Land Area	7,419.7	22
3	Forest Area	6,205.0	19
4	Area under Non-Agricultural Uses (Rural +Urban)	4,198.7	13
5	Culturable Waste Land Area	1,021.6	3

S. No	Classification	Area	
		In ha	In %
6	Permanent Pastures and Other Grazing Land Area	826.6	2
7	Current Fallows Area	820.9	2
8	Barren & Un-cultivable Land Area	605.6	2
9	Fallows Land other than Current Fallows Area	470.5	1
10	Land Under Miscellaneous Tree Crops etc. Area	391.8	1
Total		33,432.9	100

2.3.2 Surface Water Bodies

The Fatehpur block is part of the middle Gangetic plains regions of India. The surface water bodies in Gangetic plains mostly has lesser water spread areas in comparison to plateaus and arid & semi-arid regions. Secondly, most of the land parcels are farmlands hence, scope for larger structures is comparatively lesser. Although the surface run-off generated during monsoon period is enough to store in surface waterbodies but due to peculiar landscape and land use pattern potential for enhancing surface water availability remains limited.

S. No.	Names of Structures	Number of Structures	Storage Capacity	
			In ha.m	In %
1	Other	1	1,101.3	52
2	Lakes	30	611.1	29
3	Ponds	108	211.8	10
4	Reservoir	1	142.7	7
5	Tanks/WCS	63	42.2	1.6
6	Water Harvesting Structure	121	7.5	0.4
Total		324	2,116.6	100

2.3.3 Surface Water Supply

S. No	Type	Area Irrigated (ha)	Water Supply	
			In ha.m	In %
1	Other Source	5,755.3	3,366.9	97
2	Canals Area	136.0	79.6	2.5
3	Tanks/Lakes Area	23.0	13.5	0.5
4	Waterfall Area	0.0	0.0	0
Total		5,914.3	3,459.9	100

2.3.4 Groundwater Supply

Annual Groundwater Extractable (ha.m)	Annual Groundwater extraction (ha.m)	Stage of Ground-water extraction	Groundwater extraction category
7,241	2,944	40.65 %	Safe

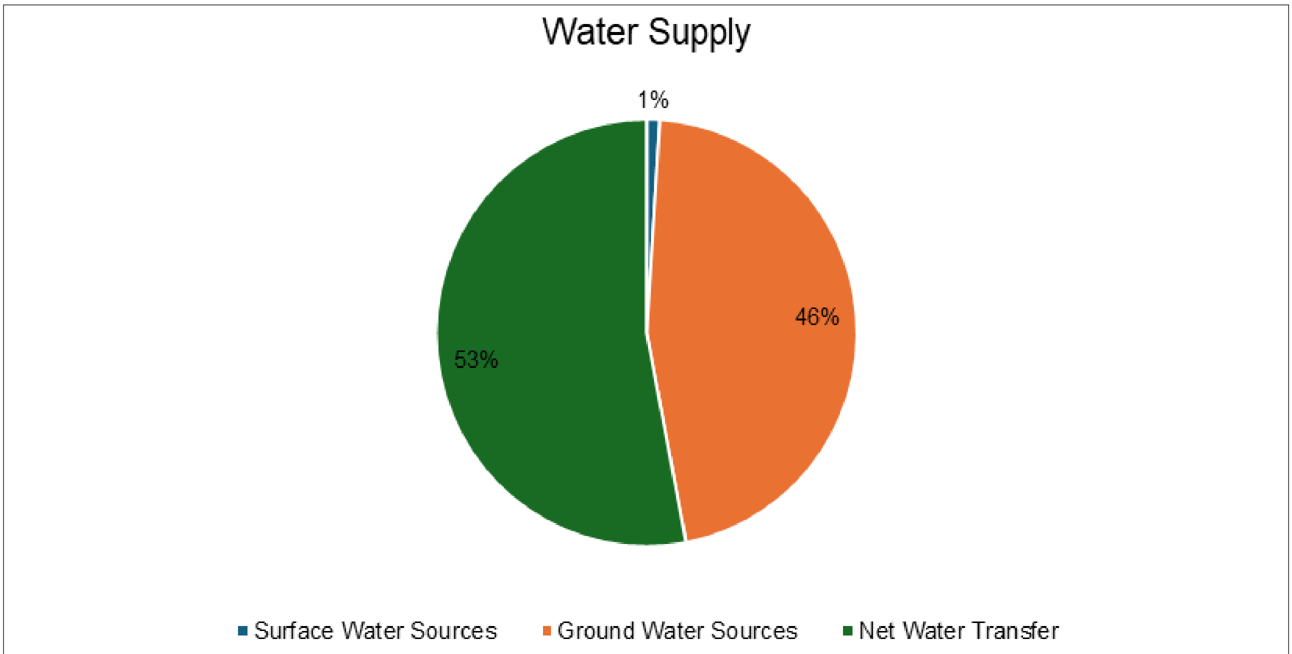
2.3.5 Water Transfer

Water Use	Inward Transfer (ha.m)	Outward Transfer (ha.m)	Net Transfer (Inwards-Outwards) (ha.m)
Domestic	0	0	0
Agriculture	3,366.9	0	3,366.9
Industry	0	0	0
Total	3,366.9	0	3,366.9

2.3.6 Amount of Run-off

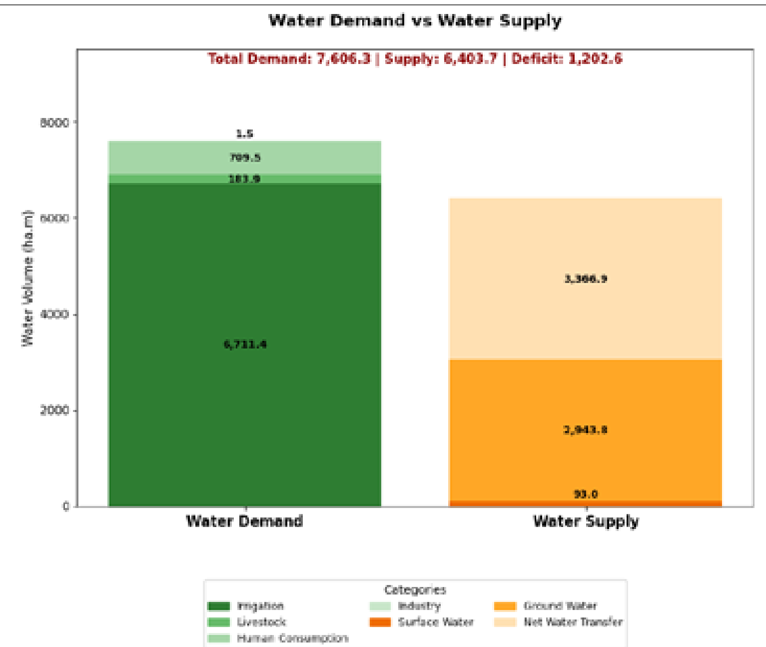
The Fatehpur block belongs to the Gangetic plains and the land use pattern data reveals that major parts of the block geography are plain areas under cultivation. The block has an average of 1003 mm rainfall, so there is potential for harvesting 8,532.3 HaM run-off annually.

Types of Run-Offs	Area (in ha)	Run-off (cu.m per ha)	Run-off	
			In ha.m	In %
Good Catchment Area	11,009.3	3,750	4,128.5	48
Average Catchment Area	2240	2,810	629.4	8
Poor Catchment Area	20,183.6	1,870	3,774.3	44
Total	33,432.9		8,532.3	100



2.4 Water Budgeting at Block Level

S. No	Descriptions	Volume	
		In ha.m	In %
A. Water Demand			
1	Water for Irrigation	6,711.4	88
2	Water for Livestock	183.9	2
3	Water for Human consumption	709.5	9
4	Water for Industry	1.52	0.02
5	Block wise water required	7,606.3	100
B. Water Supply			
6	Supply from Local Surface Water Sources	93.0	1
7	Supply from Groundwater Sources	2,943.8	46
8	Net Water Transfer	3,366.9	53
9	Total Supply	6,403.7	100
C. Water Budgeting			
10	Water deficit/Surplus	-1,202.7	16
D. Potential for rainwater harvesting/ GW augmentation (in ha.m)			
11	Available Run-off from rainwater	8,532.3	
12	Harvested Run-off	2,116.60	
13	Potential Runoff Available for Harvesting/GW Augmentation	4,282.6	
E. Potential for Groundwater development			
14	Stage of Groundwater Development (from IN-GRES portal)	40.65	
15	Groundwater Development Category (from IN-GRES portal)	Safe	



2.4.1 Annotations

(i) The Fatehpur block area belongs to the Gangetic plain region and most parts of the block are under crops lands.

(ii) Large parts of the blocks are under agricultural uses, but since it is part of Gangetic region the soil moisture regime is good hence, the irrigation water demands are reasonably well-aligned with the national average.

(iii) The Gangetic region is known for canal command area and in the block, it is evident that 54% of the irrigation demands are met by surface water sources from outside the geography.

(iv) The block has water harvesting capacities of 2,116.6 ha.m, however, less than 5% of the harvested water is being productively used for local water demands.

(v) The Stage of Groundwater development is in the safe category (40.65 %).

(vi) The block is water deficit by 16% (1202.7 ha.m).

(vii) The Fatehpur block has 7,606.3 ha.m water requirements for all purposes, out of this 88% is for irrigation only.

(viii) The block has 6,403.7 ha.m (1% surface water + 46% Groundwater + 53% outside the block) of supply from all sources.

2.4.2 Recommendations

(i) 54% of irrigation water demands are met by surface water sources. Accordingly, it is important to focus more on introducing micro irrigation practices to improve water productivity.

(ii) The block has untapped surface water sources, which need to be used efficiently to minimise reliance on scarce Groundwater sources. The block has available potential for run-off harvesting and Groundwater augmentation of 4,282.6 ha.m.

2.4.3 Takeaways for Rural Drinking Water Supply

(i) The total JJM coverage is 88.52% as of March 2025.

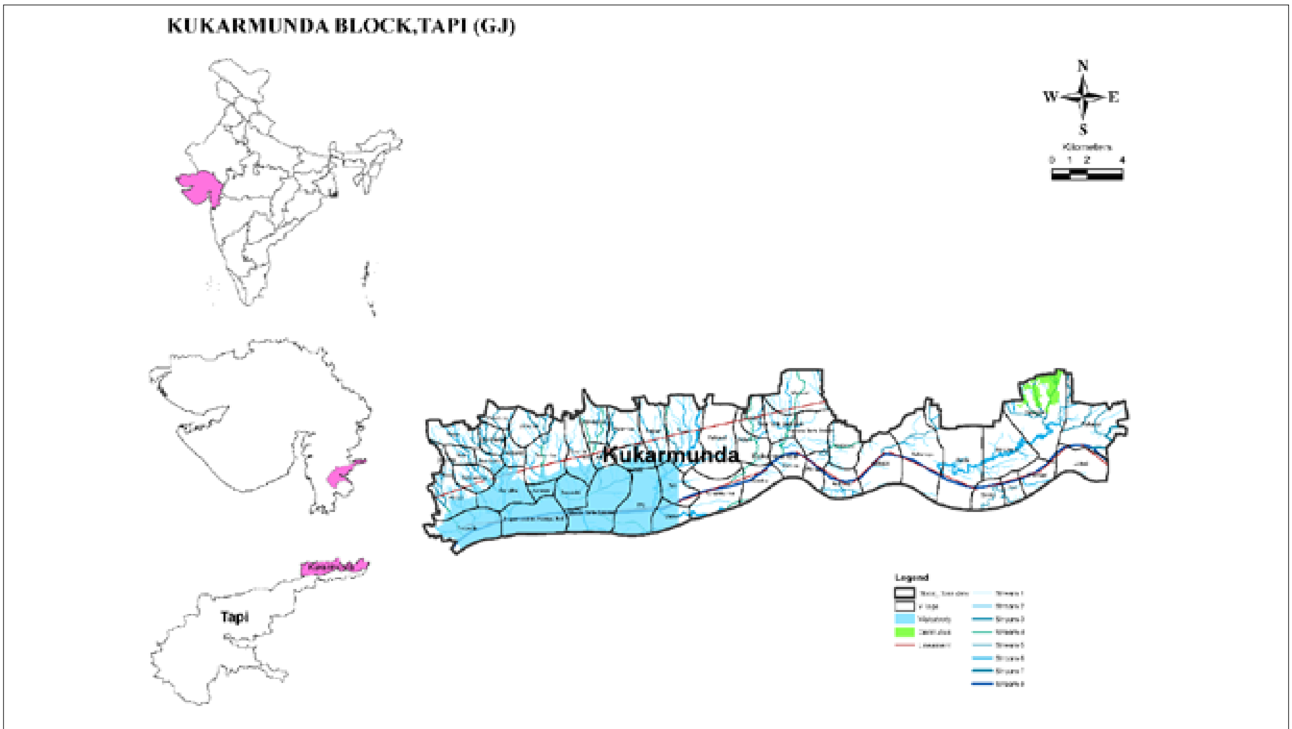
(ii) Of the 123 PWS schemes in the block, 79 (64%) are SVS and 44 (36%) are MVS. Consequently, the block mostly depends on Groundwater for drinking water in rural areas. Sufficient Groundwater is available for future drinking needs.

(iii) Measures to be taken to protect the Groundwater and surface water quality and do GW augmentation.

3. Kukarmunda Block, Tapi District, Gujarat

3.1 Introduction

State	District	Block	Number of villages	Number of Urban centres
Gujarat	Tapi	Kukarmunda	49	0



3.2 Demand Side Management

3.2.1 Water Requirements for Human Consumption

#	Total Population			Population Growth	Water demand (lpcd)	Annual Water Requirements (ha.m)
	Female	Male	Total			
Rural	30,636	29,962	60,598	75,747	55	182.5
Urban	0	0	0	0	150	0.0
Total	30,636	29,962	60,598	75,747		182.5

3.2.2 Water Requirement for Livestock Consumption

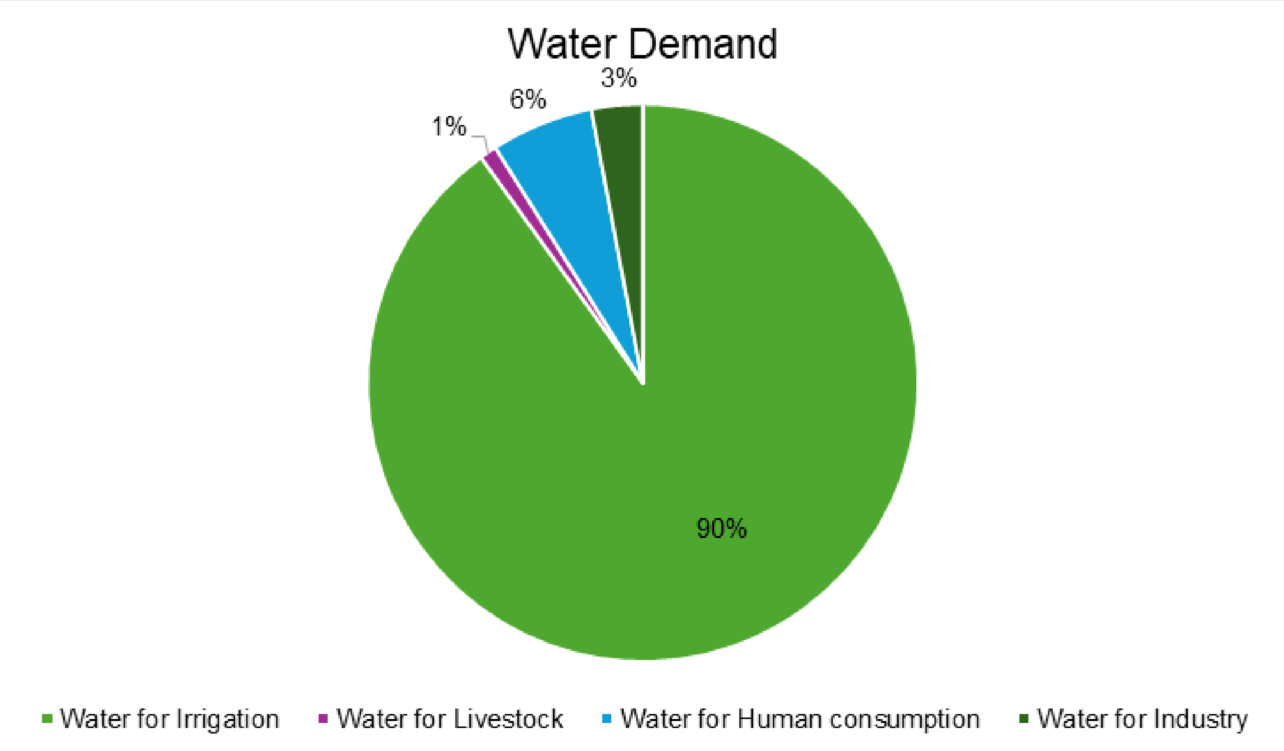
S.No	Type of Animal	Number of Animals	Water Req. (ha.m)
1	Buffaloes	9,204	22.5
2	Cow/Cattle	8,130	19.9
3	Goat	8,122	2.1
4	Sheep	0	0
5	Horses	0	0
6	Camels	0	0
7	Pigs	0	0
8	Poultry	0	0
Total		25,456	44.5

3.2.3 Irrigation Water Requirement

Irrigated Area (in ha)	Water required per hectare (ha.m)	Irrigation Water Requirement (ha.m)
1	2	3 = (1*2)
5,656.4	0.5	2,828.2

3.2.4 Industrial Water Requirement

Type of Industry	Number of Industrial Units	Annual Water Demand (ha.m)
Food Processing Industry	2	78.44



3.3 Supply Side Management

3.3.1 Information on Land Use

As per census 2011, the Kukarmunda block has 16,172.34 hectares area for different uses.

S. No	Classification	Area	
		In ha	In %
1	Barren & Un-cultivable Land Area	5,457.5	33.7
2	Area Irrigated by Source	4,834.5	29.9
3	Total Unirrigated Land Area	4419	27.3
4	Culturable Waste Land Area	652.9	4.0
5	Area under Non-Agricultural Uses (Rural +Urban)	367.2	2.3
6	Permanent Pastures and Other Grazing Land Area	340.8	2.1
7	Fallows Land other than Current Fallows Area	95.3	0.6
8	Current Fallows Area	5.14	0.0
9	Forest Area	0	0.0
10	Land Under Miscellaneous Tree Crops etc. Area	0	0.0
Total		16,172.34	100

3.3.2 Surface Water Bodies

The Kukarmunda block is part of the Gujarat Plain and Hills Region of India. The block has the biggest dam of Gujarat state named "Ukai Dam which has a large surface capacity and supplies water to various districts of the state. The Ukai dam itself has a storage capacity of 3,90,514.7 ham. The dam also receives run-off from adjoining geographies as well.

S. No	Names of Structures	Number of structures	Storage Capacity (in ha.m)
1	Other (Ukai Dam)	1	3,90,515.0
2	Water harvesting Structure	77	7.7
3	Tanks/WCS	59	0.3
4	Ponds	1	0.2
5	Lakes	0	0
6	Reservoir	0	0
Total		138.00	3,90,522.9

3.3.3 Surface Water Supply

The 2.5% irrigation areas of the block are dependent on surface water sources.

Type	Area Irrigated (ha)	Water Supply	
		In ha.m	In %
Other Source (Water from outside)	95.8	56	80
Canals Area	15.5	9.1	13
Tanks/Lakes Area	8.0	4.7	7
Waterfall Area	0.0	0.0	0
Total	119.3	69.8	100

3.3.4 Groundwater Supply

Annual Groundwater Extractable (ha.m)	Annual Groundwater extraction (ha.m)	Stage of Ground-water extraction	Groundwater extraction category
2,795	1,921	68.74 %	Safe

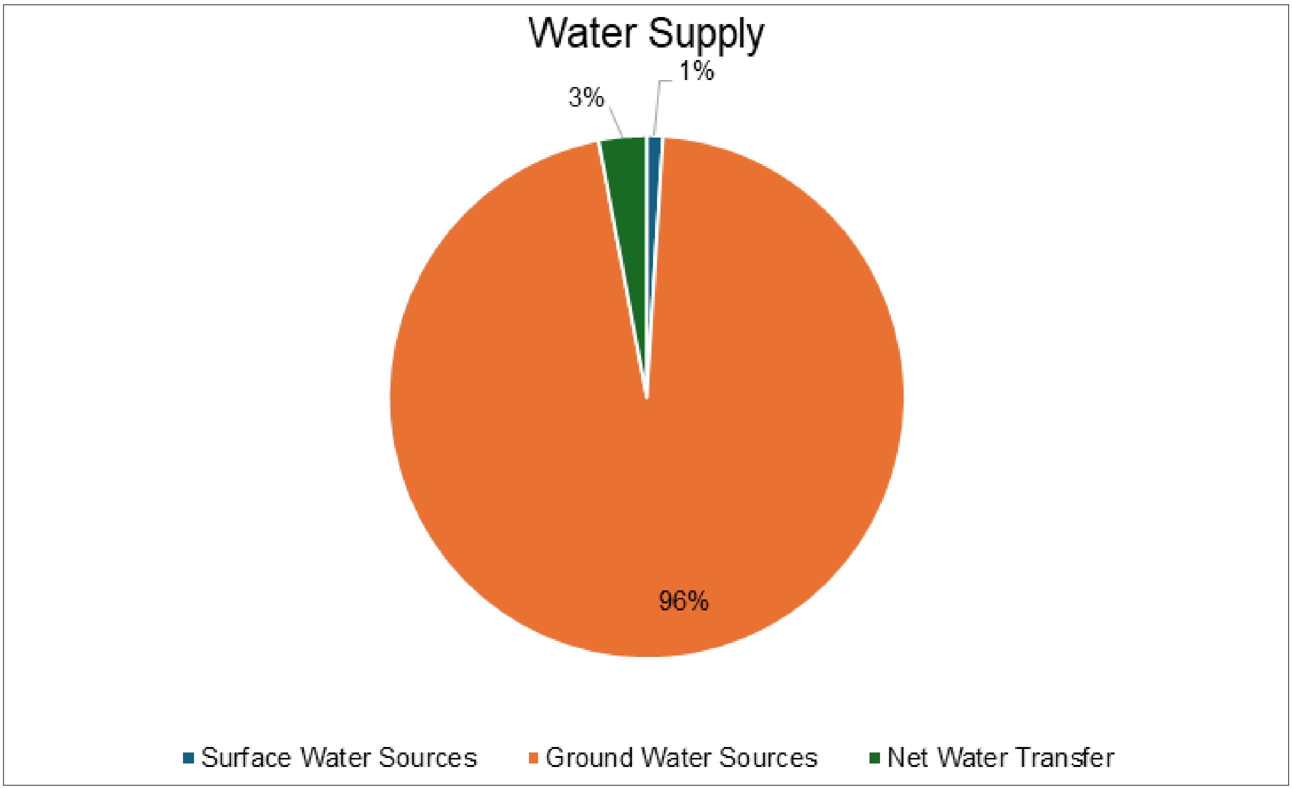
3.3.5 Water Transfer

Water Use	Inward Transfer (ha.m)	Outward Transfer (ha.m)	Net Transfer (ha.m)
Domestic	0	0	0
Agriculture	56	0	56
Industry	0	0	0
Total	**56**	0	**56**

3.3.6 Amount of Run-off

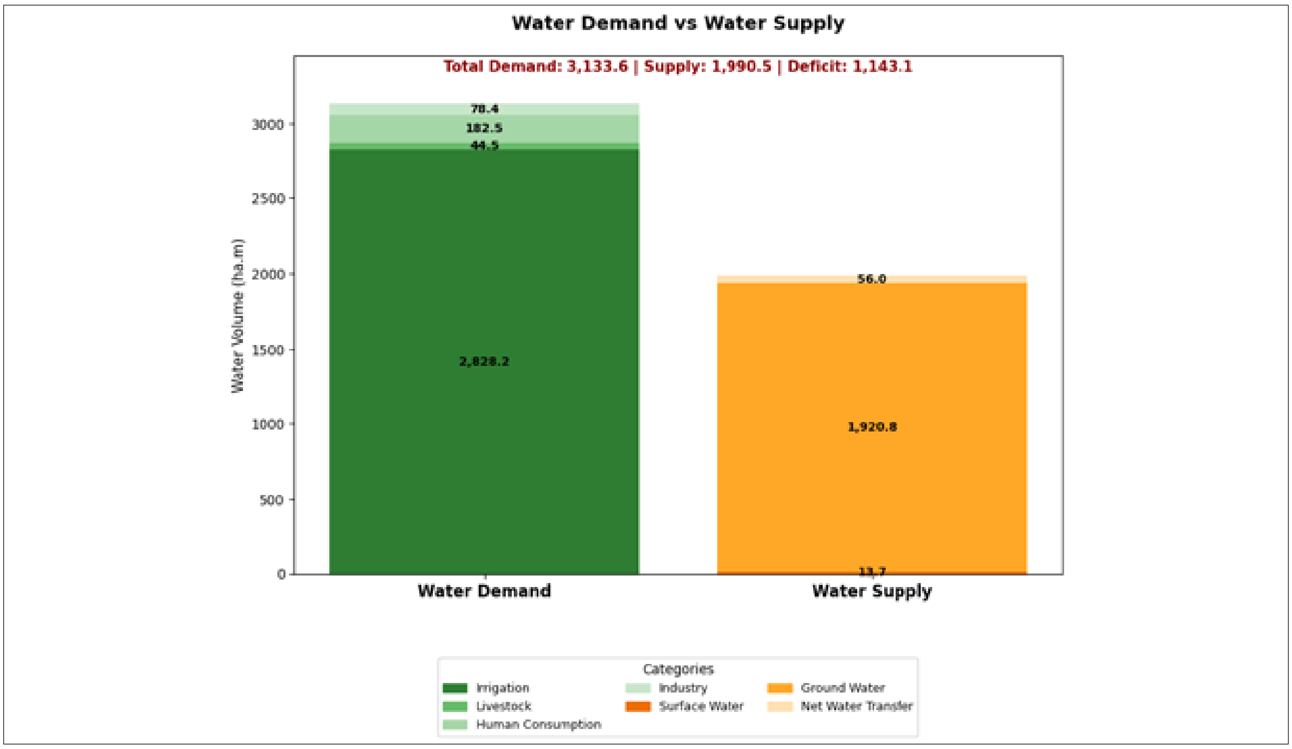
The Kukarmunda block belongs to the Gujarat Plain and Hills Region of India. The block has an average of 939 mm rainfall and has potential for harvesting 3,542.1 ha.m run-off annually.

Types of Run-offs	Area (in ha)	run-off (cu.m per ha)	Run-off	
			In ha.m	In %
Good Catchment Area	5,824.7	3,154.25	1,837.3	52
Average Catchment Area	993.7	2,358.75	234.4	6
Poor Catchment Area	9,353.9	1572	1,470.4	42
Total	16,172.3		3,542.1	100



3.4 Water Budgeting at Block Level

S. No	Descriptions	Volume	
		In ha.m	In %
A. Water Demand			
1	Water for Irrigation	2,828.2	90
2	Water for Livestock	44.5	1
3	Water for Human Consumption	182.5	6
4	Water for Industry	78.44	3
5	Block wise water required	3,133.6	100
B. Water Supply			
6	Supply from Local Surface Water Sources	13.7	1
7	Supply from Groundwater Sources	1,920.8	96
8	Net Water Transfer	56.0	3
9	Total Supply	1,990.6	100
C. Water Budgeting			
10	Water Deficit/Surplus	-1,143.0	37%
D. Potential for rainwater harvesting/ GW augmentation (in ha.m)			
11	Available Run-off from Rainwater	3,542.1	
12	Harvested Run-off	3,90,522.90	
13	Potential Runoff Available for Harvesting/GW Augmentation	Nil	
E. Potential for Groundwater Development			
14	Stage of Groundwater Development (from IN-GRES portal)	68.74	
15	Groundwater Development Category (from IN-GRES portal)	Safe	



3.4.1 Annotations

(i) The Kukarmunda block is agriculture dominated, and irrigation intensity is comparatively high.

(ii) The Ukai dam, one of the block's largest reservoirs, has a storage capacity of 3,90,514.67 ha.m. The block is in a low-lying location, resulting in less run-off (3,542.1 ha.m) within the geography. Whereas it received water from the neighboring catchment, resulting in increased water storage (3,90,514.67 ha.m) inside the block. This storage facility not only meets local demand but also serves the water demand of neighbouring locations.

(iii) Although the block has huge surface water availability, the reliance on Groundwater sources is significantly high (96%) in the block.

(iv) The Kukarmunda block has 3,113.6 ha.m water requirements for all purposes, out of this 90% is for irrigation only.

(v) The block has 1,990.6 ha.m (1% surface water + 96% Groundwater + 3% outside the block) supply from all sources.

3.4.2 Recommendations

(i) The significant dependence on Groundwater may affect the development of Groundwater sources now classified as safe. Additionally, the block has a 37% water deficit (1,143 ha.m).

(ii) Therefore, it is crucial to reduce Groundwater use and improve the utilisation of surface water sources for varied purposes.

3.4.3 Takeaways for Rural Drinking Water Supply

(i) The JJM coverage is 100% as on March 2025.

(ii) Of the 85 PWS schemes in the block, 80 (94%) are SVS and 5 (6%) are MVS. As a result, the block relies heavily on Groundwater for its rural drinking water supply.

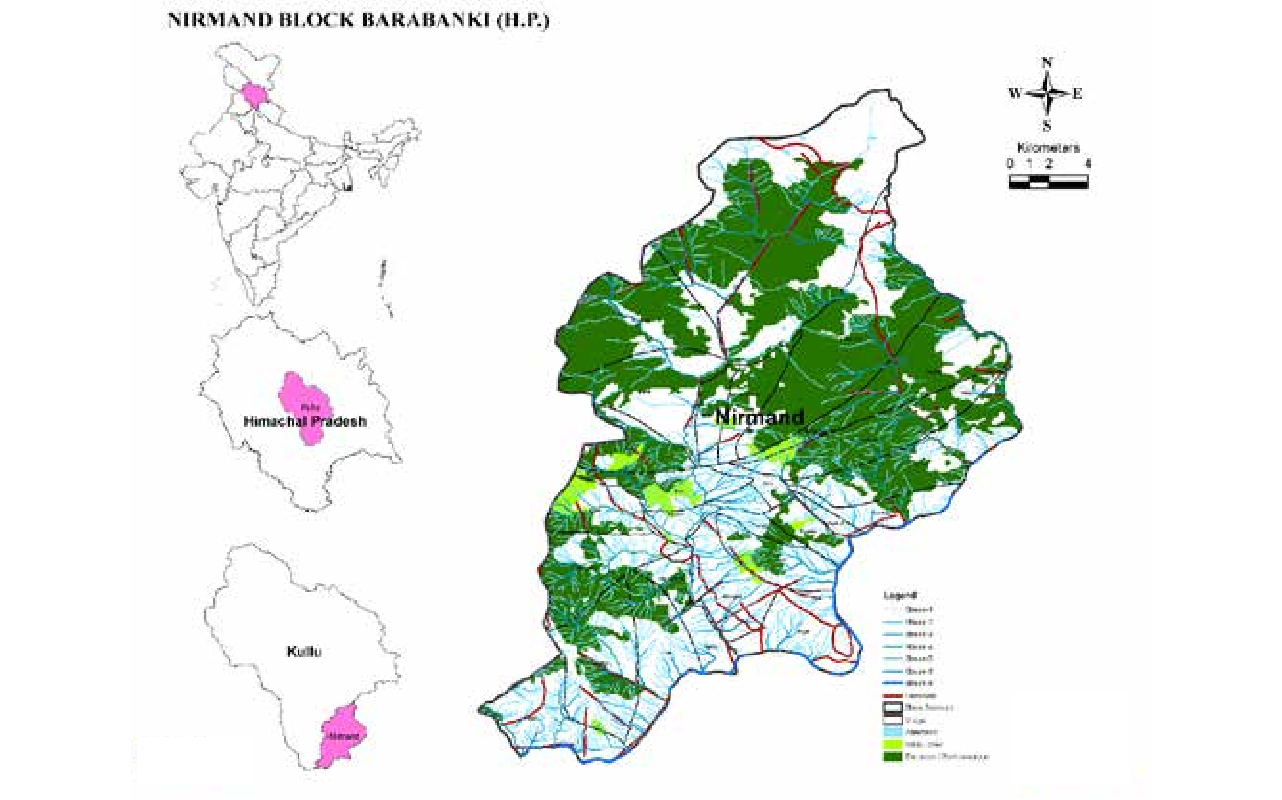
(iii) The block has adequate quantity of Groundwater for future drinking water needs.

(iv) Measures to be taken to protect the Groundwater quality and GW augmentation.

4. Nirmand Block, Kullu District, Himachal Pradesh

4.1 Introduction

State	District	Block	Number of villages	Number of Urban centres
Himachal Pradesh	Kullu	Nirmad	26	0



4.2 Demand Side Management

4.2.1 Water Requirements for Human Consumption

#	Total Population			Population Growth	Water demand (lpcd)	Annual Water Requirements (ha.m)
	Female	Male	Total			
Rural	26,087	27,002	53,089	66,361	55	159.9
Urban	0	0	0	0	150	0.0
Total	26,087	27,002	53,089	66,361		159.9

4.2.2 Livestock Water Requirement

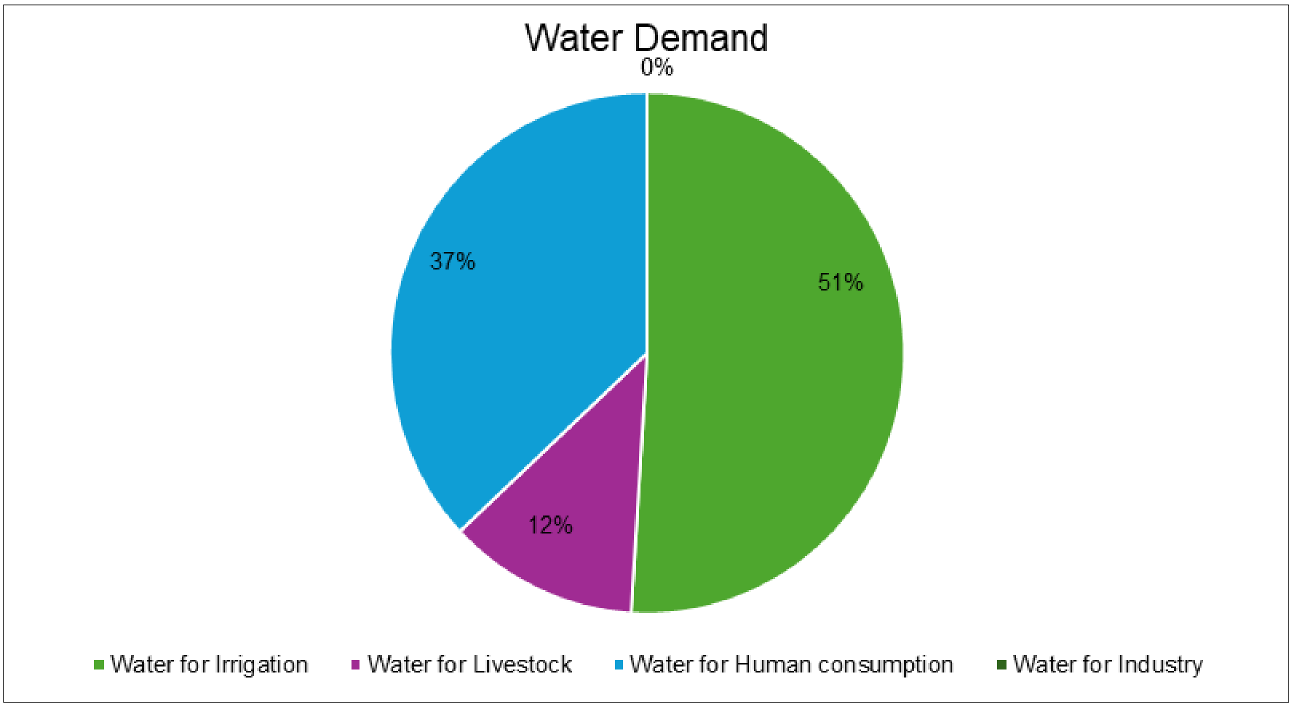
S. No	Type of Animal	Number of animals	Water Req. (ha.m)
1	Cow/Cattle	18,686	45.7
2	Goat	6,220	1.6
3	Sheep	5,857	1.5
4	Buffaloes	278	0.7
5	Horses	0	0
6	Camels	0	0
7	Pigs	0	0
8	Poultry	0	0
	Total	31,041	49.5

4.2.3 Water Requirements for Livestock Consumption

Irrigated Area (in ha)	Water required per hectare (ha.m)	Irrigation Water Requirement (ha.m)
1	2	3 = (1*2)
429.2	0.5	214.6

4.2.4 Industrial Water Requirement

No industries in this block.



4.3 Supply Side Management

4.3.1 Information on Land Use

As per census 2011, the Nirmand block has 7,765.9 hectares area for various uses.

S. No	Classification	Area	
		In ha	In %
1	Total Unirrigated Land Area	5,482.9	71
2	Area under Non-Agricultural Uses (Rural +Urban)	825.7	11
3	Culturable Waste Land Area	487.3	6
4	Area Irrigated by Source	366.8	5
5	Barren & Un-cultivable Land Area	259	3
6	Forest Area	131	2
7	Current Fallows Area	86	1
8	Fallows Land other than Current Fallows Area	54	1
9	Permanent Pastures and Other Grazing Land Area	41.4	0.6
10	Land Under Miscellaneous Tree Crops etc. Area	31.8	0.4
	Total	7,765.9	100

4.3.2 Surface Water Bodies

The Nirmand block is part in the Western Himalayan region of India. The Himalayan region has larger areas supported by good catchment & average areas and helpful for the surface run-off generated during the monsoon period to store in surface waterbodies.

S. No.	Names of Structures	Number of structures	Storage Capacity	
			In ha.m	In %
1	Lakes	6	105.8	63
2	Ponds	39	45.2	27
3	Tanks/WCS	17	10.9	7
4	Water harvesting Structure	68	4.9	3
5	Reservoir	0	0	0
	Total	130	166.8	100

4.3.3 Surface Water Supply

S. No	Type	Area Irrigated (in ha)	Water Supply	
			In ha.m	In %
1	Canals Area	202	118.2	58
2	Other Source (Water from outside)	137.8	80.6	40
3	Waterfall Area	7	4.1	2
4	Tanks/Lakes Area	0	0	0
	Total	346.8	202.9	100

4.3.4 Groundwater Supply

The Kullu district information on Groundwater monitoring is not available in IN-GRES, so Groundwater extraction information is taken from the nearest monitoring station which is Balh Valley in Mandi district[24].

Annual Groundwater Extractable (ha.m)	Annual Groundwater extraction (ha.m)	Stage of Groundwater extraction	Groundwater extraction category
2,440	1,034	42.39 %	Safe

4.3.5 Water Transfer

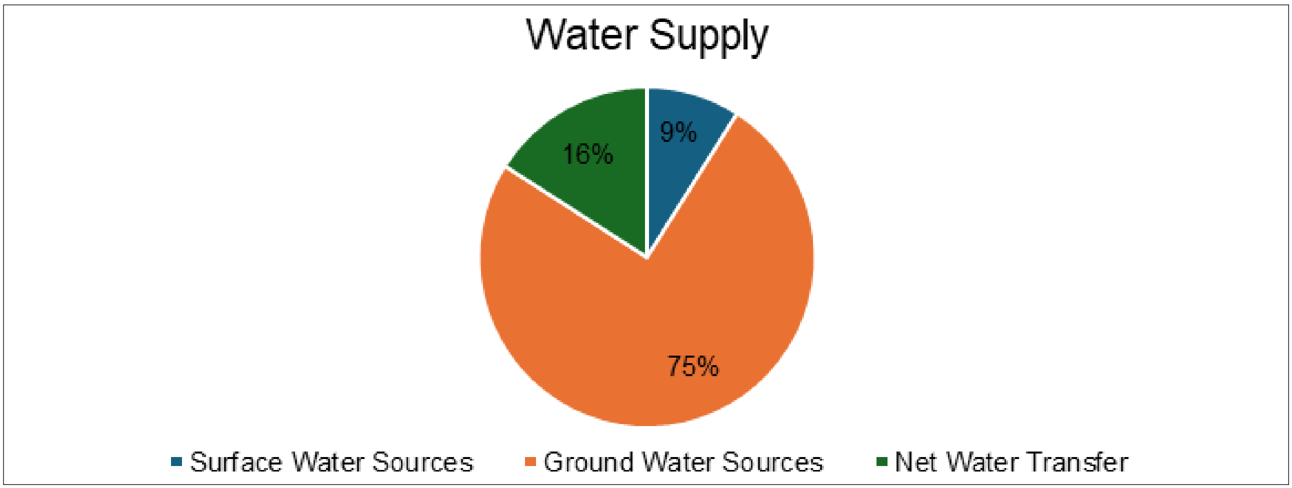
Water Use	Inward Transfer (ha.m)	Outward Transfer (ha.m)	Net Transfer (Inwards-Outwards) ha.m
Domestic	0	309.2	+309.2
Agriculture	80.6	0	-80.6
Industry	0	0	0
Total	80.6	309.2	228.5

4.3.6 Amount of Run-off

The Nirmad block belongs to the Western Himalayan region of India and the land use pattern data reveals that major parts of the block geography are undulating and under non-cultivation uses. The block has an average of 800 mm rainfall and has the potential for harvesting 1,045.6 ha.m run-off annually.

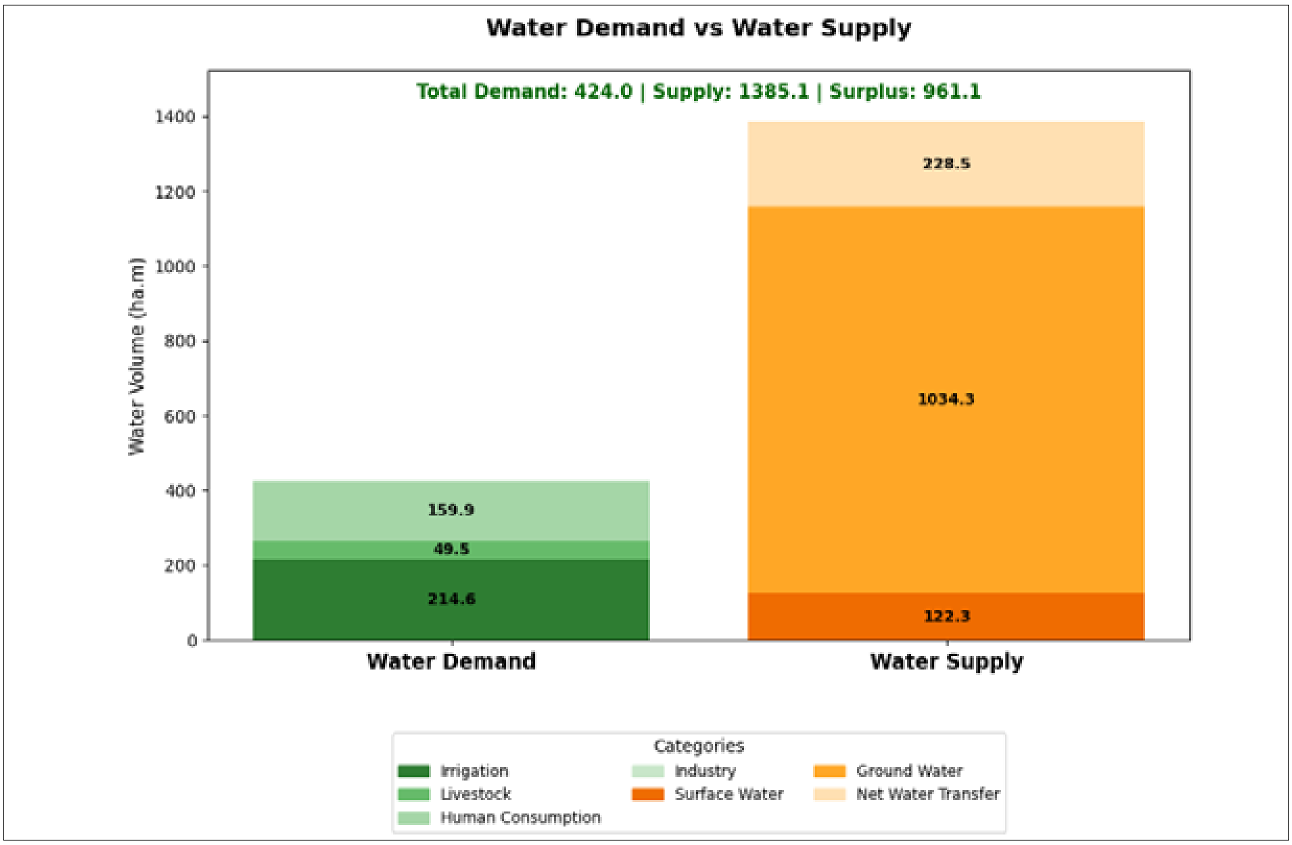
24 GecDashboard (iith.ac.in)

Types of Run-offs	Area (in ha)	Run-off (cu.m per ha)	Run-off	
			In ha.m	In %
Good Catchment Area	1,215.7	2,218.5	269.7	26
Average Catchment Area	560.5	1,704	95.5	9
Poor Catchment Area	5,989.7	1,136	680.4	65
Total	7,765.9		1,045.6	100



4.4 Water Budgeting at Block Level

S. No	Descriptions	Volume	
		In ha.m	In %
A. Water Demand			
1	Water for Irrigation	214.6	51
2	Water for Livestock	49.5	12
3	Water for Human Consumption	159.9	37
4	Water for Industry	0	0
5	Block Wise Water Required	423.9	100
B. Water Supply			
6	Surface Water Sources	122.3	9
7	Groundwater Sources	1,034.3	75
8	Net Water Transfer	228.5	16
9	Total Supply	1,385.1	100
C. Water Budgeting			
10	Water Deficit/Surplus	961.2	227
D. Potential for Rainwater Harvesting/GW Augmentation (in ha.m)			
11	Available Run-off from Rainwater	1,045.6	
12	Harvested run-off	166.80	
13	Potential Runoff Available for Harvesting/GW Augmentation	617.4	
E. Potential for Groundwater Development			
14	Stage of Groundwater Development (from IN-GRES portal)	42.39	
15	Groundwater Development Category (from IN-GRES portal)	Safe	



4.4.1 Annotations

(i) Since the Nirmand block is part of the Himalayan region, the land use pattern is totally different as evident from the table above.

(ii) As the block belongs to the Himalayan region, it is dominated by rain-fed farming, hence surface water source is minimally used for irrigation purposes.

(iii) In the case of the Himalayan region, water from springs plays an important role in catering to local water needs, however it is difficult to reflect in the water budgeting process, due to the limitation of required datasets.

(iv) The Himalayan region is also known for reliance on glacier water, however due to inadequate availability of datasets patenting to glacier water, it is difficult to incorporate in the water budgeting process.

(v) The block has harvested 37,971.40 ha.m of water in surface water bodies but has utilised only 3.6% of the harvested water for irrigation purposes

(vi) The Nirmand block has 423.9 ha.m water requirements for all purposes, out of this 51% is for irrigation only.

(vii) The Stage of Groundwater development is in the safe category.

(viii) The block has 1,385.1 ha.m (9% surface water + 75% Groundwater + 16% outside the block) of supply from all sources.

(ix) The block is water surplus by 227% (961.2 ha.m).

(x) The block has potential to harvest 617.4 ha.m of run-off.

4.4.2 Recommendations

(i) Although the Himalayan region receives good precipitation, there is a limitation in enhancing surface water storage capacities whereas the sub-surface water plays an important role.

(ii) In case of the Himalayan region, more focus is on spring-shed management and the glacier water management is crucial to ensure water security.

4.4.3 Takeaways for Rural Drinking Water Supply

(i) The JJM coverage is 100% as of March 2025.

(ii) Of the 178 PWS schemes in the block, 116 (65%) are SVS and 62 (35%) are MVS. Hence, the block is mainly dependent on Groundwater for rural drinking water supply.

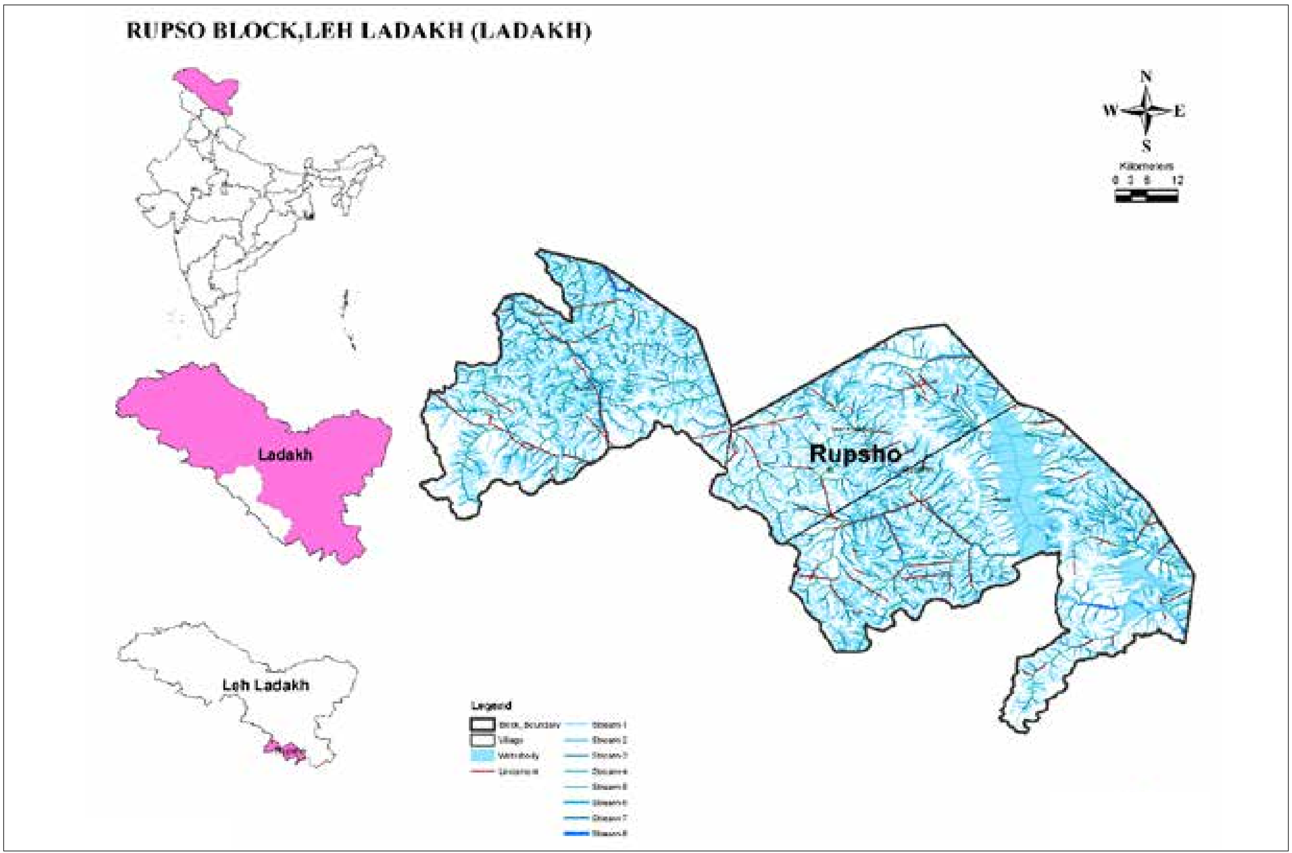
(iii) The block has an adequate quantity of Groundwater for future drinking water needs.

(iv) Measures to be taken to protect the Groundwater quality.

5. Rupsho Block, Leh District, Ladakh

5.1 Introduction

State	District	Block	Number of Villages	Number of Urban Centres
Ladakh	Leh	Rupsho	3	0



5.2 Demand Side Management

5.2.1 Water Requirements for Human Consumption

	Total Population			Population Growth	Water demand (lpcd)	Annual Water Requirements (ha.m)
	Female	Male	Total			
Rural	1,135	1,190	2,325	2,906.25	55	7.0
Urban	0	0	0	0	150	0
Total	1,135	1,190	2,325	2,906.25		7.0

5.2.2 Water Requirement for Livestock Consumption

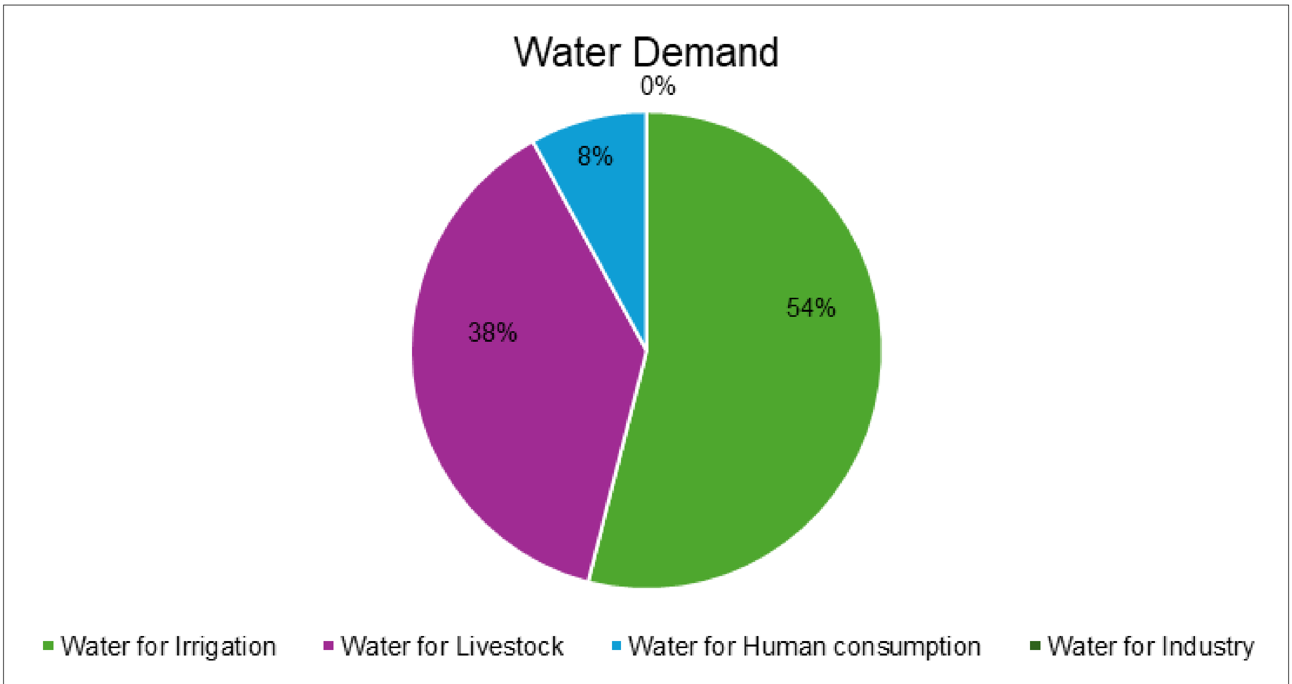
S. No	Type of Animal	Number of Animals	Water Req. (ha.m)
1	Goat	78,776	20.1
2	Sheep	48,019	12.3
3	Cow/Cattle	117	0.3
4	Buffaloes	0	0.0
5	Horses	0	0.0
6	Camels	0	0.0
7	Pigs	0	0.0
8	Poultry	0	0.0
Total		1,26,912	32.7

5.2.3 Irrigation Water Requirement

Irrigated Area (in ha)	Water required per hectare (ha.m)	Irrigation Water Requirement (ha.m)
1	2	3 = (1*2)
91.7	0.5	45.9

5.2.4 Industrial Water Requirement

There are no industries in the block.



5.3 Supply Side Management

5.3.1 Information on Land Use

As per census 2011, the Rupsho block has 4,44,865 hectares areas for various uses.

S. No	Classification	Area	
		In ha	In %
1	Barren & Un-cultivable Land Area	2,92,889	65.84
2	Area under Non-Agricultural Uses	85,510	19.22
3	Fallows Land other than Current Fallows Area	35,428	7.96
4	Culturable Waste Land Area	22,504	5.06
5	Total Unirrigated Land Area	4,926	1.11
6	Permanent Pastures and Other Grazing Land Area	3,318	0.75
7	Current Fallows Area	212	0.05
8	Area Irrigated by Source	78	0.02
9	Land Under Miscellaneous Tree Crops etc. Area	0	0.00
10	Forest Area	0	0.00
Total		4,44,865	100

5.3.2 Surface Water Bodies

The other water structures in the table above depicts the surface water storage structures having a spread area of more than 100 hectares as classified in Minor Irrigation Census.

S. No	Names of Structures	Number of structures	Storage Capacity	
			In ha.m	In %
1	Other	48	6,81,881.8	95.84
2	Reservoir	136	27,592.8	3.88
3	Lakes	66	1,927.6	0.27
4	Ponds	29	73.4	0.01
5	Tanks/WCS	2	2	0.002
6	Water Harvesting Structure	12	1.5	0.001
Total		293	7,11,479.1	100

5.3.3 Surface Water Supply

S. No	Type	Area Irrigated (ha)	Water Supply	
			In ha.m	In %
1	Canals	78.4	45.9	100
2	Tanks/Lakes Area	0	0	0
3	Other Source (Water from outside)	0	0	0
4	Waterfall Area	0	0	0
Total		78.4	45.9	100

5.3.4 Groundwater Supply

Annual Groundwater Extractable (ha.m)	Annual Groundwater extraction (ha.m)	Stage of Groundwater extraction	Groundwater extraction category
183	112	61.38%	Safe

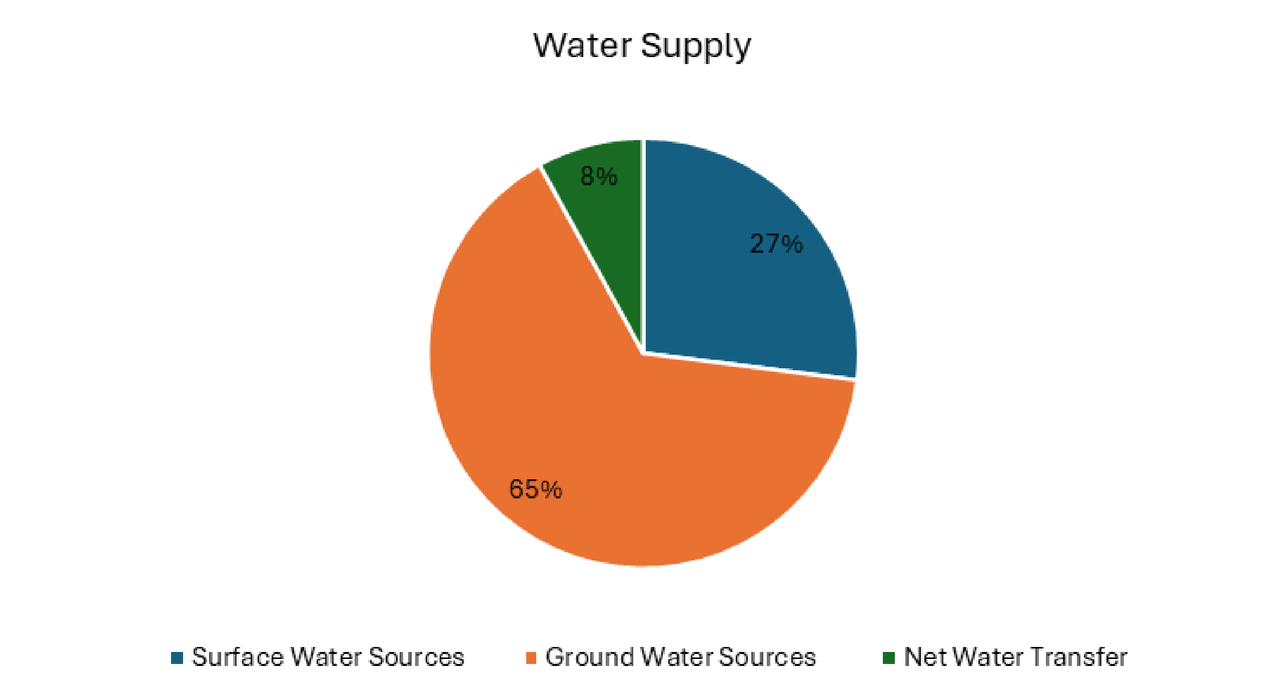
5.3.5 Water Transfer

Water Use	Inward Transfer (ha.m)	Outward Transfer (ha.m)	Net Transfer (Inwards-Outwards) ha.m
Domestic	14	0	14
Agriculture	0	0	0
Industry	0	0	0
Total	14	0	14

5.3.6 Amount of Run-off

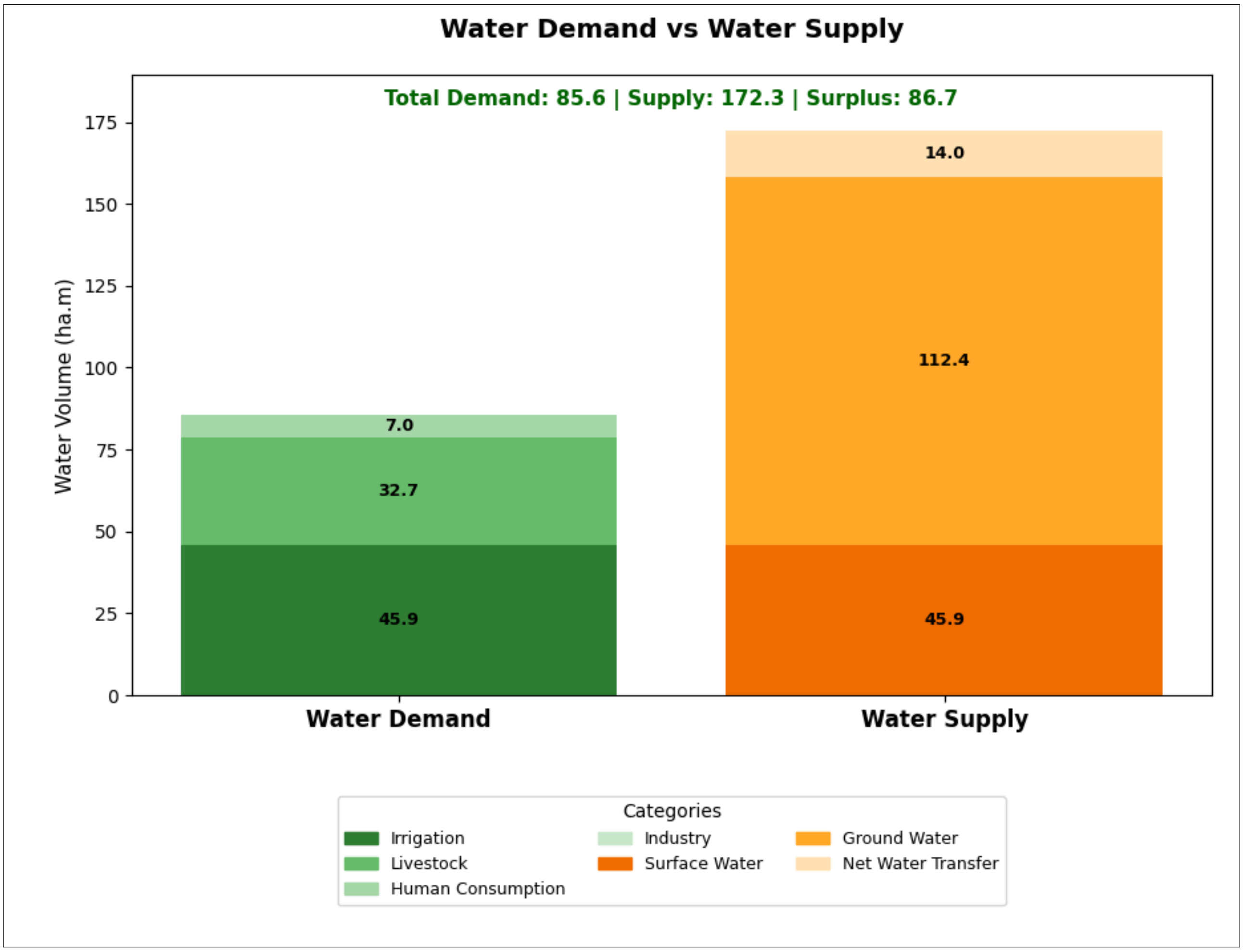
The Rupsho block belongs to the Hills Region of India and the land use pattern data reveals that major parts of the block geography are undulating and for non-cultivation uses. The block has an average of 62 mm of rainfall and has the potential for harvesting 41.8 ha.m run-off annually.

Types of Run-offs	Area (ha)	Run-off (cu.m per ha)	Run-off	
			In ha.m	In %
Good Catchment Area	3,78,399.0	1	37.8	90
Average Catchment Area	25,822.4	0.75	1.9	5
Poor Catchment Area	40,643.7	0.5	2.0	5
Total	4,44,865.1		41.8	100



5.4 Water Budgeting at Block Level

S. No	Descriptions	Volume	
		In ha.m	In %
A. Water Demand			
1	Water for Irrigation	45.9	54
2	Water for Livestock	32.7	38
3	Water for Human Consumption	7.0	8
4	Water for Industry	0	0
5	Block Wise Water Required	85.5	100
B. Water Supply			
6	Supply from Local Surface Water Sources	45.9	27
7	Supply from Groundwater Sources	112.4	65
8	Net Water Transfer	14.0	8
9	Total Supply	172.2	100
C. Water Budgeting			
10	Water Deficit/Surplus	86.7	101
D. Potential for Run-off Harvesting/GW Augmentation (in ha.m)			
11	Available Run-off from Rainwater	41.8	
12	Harvested Run-off	7,11,479.1	
13	Potential Run-off Available for Harvesting/GW Augmentation	Nil	
E. Potential for Groundwater Development			
14	Stage of Groundwater Development (from IN-GRES portal)	61.38	
15	Groundwater Development Category (from IN-GRES portal)	Safe	



5.4.1 Annotations

(i) Since the Rupsho block is a part of the Upper Himalayan region and cold desert, the land use pattern is unique as evident from the table above.

(ii) As the block belongs to the Upper Himalayan region, it is dominated by the glacier water-based farming during summers (April-August), hence the glacier water source is being used for irrigation purposes.

(iii) In the case of the Upper Himalayan region, water from the spring and glacier plays an important role in catering to local water needs, however, it is difficult to reflect in the water budgeting process, due to the limitation of required datasets.

(iv) The Himalayan region is also known for its reliance on glacier water however due to inadequate availability of datasets patenting to glacier water it is difficult to incorporate in the water budgeting process.

(v) The Upper Himalayan region receives very little precipitation, there is limitation of enhancing surface water storage capacities, whereas the sub-surface water plays an important role.

(vi) In the Upper Himalayan region, glacier water plays a major role, which is evident in the case of Rupsho block where surface water harvesting is more than 0.7 million ha.m**,** whereas surface run-off induced by precipitation is hardly 41.8 ha.m.

(vii) The Stage of Groundwater development is in the safe category.

(viii) The Rupsho block has **85.5** ha.m water requirements for all purposes, out of this 54% is for irrigation only.

(ix) The block has **172.2** ha.m (27% surface water + 65% Groundwater + 8% outside the block) of supply from all sources.

(x) The block is water surplus by 101% (86.7 ha.m)

5.4.2 Recommendations

(i) The geomorphology of the block shows that it is dependent on unconfined aquafer, so it becomes very important to protect these subsurface water sources from contamination.

5.4.3 Takeaways for Rural Drinking Water Supply

(i) JJM coverage is 100% as of March 2025.

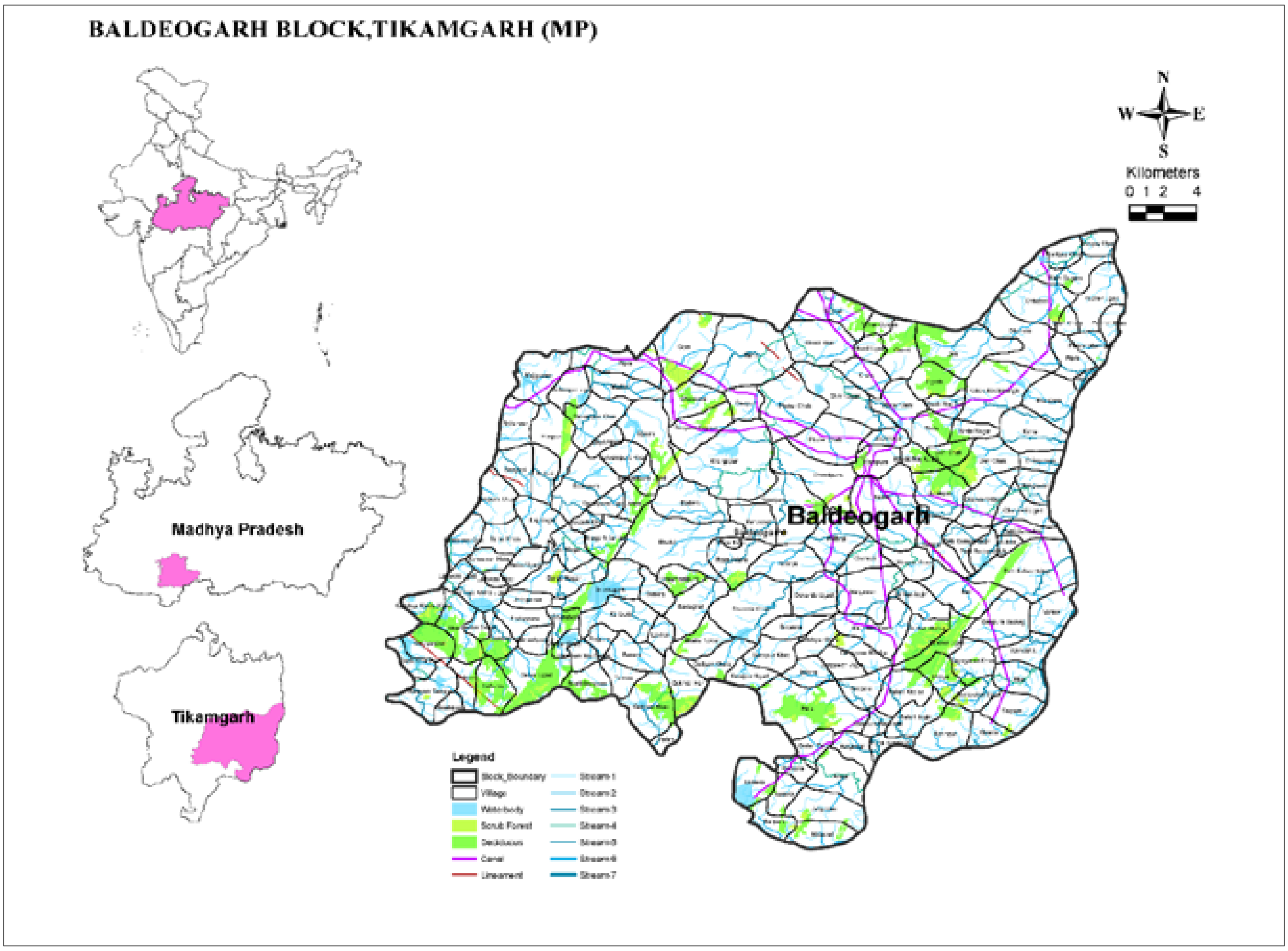
(ii) Both ground and sub-surface water are available to meet the current and future drinking water demands.

(iii) Measures to be taken to protect the sub-surface water quality.

6. Baldeogarh Block, Tikamgarh District, Madhya Pradesh

6.1 Introduction

State	District	Block	Number of villages	Number of Urban centres
Madhya Pradesh	Tikamgargh	Baldeogargh	162	1



6.2 Demand Side Management

6.2.1 Water Requirements for Human Consumption

#	Total Population			Population Growth	Water demand (lpcd)	Annual Water Requirements (ha.m)
	Female	Male	Total			
Rural	1,01,284	1,12,808	2,14,092	2,67,615	55	644.7
Urban	4,238	4,841	9079	11,349	150	74.6
Total	1,05,522	1,17,649	2,23,171	2,78,964		719.2

6.2.2 Water Requirement for Livestock Consumption

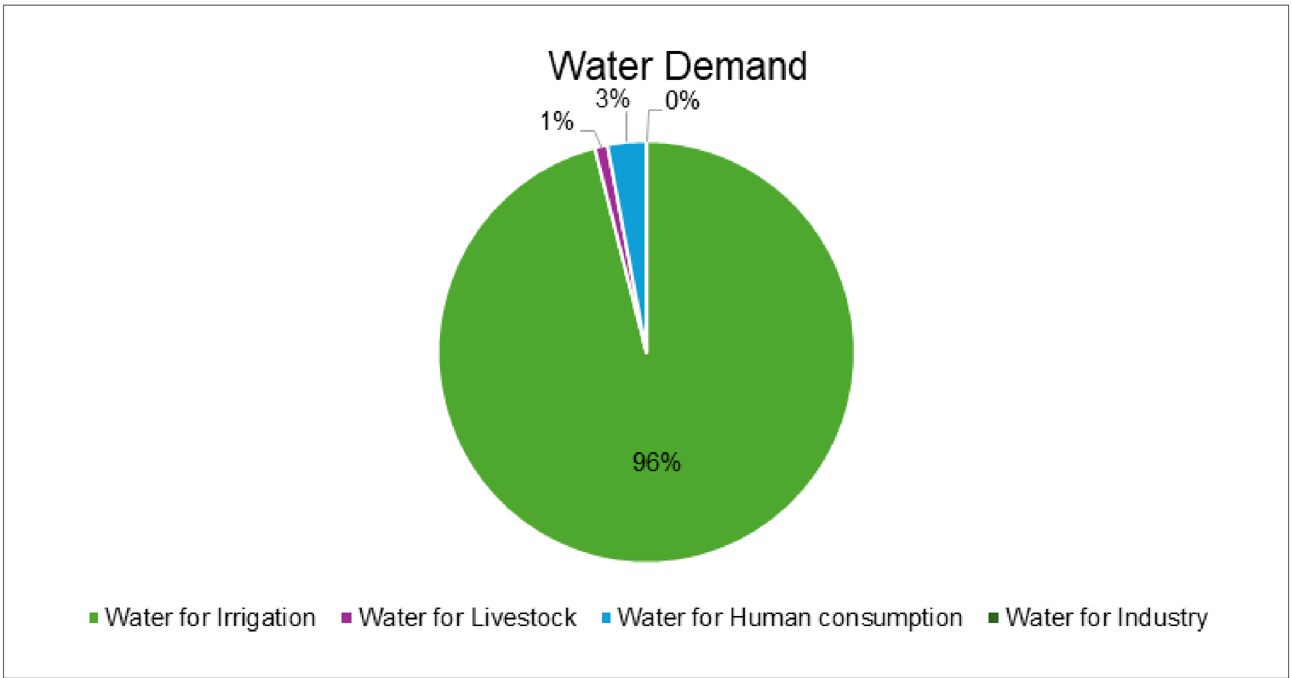
S. No	Type of Animal	Number of Animals	Water Req. (ha.m)
1	Buffaloes	26,843	65.6
2	Cow/Cattle	25,188	61.6
3	Goat	23,244	5.9
4	Pigs	709	0.6
5	Sheep	1,362	0.3
6	Horses	0	0
7	Camels	0	0
8	Poultry	0	0
Total		77,346	134.1

6.2.3 Irrigation Water Requirement

Irrigated Area (in ha)	Water required per hectare (ha.m)	Irrigation Water Requirement (ha.m)
1	2	3 = (1*2)
40,947.4	0.5	20,473.7

6.2.4 Industrial Water Requirement

There are no industries in the block.



6.3 Supply Side Management

6.3.1 Information on Land Use

As per census 2011, the Baldeogarh block has 85,227.41 hectares areas for various uses.

S. No	Classification	Area	
		In ha	In %
1	Area Irrigated by Source	34,997.8	41
2	Area under Non-Agricultural Uses (Rural +Urban)	8,545.5	10
3	Total Unirrigated Land Area	8,301.7	10
4	Fallows Land other than Current Fallows Area	8,084.9	9
5	Barren & Un-cultivable Land Area	6,523.4	8
6	Culturable Waste Land Area	5,098.5	6
7	Permanent Pastures and Other Grazing Land Area	4,834.2	6
8	Current Fallows Area	4,725.5	6
9	Forest Area	4,069.2	5
10	Land Under Miscellaneous Tree Crops etc. Area	46.71	0.05
Total		85,227.41	100

6.3.2 Surface Water Bodies

The number of surface water bodies is mostly less and is part of the Plateau regions, but water spread areas are on the higher side, in comparison to the Gangetic plains. The Plateau regions have larger areas supported by good catchment & average areas; those are helpful for the surface run-off generated during the monsoon period to store in surface waterbodies.

S. No	Names of Structures	Number of Structures	Storage Capacity	
			In ha.m	In %
1	Others	3	11,903.1	75
2	Reservoir	18	3,242.4	20
3	Lakes	26	690.5	4
4	Ponds	26	57.7	0.7
5	Tanks/WCS	8	5	0.003
6	Water harvesting Structure	2	0.2	0
Total		83	15,898.9	100

The other water structures in the table above depict the surface water storage structures having a spread area of more than 100 hectares as classified in Minor Irrigation Census.

6.3.3 Surface Water Supply

The Baldeogarh block is predominantly dependent on Groundwater sources (82.6%). The block has availability of run-off and harvested water in surface water bodies, which has not been utilised appropriately.

S. No	Type	Area Irrigated (ha)	Water Supply	
			In ha.m	In %
1	Other Source (Water from outside)	2,699.8	1,579.4	44
2	Tanks/Lakes Area	1,571.9	919.6	26
3	Canals Area	1,553.9	909.0	26
4	Waterfall Area	266.2	155.7	4
Total		6,091.80	3,563.7	100

6.3.4 Groundwater Supply

Annual Groundwater Extractable (ha.m)	Annual Groundwater extraction (ha.m)	Stage of Ground-water extraction	Groundwater extraction category
8,552	6,358	74.35 %	Semi-Critical

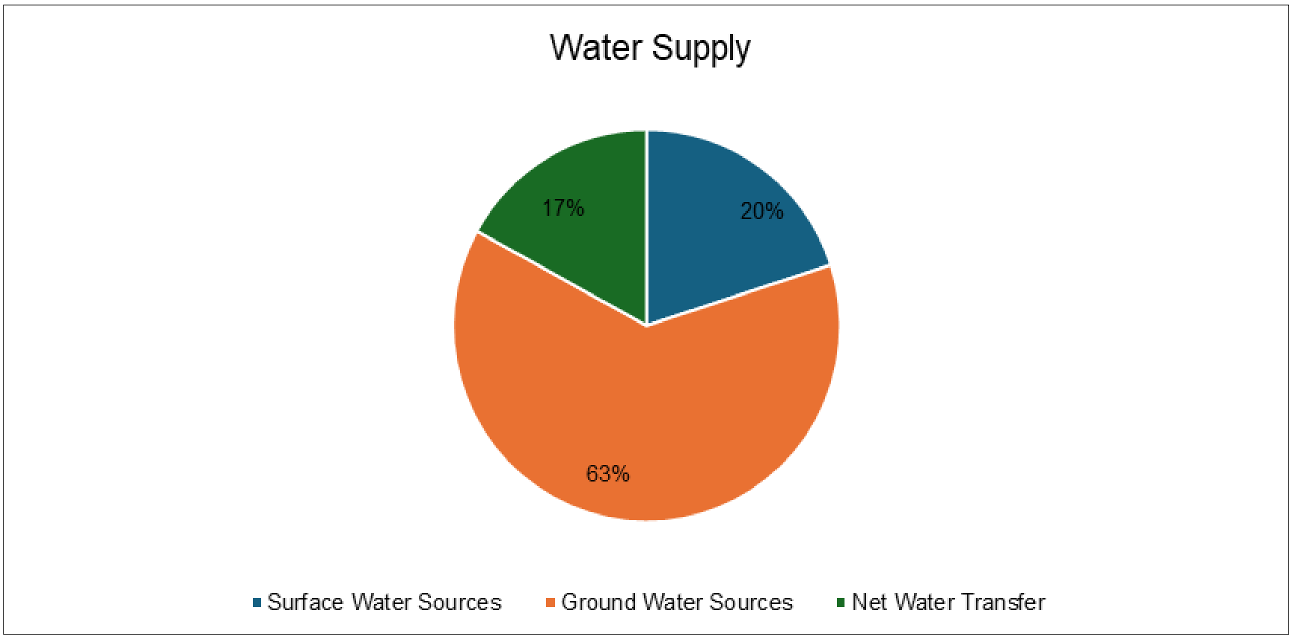
6.3.5 Water Transfer

Water Use	Inward Transfer (ha.m)	Outward Transfer (ha.m)	Net Transfer (Inwards-Outwards) ha.m
Domestic	167.53	0	167.53
Agriculture	1579.4	0	1579.4
Industry	0	0	0
Total	1,746.9	0	1,746.9

6.3.6 Amount of Run-off

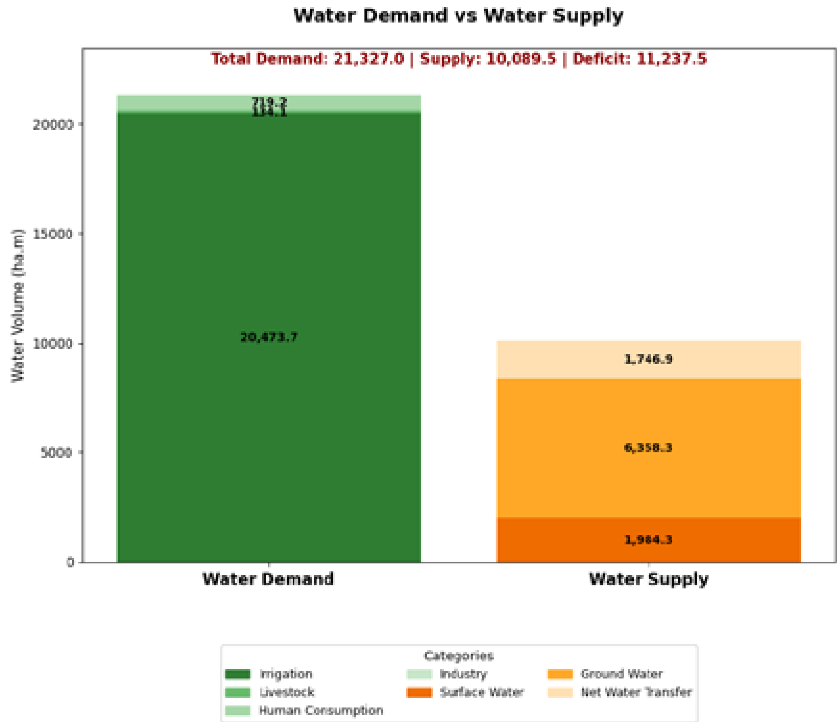
The Baldeogarh block belongs to the Central Plateau and Hills Region of India and the land use pattern data reveals that major parts of the block geography are undulating and for non-cultivation uses. The block has an average of 944 mm rainfall and has the potential for harvesting 1,7211.0 ha.m run-off annually.

Types of Run-offs	Area (ha)	Run-off (cu.m per ha)	Run-off	
			In ha.m	In %
Good Catchment Area	19,138.1	3,154.25	6,036.6	35
Average Catchment Area	99,79.41	2,358.75	2,353.9	14
Poor Catchment Area	56,109.9	1572	8,820.5	51
Total	75,248.00		17,211.00	100



6.4 Water Budgeting at Block Level

S. No	Descriptions	Volume	
		In ha.m	In %
A. Water Demand			
1	Water for Irrigation	20,473.7	96
2	Water for Livestock	134.1	1
3	Water for Human Consumption	719.2	3
4	Water for Industry	0	0
5	Block Wise Water Required	21,327.1	100
B. Water Supply			
6	Supply from Local Surface Water Sources	1,984.3	20
7	Supply from by Groundwater Sources	6,358.3	63
8	Net Water Transfer	1,746.9	17
9	Total Supply	10,089.5	100
C. Water Budgeting			
10	Water Deficit/Surplus	-11,237.5	53
D. Potential for Run-off Harvesting/GW Augmentation (in ha.m)			
11	Available Run-off from Rainwater	17,211.0	
12	Harvested Run-off	15,898.90	
13	Potential Run-off Available for Harvesting/GW Augmentation	Nil	
E. Potential for Groundwater Development			
14	Stage of Groundwater Development (from IN-GRES portal)	74.35	
15	Groundwater Development Category (from IN-GRES portal)	Semi-Critical	



6.4.1 Annotations

(i) The Baldeogargh block area belongs to the Bundelkhand region of central India is well known for water scarcity.

(ii) The average precipitation in Baldeogargh block is almost at par with the national average, however due to unique geology (being part of the plateau region) surface and Groundwater potential have certain limitations.

(iii) On the other hand, the region has comparatively higher arable areas (65%) dominated by irrigated areas.

(iv) The net implication is that a major part of this region is over exploiting Groundwater sources and exhausting surface water sources.

(v) The block is heavily dependent on Groundwater (63%) for all purposes, and it is water deficit by 53% (-11,237.5 ha.m)

(vi) The Stage of Groundwater development is in semi-critical category (74.35 %).

(vii) The Baldeogargh block has **21,327.1** ha.m water requirements for all purposes, out of this 96% is for irrigation only.

(viii) The block has **10,089.5** ha.m (20% surface water + 63% Groundwater + 17% outside the block) of supply from all sources.

6.4.2 Recommendations

(i) The block has huge surface water storage capacities (15,898.90 ha.m), however it uses only 12.5% of the surface water storage. The block needs to optimally use the surface water storage capacities.

(ii) Although the area is known for traditional water bodies meant for catering to local water needs for different purposes, but due to poor maintenance of this infrastructure, it remains water stressed for decades. The immediate focus should be in renovating and reviving these traditional water bodies.

6.4.3 Takeaways for Rural Drinking Water Supply

(i) The block has 55% JJM coverage as on March 2025.

(ii) Of the 419 PWS schemes in the block, 416 (99%) are SVS and 3 (1%) are MVS. Hence, the block is mainly dependent on Groundwater for rural drinking water supply.

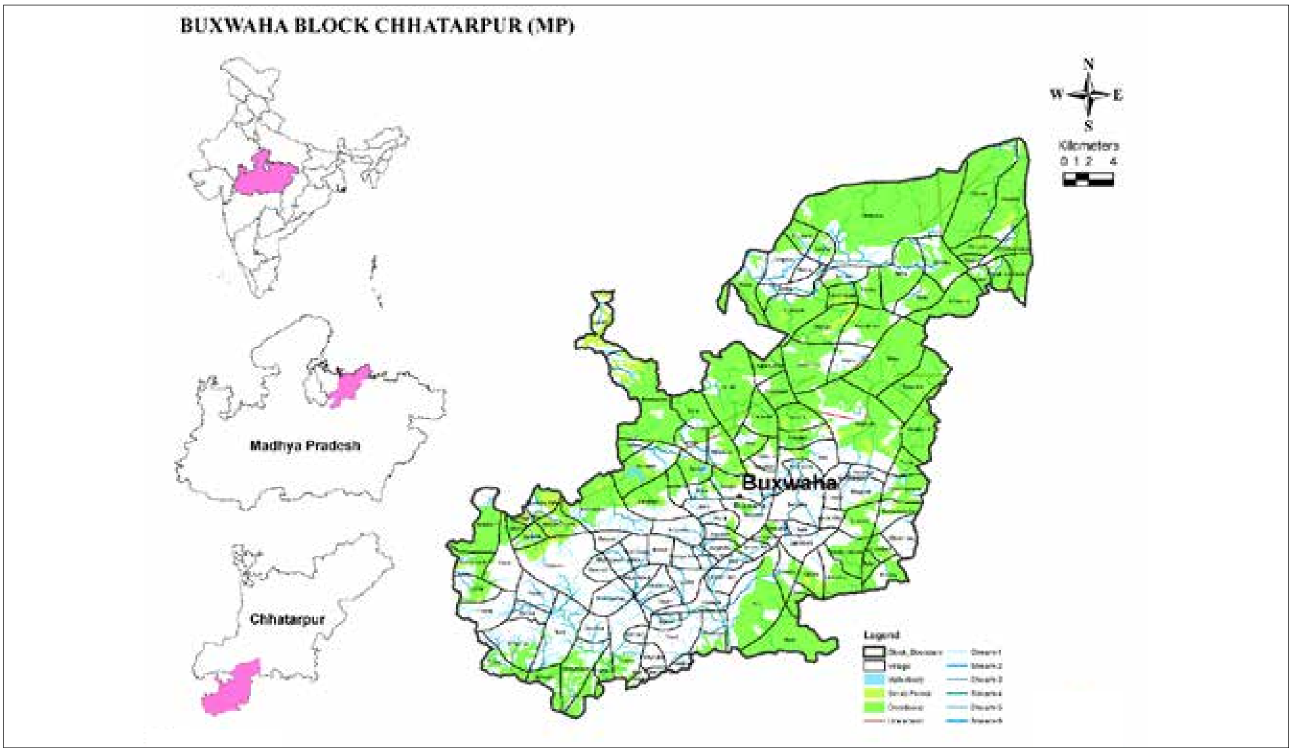
(iii) Surface water is required to meet the current and future drinking water demands.

(iv) Measures to be taken to protect the Groundwater quality and GW augmentation.

7. Buxwaha Block, Chhatarpur District, Madhya Pradesh

7.1 Introduction

State	District	Block	Number of villages	Number of Urban centres
Madhya Pradesh	Chhatarpur	Buxwaha	136	1



7.2 Demand Side Management

7.2.1 Water Requirements for Human Consumption

#	Total Population			Population Growth	Water demand (lpcd)	Annual Water Requirements (ha.m)
	Female	Male	Total			
Rural	37,163	42,898	80,061	1,00,076	55	241.1
Urban	4,829	5,387	10,216	12,770	150	83.9
Total	41,992	48,285	90,277	1,12,846		325.0

7.2.2 Water Requirements for Livestock Consumption

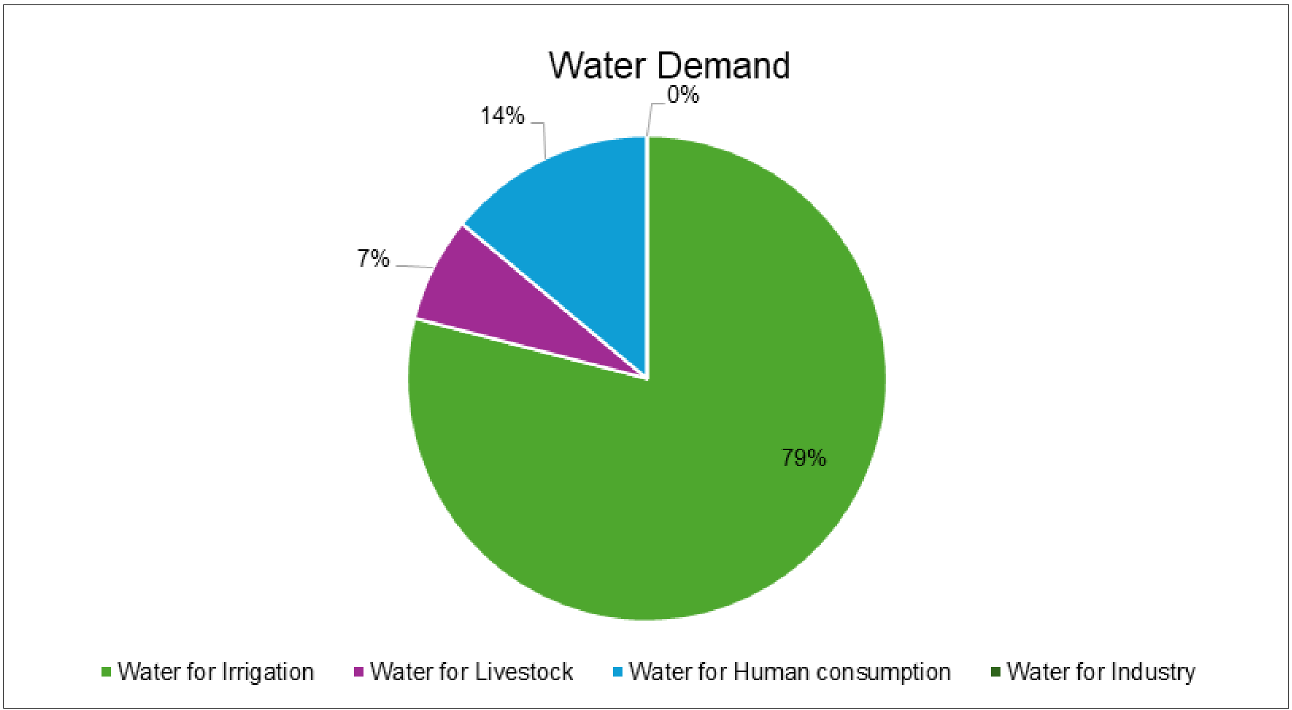
S. No	Type of Animal	Number of Animals	Water Req. (ha.m)
1	Cow/Cattle	37,080	90.7
2	Buffaloes	22,298	54.5
3	Goat	9,576	2.4
4	Pigs	499	0.4
5	Sheep	19	0.005
6	Horses	5	0.01
7	Camels	0	0
8	Poultry	0	0
Total		69,477	148.1

7.2.3 Irrigation Water Requirement

Irrigated Area (in ha)	Water required per hectare (ha.m)	Irrigation Water Requirement (ha.m)
1	2	3 = (1*2)
3,540.2	0.5	1,770.1

7.2.4 Industrial Water Requirement

There are no industries in the block.



7.3 Supply Side Management

7.3.1 Information on Land Use

As per census 2011, the Buxwaha block has 91,149.1 hectares areas for various purposes.

S. No	Classification	Area	
		In ha	In %
1	Forest Area	27,422.5	30
2	Total Unirrigated Land Area	20,186.6	22
3	Permanent Pastures and Other Grazing Land Area	12,455.0	14
4	Barren & Un-cultivable Land Area	11,126.8	12
5	Culturable Waste Land Area	5,051.1	6
6	Area under Non-Agricultural Uses (Rural +Urban)	4,947.2	5
7	Fallows Land other than Current Fallows Area	3,699.1	4
8	Area Irrigated by Source	3,025.8	3
9	Current Fallows Area	2,787.7	2.5
10	Land Under Miscellaneous Tree Crops etc. Area	447.3	0.5
Total		91,149.1	100

7.3.2 Surface Water Bodies

The Buxwaha block is part of the Central Plateau and Hills Region of India.The Buxwaha block major land parcels are forest cover, un-cultivable land, fallows & non-agriculture area, hence, the scope for larger structures for surface water is comparatively higher.

S. No.	Names of Structures	Number of Structures	Storage Capacity	
			In ha.m	In %
1	Reservoir	4	735.6	64
2	Lakes	14	273.9	24
3	Ponds	71	118.4	10
4	Tanks/WCS	33	22	1.8
5	Water harvesting Structure	40	3.3	0.2
6	Other	0	0	0
Total		162.00	1,153.2	100

7.3.3 Surface Water Supply

S. No	Type	Area Irrigated (ha)	Water Supply	
			In ha.m	In %
1	Other Source (Water from outside)	233.4	136.5	35
2	Canals Area	206	120.5	31
3	Tanks/Lakes Area	150	87.8	23
4	Waterfall Area	71	41.5	11
Total		660.4	386.3	100

7.3.4 Groundwater Supply

Annual Groundwater Extractable (ha.m)	Annual Groundwater Extraction (ha.m)	Stage of Ground-water Extraction	Groundwater Extraction Category
6,429	5,203	80.92 %	Semi-Critical

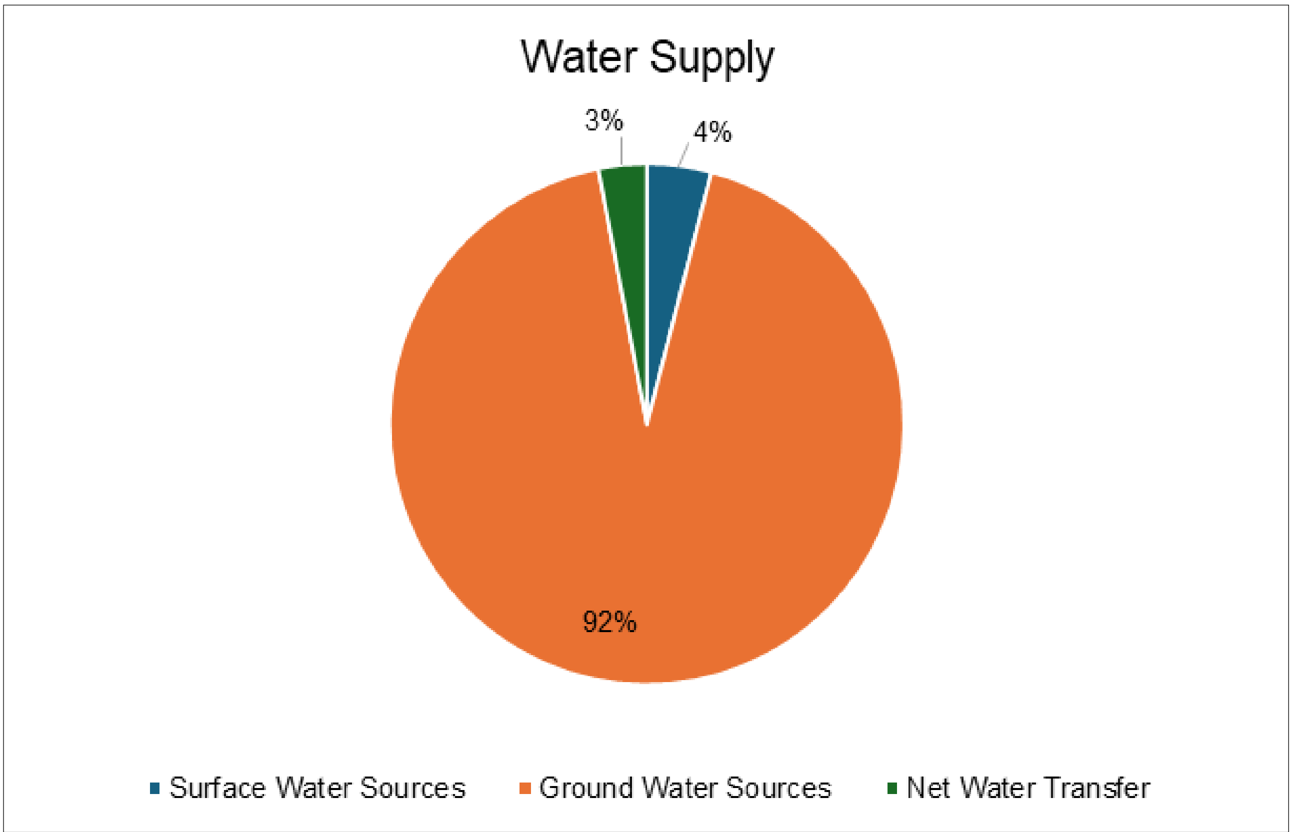
7.3.5 Water Transfer

Water Use	Inward Transfer (ha.m)	Outward Transfer (ha.m)	Net Transfer (Inwards-Outwards) ha.m
Agriculture	136.5	0	136.5
Domestic	49	0	49
Industry	0	0	0
Total	185.5	0	185.5

7.3.6 Amount of Run-off

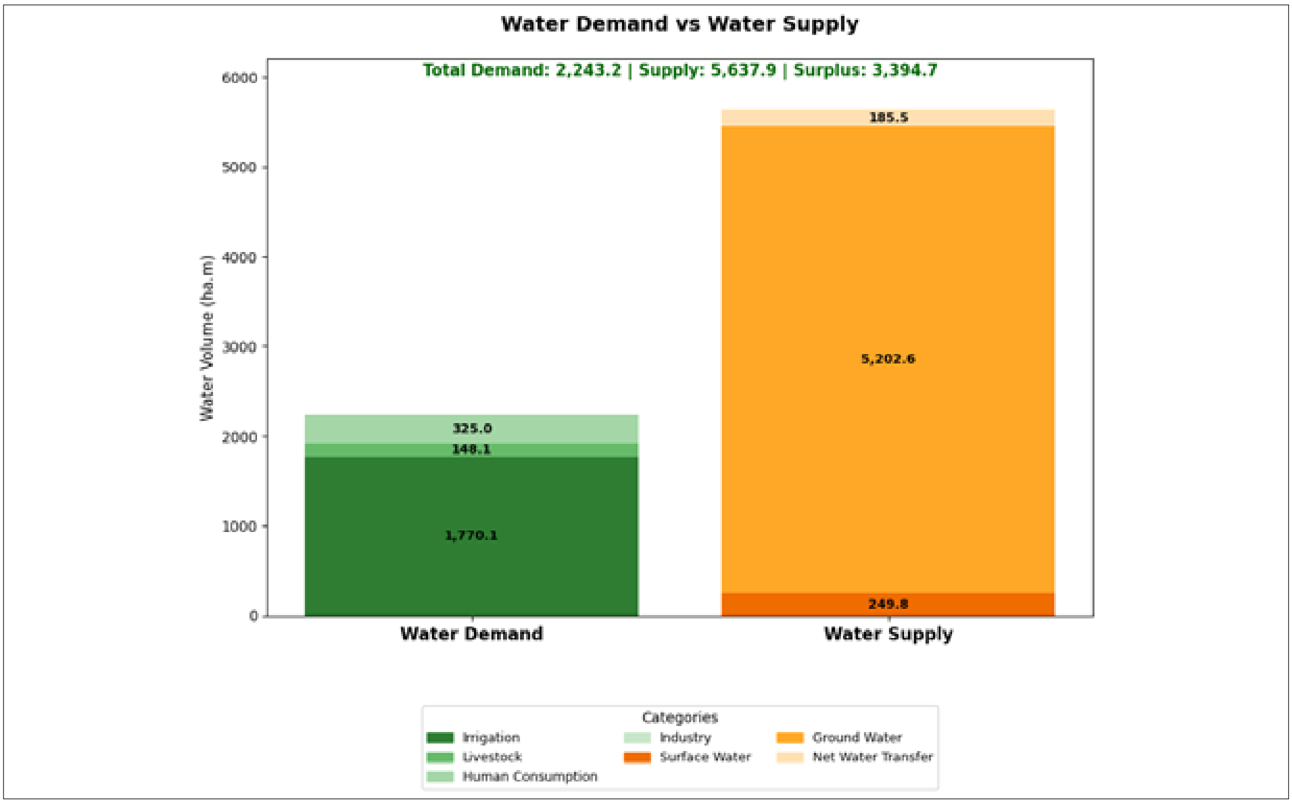
The Buxwaha block belongs to the Central Plateau and Hills Region of India and the land use pattern data reveals that major parts of the block geography are undulating and under non-cultivation uses. The block has an average of 1,093 mm rainfall, and it has the potential for harvesting 26,909.8 ha.m run-off annually.

Types of Run-offs	Area (ha)	Run-off (cum per ha)	Run-off	
			In ha..m	In %
Good Catchment Area	43,496.5	3750	16,311.2	61
Average Catchment Area	17,953.4	2810	5,044.9	19
Poor Catchment Area	29,699.2	1870	5,553.8	21
Total	91,149.1		26,909.8	100



7.4 Water Budgeting at Block Level

S. No	Descriptions	Volume	
		In ha.m	In %
A. Water Demand			
1	Water for Irrigation	1,770.1	79
2	Water for Livestock	148.1	7
3	Water for Human Consumption	325.0	14
4	Water for Industry	0	0
5	Block wise water required	2,243.1	100
B. Water Supply			
6	Surface Water Supply	249.8	4
7	Groundwater Supply	5,202.6	92
8	Net Water Transfer	185.5	3
9	Total Supply	5,637.9	100
C. Water Budgeting			
10	Water Deficit/Surplus	3,394.8	151
D. Potential for Run-off Harvesting/ GW Augmentation			
11	Available Run-off from Rainwater	26,909.8	
12	Harvested Run-off	1,153.20	
E. Potential for Groundwater Development			
13	Potential Run-off Available for Harvesting/GW Augmentation	19,029.2	
14	Stage of Groundwater Development (from IN-GRES portal)	80.92	
15	Groundwater Development Category (from IN-GRES portal)	Semi-Critical	



7.4.1 **Annotation**

(i) The Buxwaha block area belongs to the Bundelkhand region of central India is well known for water scarcity.

(ii) The average precipitation in the Buxwaha block is almost at par with the national average, however due to unique geology (being part of plateau region) surface and Groundwater potential, have certain limitations.

(iii) The Buxwaha block is dominated by the forest landscape covering more than 30% of the total geographical areas.

(iv) The block has harvested 1,153.20 ha.m water in surface water bodies, whereas only 26.7% is utilised for irrigation purposes.

(v) The Buxwaha block has 2,243.1 ha.m water requirements for all purposes, out of this 79% is for irrigation only.

(vi) The block has 5,637.9 ha.m (4% surface water + 92% Groundwater + 3% outside the block) of supply from all sources.

7.4.2 **Recommendations**

(i) With 30% forest cover areas, it is important to focus more on catchment areas treatment to harness water potential of region through the optimising surface water harvesting as well as Groundwater augmentation for local needs.

(ii) The block can hardly harvest 4% (1,153.20 ha.m) of the available run-off (26,909.8 ha.m) hence, it is important to focus more on identifying opportunities to enhance surface water storage and minimise reliance on Groundwater extraction (92%), as the Stage of Groundwater development is in semi-critical category (80.92 %).

(iii) Although, the block has good precipitation and productive landscape, the area under irrigation is very low (3%), hence, it is important to improve irrigation intensity in the block. On the other hand, the region has comparatively higher arable areas dominated by rainfed farming.

7.4.3 Takeaways for Rural Drinking Water supply

(i) The JJM coverage is 65.5% as of March 2025.

(ii) Of the 143 PWS schemes in the block, 142 (99%) are SVS and 1 (1%) are MVS. Hence, the block is mainly dependent on Groundwater for the rural drinking water supply.

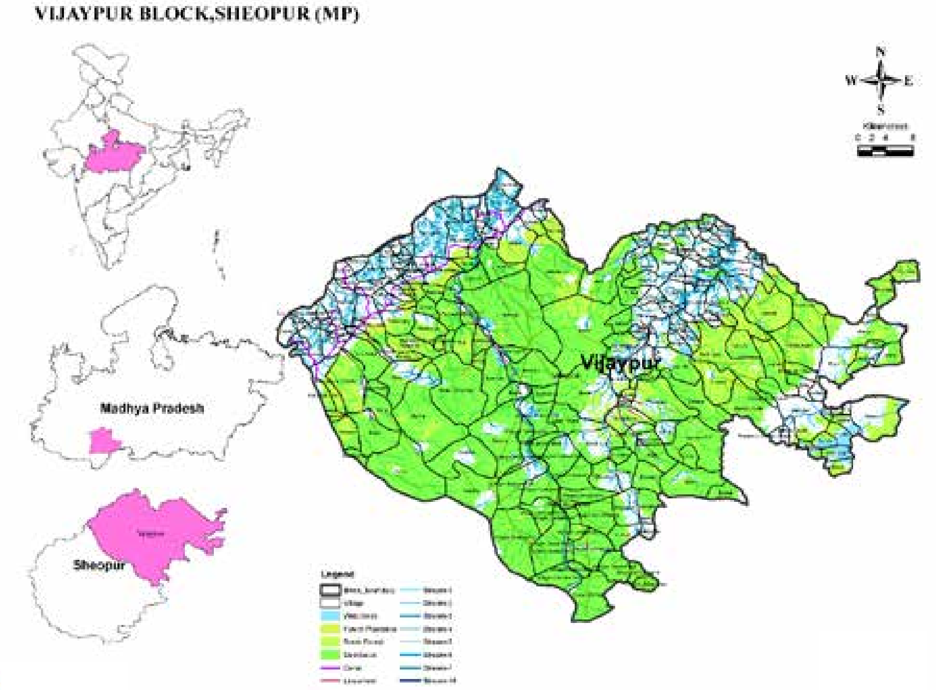
(iii) Surface water is required to meet the current and future drinking water demands.

(iv) Measures to be taken to protect the Groundwater quality and GW augmentation.

8. Vijaypur Block, Sheopur District, Madhya Pradesh

8.1 Introduction

State	District	Block	Number of villages	Number of Urban centres
Madhya Pradesh	Sheopur	Vijaypur	213	1



8.2 Demand Side Management

8.2.1 Water Requirements for Human Consumption

#	Total Population			Population Growth	Water Demand	Annual Water Requirements (ha.m)
	Female	Male	Total			
Rural	99,688	1,15,353	2,15,041	2,68,801	55	647.5
Urban	7,809	9,155	16,964	21,205	150	139.3
Total	1,07,497	1,24,508	2,32,005	290,006		786.9

8.2.2 Water Requirements for Livestock Consumption

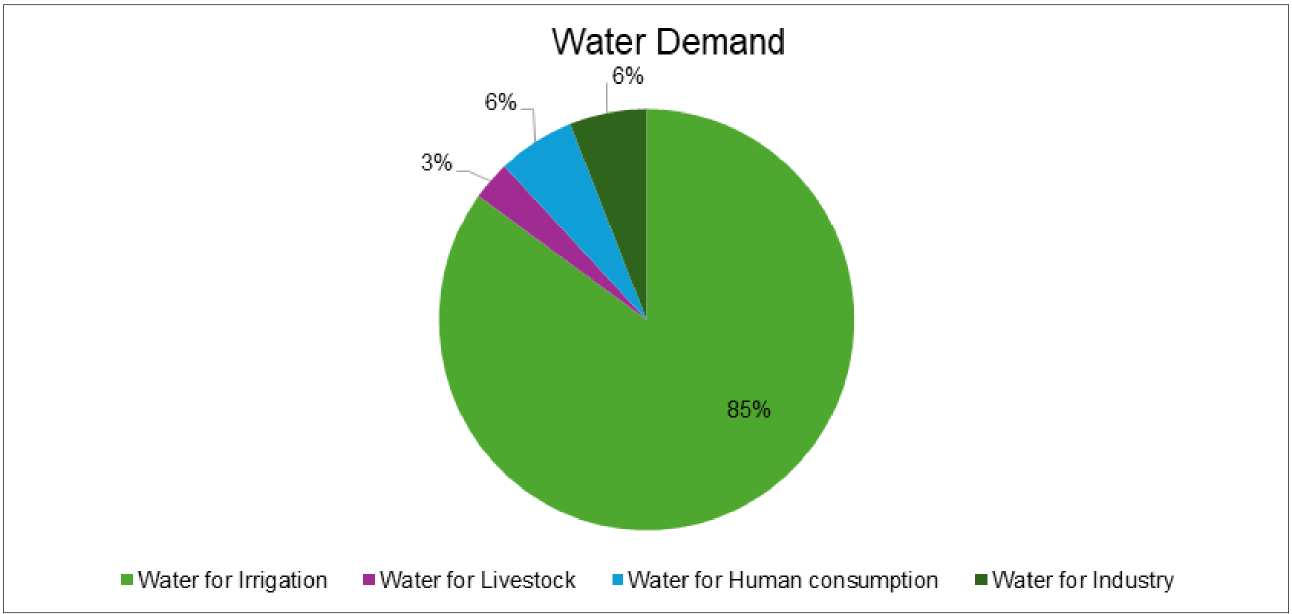
S. No	Type of Animal	Number of Animals	Water Req. (ha.m)
1	Buffaloes	66,344	162.2
2	Cow/Cattle	55,968	136.9
3	Goat	65,589	16.8
4	Sheep	2,046	0.5
5	Pigs	409	0.3
6	Horses	0	0
7	Camels	0	0
8	Poultry	0	0
Total		1,90,356	316.7

8.2.3 Irrigation Water Requirement

Irrigated Area (in ha)	Water required per hectare (ha.m)	Irrigation Water Requirement (ha.m)
1	2	3 = (1*2)
21,728.07	0.5	10,864

8.2.4 Industrial Water Requirement

Type of Industry	Number of Industrial Units	Annual Water Demand (ha.m)
Rubber, Chemical & Petrochemical	1	750



8.3 Supply Side Management

8.3.1 Information on Land Use

As per census 2011, the Vijaypur block has 2,45,988 hectares area for various uses.

S. No	Classification	Area	
		In ha	In %
1	Forest Area	1,24,934	51
2	Barren & Un-cultivable Land Area	33,726	14
3	Total Unirrigated Land Area	21,687	9
4	Area under Non-Agricultural Uses (Rural +Urban)	18,678	8
5	Area Irrigated by Source	18,571	8
6	Culturable Waste Land Area	12,851	5
7	Permanent Pastures and Other Grazing Land Area	8,753	4
8	Fallows Land other than Current Fallows Area	4,242	2
9	Current Fallows Area	2,481	1
10	Land Under Miscellaneous Tree Crops etc. Area	65	0.002
Total		2,45,988	100

8.3.2 Surface Water Bodies

S. No.	Names of Structures	No of Structures	Storage Capacity	
			In ha.m	In %
1	Other	6	35,291.0	93
2	Lakes	62	1,337.5	3
3	Reservoir	10	996.9	2
4	Ponds	151	294.5	1
5	Tanks/WCS	75	48.4	0.5
6	Water harvesting Structure	31	3.1	0.003
Total		335.00	37,971.4	100

8.3.3 Surface Water Supply

The 59.5% irrigation areas of the block are dependent on surface water sources.

S. No	Type	Area Irrigated (ha)	Water Supply	
			In ha.m	In %
1	Canals Area	9,021	5,277.3	82
2	Other Source	1,535	898.0	14
3	Tanks/Lakes Area	438	256.2	3.5
4	Waterfall Area	54	31.6	0.5
Total		11,048	6,463.1	100

8.3.4 Groundwater Supply

Annual Groundwater Extractable (ha.m)	Annual Groundwater Extraction (ha.m)	Stage of Ground-water Extraction	Groundwater Extraction Category
9,445	6,849	72.51 %	Semi-Critical

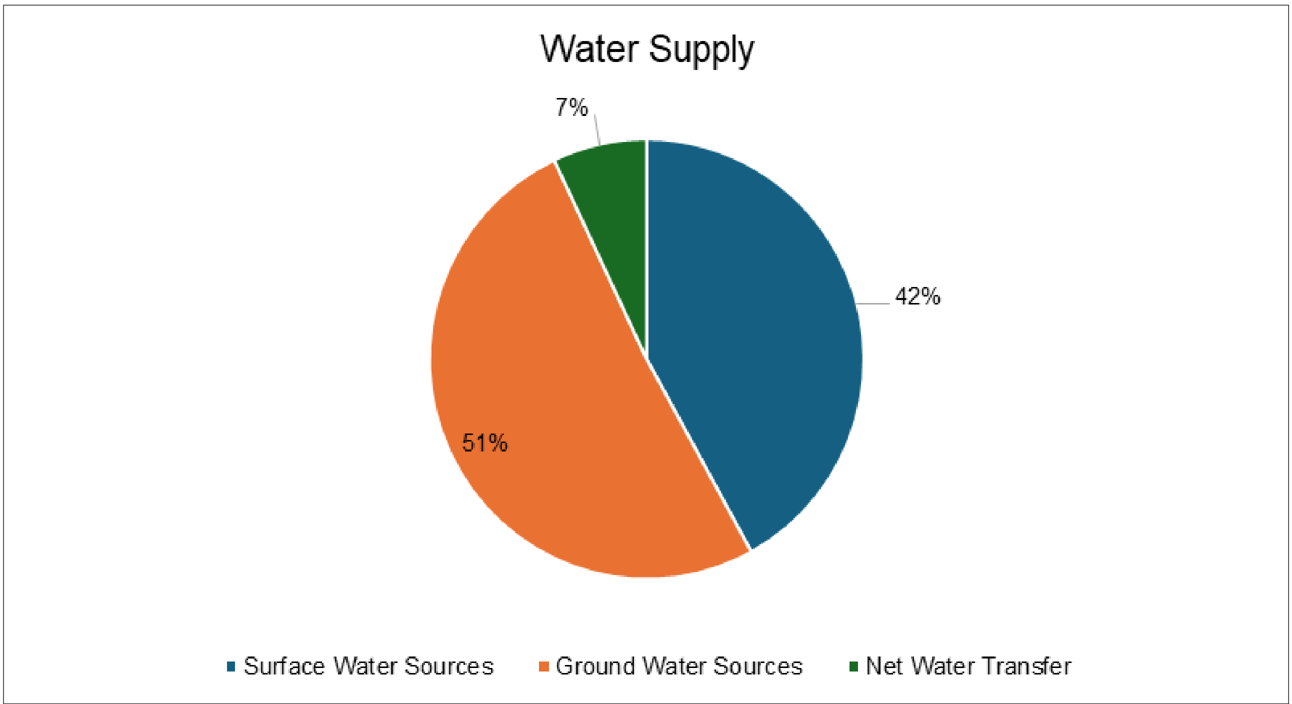
8.3.5 Water Transfer

Water Use	Inward Transfer (ha.m)	Outward Transfer (ha.m)	Net Transfer (Inwards-Outwards) ha.m
Domestic	0	0	0
Agriculture	898	0	898
Industry	0	0	0
Total	898	0	898

8.3.6 Amount of Run-off

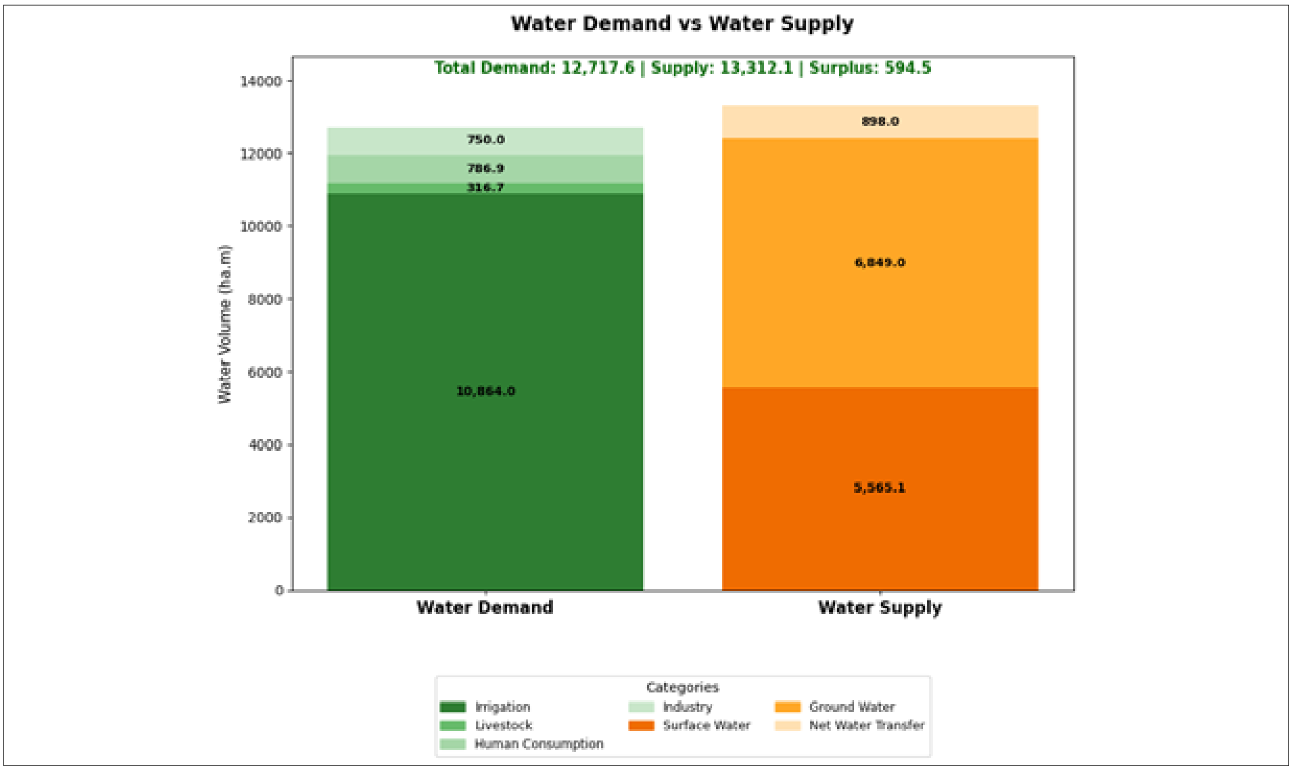
The Vijaypur block belongs to the Western Plateau and Hills Region of India and the land use pattern data reveals that major parts of the block geography are undulating and under non-cultivation uses. The block has an average of 799 mm rainfall, and it has a potential of harvesting 46,069.6 ha.m run-off annually.

Types of Run-offs	Area (ha.)	Run-off (cu.m per ha)	Run-off	
			In ha.m	In %
Good Catchment Area	1,77338	2,123.5	37,657.7	82
Average Catchment Area	21,669	1,580.0	3,423.7	7
Poor Catchment Area	46,981	1,061.75	4,988.2	11
Total	2,45,988		46,069.6	100



8.4 Water Budgeting at Block Level

S. No	Descriptions	Volume	
		In ha.m	In %
A. Water Demand			
1	Water for Irrigation	10,864.0	85
2	Water for Livestock	316.7	3
3	Water for Human Consumption	786.9	6
4	Water for Industry	750	6
5	Block Wise Water Required	12,717.6	100
B. Water Supply			
6	Surface Water Sources	5,565.1	42
7	Groundwater Sources	6,849.0	51
8	Net Water Transfer	898.0	7
9	Total Supply	13,312.1	100
C. Water Budgeting			
10	Water Deficit/Surplus (9-5)	594.5	4.7
D. Potential for Rainwater Harvesting/GW Augmentation (in ha.m)			
11	Available Run-off from Rainwater	46,069.6	
12	Harvested Run-off	37,971.40	
13	Potential Run-off Available for Harvesting/GW Augmentation	Nil	
E. Potential for Groundwater Development			
14	Stage of Groundwater Development (from IN-GRES portal)	72.51	
15	Groundwater Development Category (from IN-GRES portal)	Semi-Critical	



8.4.1 Annotations

(i) The Vijaypur block Sheopur District belongs to the south-west parts of Madhya Pradesh states and is dominated by forest landscapes more than fifty percent (51%).

(ii) Although, Vijaypur block area is forest-dominated, but it receives far less national average rainfall (799 mm).

(iii) The Vijaypur block has 12,717.6 ha.m of water requirements for all purposes, out of this 85% is for irrigation only.

(iv) The block has 13,312.1 ha.m (42% surface water + 51% Groundwater + 7% outside the block) of supply from all sources.

(v) The block is water surplus by 4.7% (594.5 ha.m).

8.4.2 Recommendations

(i) Given the region's predominance of forest cover, greater attention should be paid to treat watershed regions to maximise surface water collection and Groundwater augmentation for local requirements.

(ii) The block can harvest 82% (37,971.40 ha.m) of the available run-off (46,069.6 ha.m), however, the block is hardly using 14.7% of the available surface water, hence it is important to optimise efficient use of surface water sources to fulfil local water demands.

(iii) Secondly, it is important to focus more on identifying opportunities to improve water use efficiency in terms of surface water application for various purposes.

(iv) The block areas are highly dependent on Groundwater extraction (51%), hence it is important to leverage surface water sources efficiently to cater to local water needs, coupled with minimising dependence on Groundwater sources, as the Stage of Groundwater development is in semi-critical category (72.51 %).

8.4.3 **Takeaways for Rural Drinking Water Supply**

(i) The JJM coverage is 58.58% as of March 2025.

(ii) Of the 322 PWS schemes in the block, 306 (95%) are SVS and 16 (5%) are MVS. Hence, the block is mainly dependent on Groundwater for rural drinking water supply.

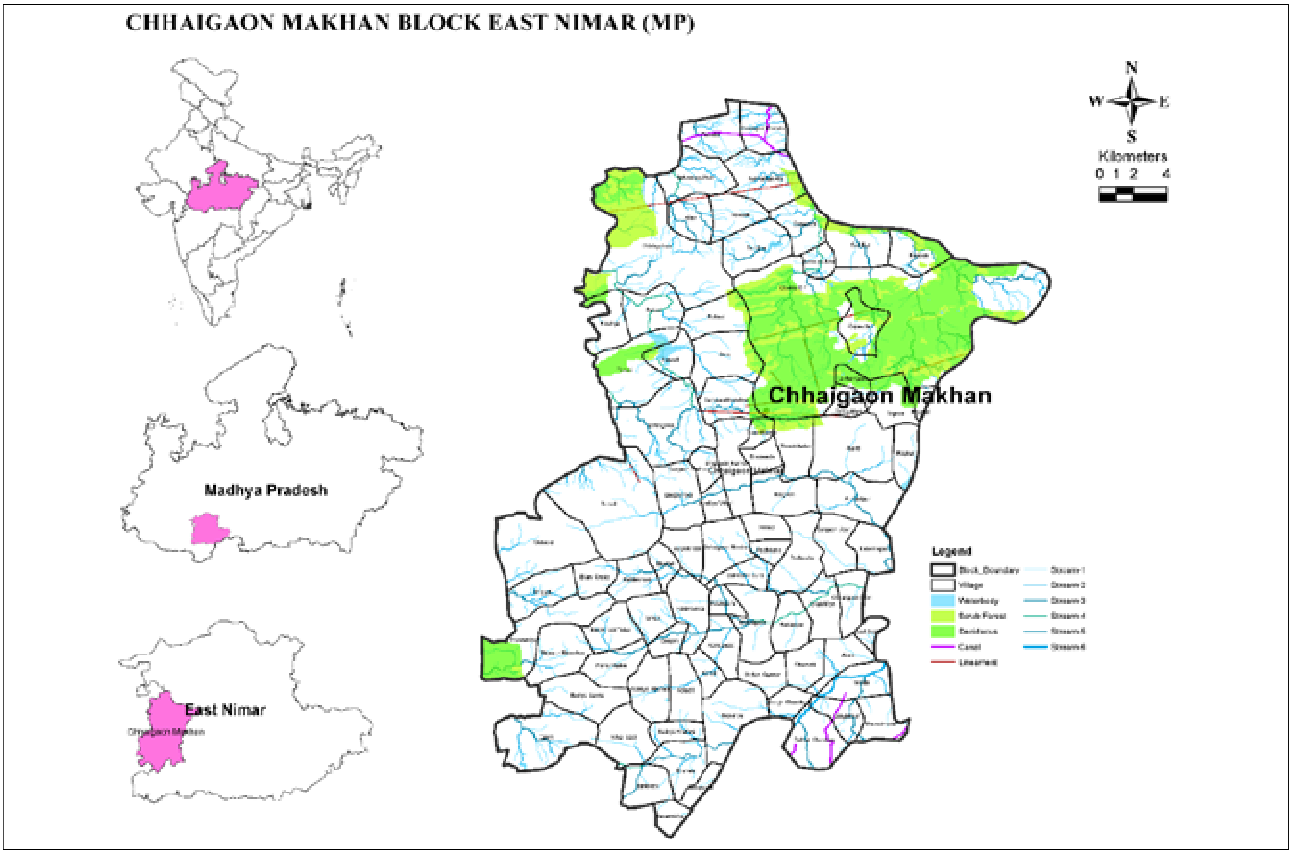
(iii) Surface water is required to meet the current and future drinking water demands.

(iv) Measures to be taken to protect the Groundwater quality and GW augmentation.

9. Chhaigaon Makhan Block, Khandwa (East Nimar) District, Madhya Pradesh

9.1 Introduction

State	District	Block	Number of villages	Number of Urban centres
Madhya Pradesh	Khandwa (East Nimar)	Chhaigaon Makhan	87	0



9.2 Demand Side Management

9.2.1 Water Requirements for Human Consumption

#	Total Population			Population Growth	Water Demand (lpcd)	Annual Water Requirements (ha.m)
	Female	Male	Total			
Rural	67.917	72,299	1,40,216	1,75,270	55	422
Urban	0	0	0	0	135	0.0
Total	67,917	72,299	1,40,216	1,75,270		422

9.2.2 Water Requirements for Livestock Consumption

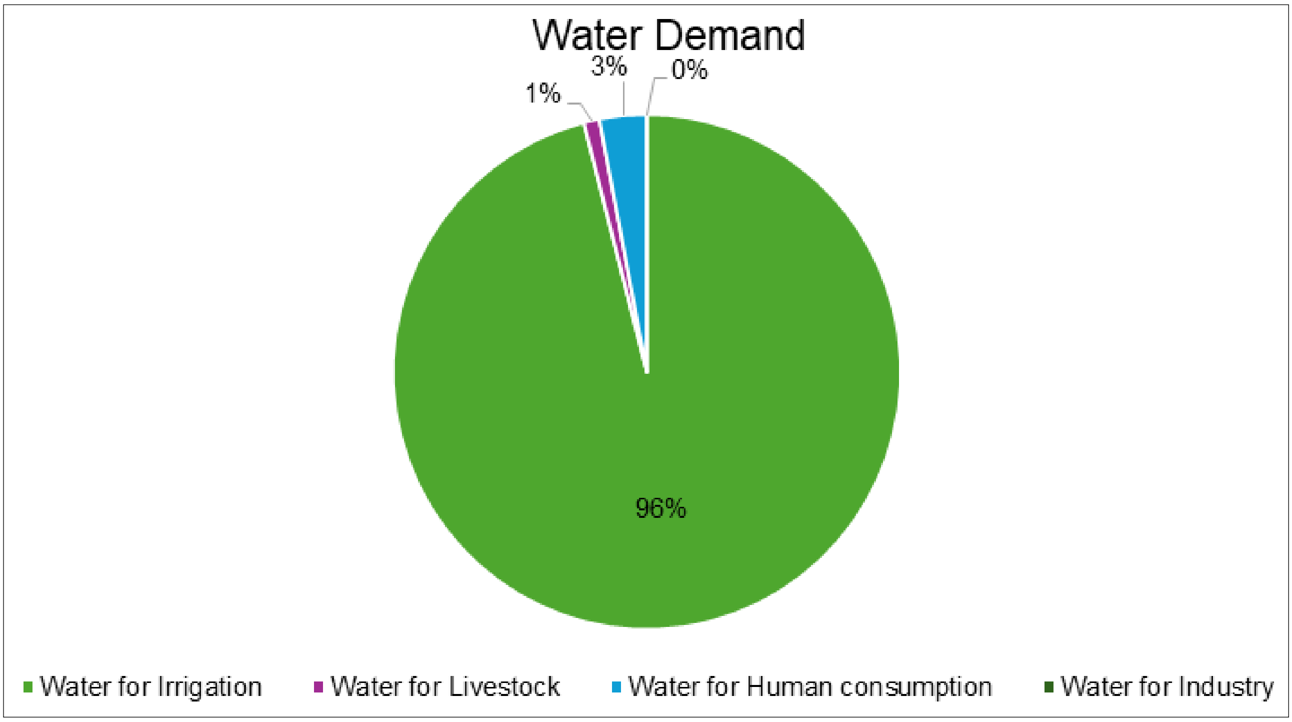
S. No	Type of Animal	Number of Animals	Water Req. (ha.m)
1	Cow/Cattle	60,974	149.1
2	Buffaloes	18,771	45.9
3	Goat	28,845	7.4
4	Pigs	45	0.04
5	Horses	19	0.03
6	Sheep	9	0.002
7	Camels	0	0
8	Poultry	0	0
	Total	1,08,663	202.5

9.2.3 Irrigation Water Requirement

Irrigated Area (in ha)	Water required per hectare (ha.m)	Irrigation Water Requirement (ha.m)
1	2	3 = (1*2)
26,467.6	0.5	13,233.8

9.2.4 Industrial Water Requirement

There are no industries in the block.



9.3 Supply Side Management

9.3.1 Information on Land Use

As per census 2011, the Chhaigaon Makhan block has 62,616.1 hectares areas for different uses.

S. No	Classification	Area	
		In ha	In %
1	Area Irrigated by Source	22,621.9	36
2	Total Unirrigated Land Area	21,807.0	35
3	Area under Non-Agricultural Uses (Rural +Urban)	4,581.0	7
4	Permanent Pastures and Other Grazing Land Area	3,111.0	5
5	Culturable Waste Land Area	2,921.0	5
6	Fallows Land other than Current Fallows Area	2,838.5	5
7	Current Fallows Area	2,340.3	4
8	Barren & Un-cultivable Land Area	1,128.3	2
9	Forest Area	1,126.7	1.8
10	Land Under Miscellaneous Tree Crops etc. Area	140.4	0.2
Total		62,616.1	100

9.3.2 Surface Water Bodies

The Chhaigaon Makhan block is part of the Western Plateau and Hills Region of India.

S. No.	Names of Structures	Number of Structures	Storage Capacity	
			In ha.m	In %
1	Other	2	2,728.2	84
2	Reservoir	2	259.5	8
3	Lakes	8	193.3	6
4	Ponds	26	47.7	1
5	Tanks/WCS	11	7.6	0.9
6	Water harvesting Structure	2	0.2	0.01
Total		51.00	3,236.5	100

9.3.3 Surface Water Supply

S. No	Type	Area Irrigated (ha)	Water Supply	
			In ha.m	In %
1	Canals Area	1,215.5	711.1	50
2	Other Source	962.7	563.2	40
3	Tanks/Lakes Area	217.8	127.4	9
4	Waterfall Area	28.3	16.6	1
Total		2,424.3	1,418.2	100

9.3.4 Groundwater Supply

Annual Groundwater Extractable (ha.m)	Annual Groundwater Extraction (ha.m)	Stage of Ground-water Extraction	Groundwater Extraction Category
12,445	10,441	83.90 %	Semi-Critical

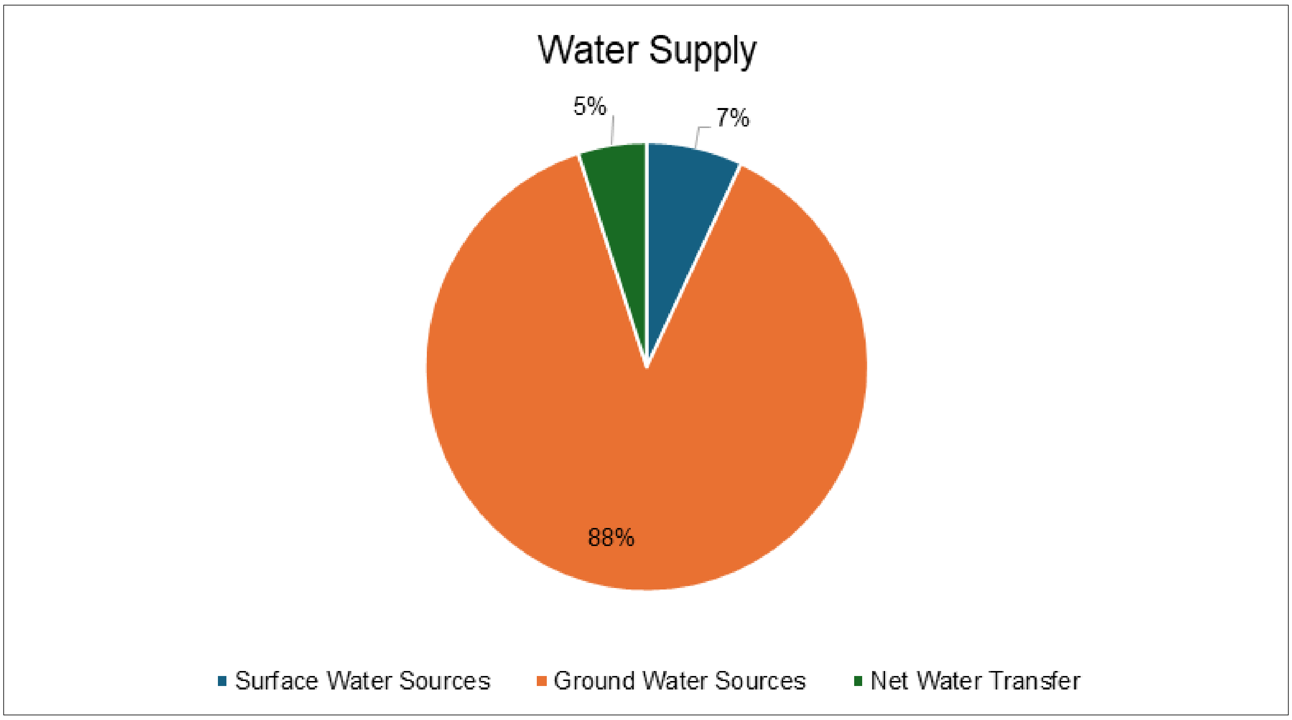
9.3.5 Water Transfer

Water Use	Inward Transfer (ha.m)	Outward Transfer (ha.m)	Net Transfer (Inwards-Outwards) ha.m
Agriculture	563.2	0	563.2
Domestic	42.13	0	42.13
Industry	0	0	0
Total	605.33	0	605.33

9.3.6 Amount of Run-off

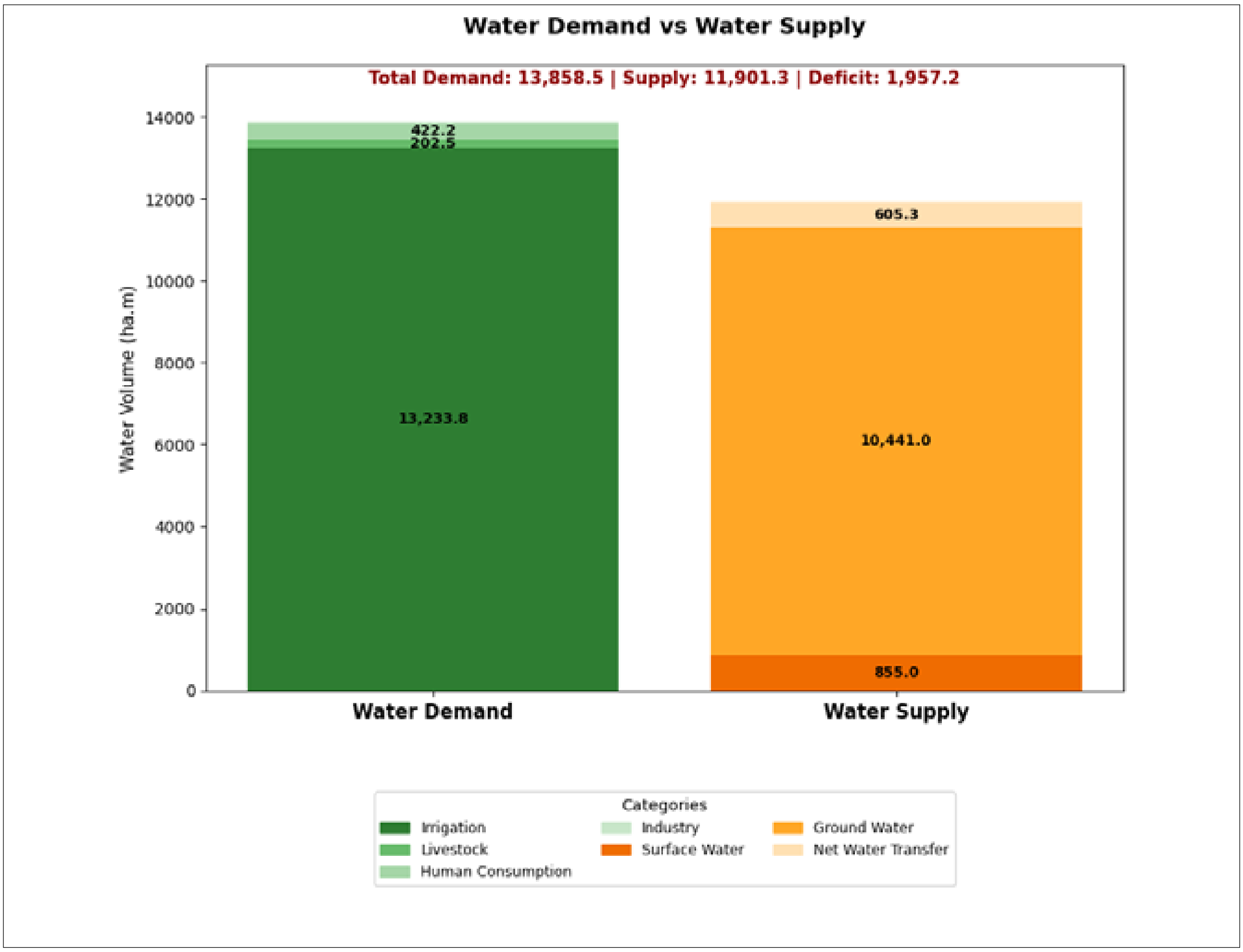
The Chhaigaon Makhan block belongs to the Western Plateau and Hills Region of India and the block geography is undulating and under non-cultivation uses. The block has an average of 950 mm rainfall, and it has the potential for harvesting 11,410.5 ha.m run-off annually.

Types of Run-offs	Area (ha)	Run-off (cu.m per ha)	Run-off	
			In ha.m	In %
Good Catchment Area	6,836.0	3,154.25	2,156.2	19
Average Catchment Area	6,172.4	2,358.75	1,455.9	13
Poor Catchment Area	49,607.7	1,572	7,798.3	68
Total	62,616.1		11,410.5	100



9.4 Water Budgeting at Block Level

S. No	Descriptions	Volume	
		In ha.m	In %
A. Water Demand			
1	Water for Irrigation	13,233.8	96
2	Water for Livestock	202.5	1
3	Water for Human Consumption	422.2	3
4	Water for Industry	0	0
5	Block Wise Water Required	13,858.5	100
B. Water Supply			
6	Surface Water Sources	855.0	7
7	Groundwater Sources	10,441.0	88
8	Net Water Transfer	605.3	5
9	Total Supply	11,901.3	100
C. Water Budgeting			
10	Water Deficit/Surplus	-1,957.1	14
D. Potential for Rainwater Harvesting/GW Augmentation (in ha.m)			
11	Available Run-off from Rainwater	11,410.5	
12	Harvested Run-off	3,236.5	
13	Potential Runoff Available for Harvesting/GW Augmentation	5,321.4	
E. Potential for Groundwater Development			
14	Stage of Groundwater Development (from IN-GRES portal)	83.90 %	
15	Groundwater Development Category (from IN-GRES portal)	Semi-Critical	



9.4.1 Annotations

(i) The Chhaigon Makan, located in the Khandwa (East Nimar) District, is situated in the southwestern region of Madhya Pradesh and is mostly characterised by arable land, covering over seventy percent of the area.

(ii) 96% of local water demands are allocated for irrigation. Secondly, 88% of the block's total water requirements are met by Groundwater sources, since the stage of Groundwater development is classified as semi-critical (83.90%).

(iii) Although the block is primarily dependent on Groundwater sources, but a significant contribution is on water supply from water sources outside (5%) of the block areas.

(iv) The block is water deficit by 14% (1,957 ha.m)

(v) The Chhaigon Makan block has 13,858.5 ha.m water requirements for all purposes, out of this 96% is for irrigation only.

(vi) The block has 11,901.3 ha.m (7% surface water + 88% Groundwater + 5% outside the block) of supply from all sources.

9.4.2 Recommendations

(i) As the available run-off (11,410.5 ha.m) of the block is significantly high in comparison of available harvesting (3,236.5 ha.m) capacities of the block, hence, it is important to intensify and enhance surface water storage capacities in the block.

(ii) The block has enhanced the surface water harvested capacities over years, yet not able to optimally use the available surface water sources (only 26.4% is being utilised), therefore, it is critical to enhance the surface water storage capacities coupled with optimal use of available surface water volume.

9.4.3 Takeaways for Rural Drinking Water supply

(i) The JJM coverage is 87.51% as on March 2025.

(ii) Of the 136 PWS schemes in the block, 130 (96%) are SVS and 6 (4%) are MVS. Hence, the block is majorly dependent on Groundwater for rural drinking water supply.

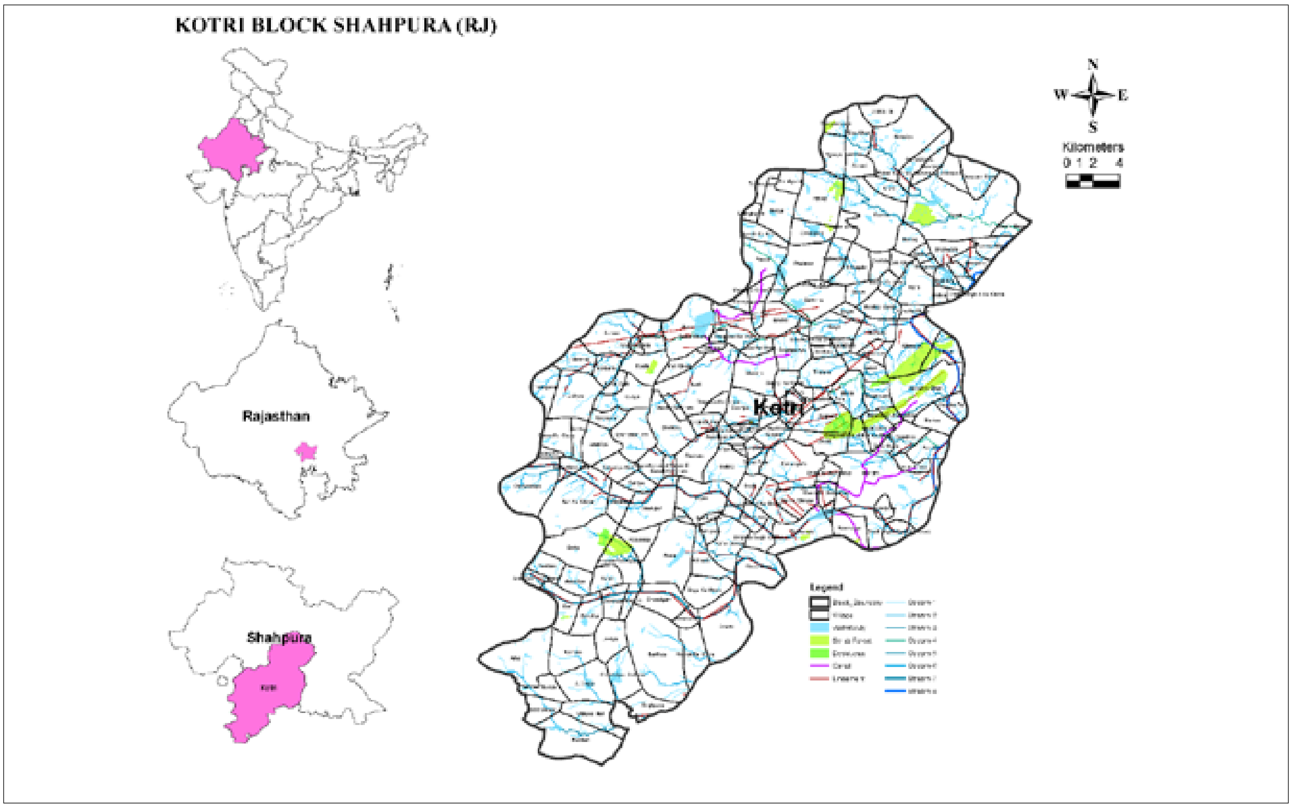
(iii) Surface water is required to meet the current and future drinking water demands.

(iv) Measures to be taken to protect the Groundwater quality and GW augmentation.

10. Kotri Block, Bhilwara District, Rajasthan

10.1 Introduction

State	District	Block	Number of villages	Number of Urban centres
Rajasthan	Bhilwara	Kotri	179	0



10.2 Demand Side Management

10.2.1 Water Requirements for Human Consumption

#	Total Population			Population Growth	Water demand (lpcd)	Annual Water Requirements (ha.m)
	Female	Male	Total			
Rural	85,800	88,901	1,74,011	2,17,514	55	524
Urban	0	0	0	0	150	0.0
Total	85,800	88,901	1,74,011	2,17,514		524

10.2.2 Water Requirement for Livestock Consumption

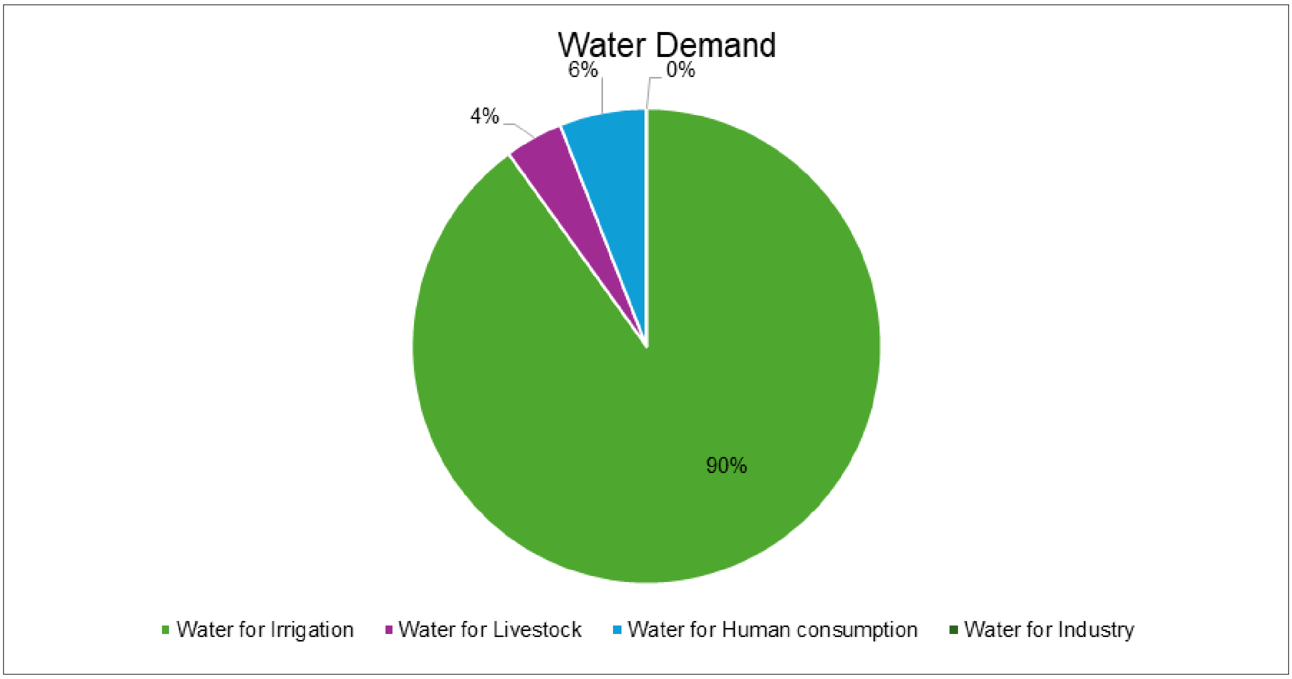
S. No	Type of Animal	Number of Animals	Water Req. (ha.m)
1	Cow/Cattles	67,009	163.9
2	Buffaloes	45,589	111.5
3	Goat	82,376	21
4	Sheep	39,522	10.1
5	Pigs	1,372	1.1
6	Horses	0	0
7	Camels	0	0
8	Poultry	0	0
Total		2,35,868	307.6

10.2.3 Irrigation Water Requirement

Irrigated Area (in ha)	Water Required per Hectare (ha.m)	Irrigation Water Requirement (ha.m)
1	2	3 = (1*2)
15,251.6	0.5	7,625.9

10.2.4 Industrial Water Requirement

There are no industries in the block.



10.3 Supply Side Management

10.3.1 Information on Land Use

As per census 2011, the Kotri block has 92,644.8 hectares for various purposes.

S. No	Classification	Area	
		In ha	In %
1	Total Unirrigated Land Area	22,500.7	24
2	Area Irrigated by Source	13,035.6	14
3	Barren & Un-cultivable Land Area	12,359.5	13
4	Culturable Waste Land Area	11,778.5	13
5	Permanent Pastures and Other Grazing Land Area	11,763.0	13
6	Area under Non-Agricultural Uses (Rural +Urban)	7,732.5	8
7	Fallows Land other than Current Fallows Area	6,315.5	7
8	Current Fallows Area	4,425.8	5
9	Forest Area	2,640.5	2.5
10	Land Under Miscellaneous Tree Crops etc. Area	93.2	0.5
Total		92,644.8	100

10.3.2 Surface Water Bodies

The number of surface water bodies is mostly less in the plateau and arid & semi-arid regions, but the water spread areas are high, in comparison to the Gangetic plains. The plateau and arid & semi-arid regions have larger areas under good & average catchment which is helpful for the surface run-off generated during the monsoon period to store in surface waterbodies. The block is part of the Central Plateau and Hills Region of India.

S. No.	Names of Structures	Number of Structures	Storage Capacity	
			In ha.m	In %
1	Reservoir	49	5,702.4	55
2	Lakes	112	2,440.0	24
3	Other	1	1,723.9	17
4	Ponds	160	418.8	4
5	Tanks/WCS	61	41.6	0.4
6	Water harvesting Structure	17	1.6	0.02
Total		400.00	10,328.30	100

10.3.3 Surface Water Supply

S. No	Type	Area Irrigated (ha)	Water Supply	
			In ha.m	In %
1	Canals Area	828	484.4	74
2	Other Source (Water from outside)	216.8	126.8	19
3	Tanks/Lakes Area	56.7	33.2	5
4	Waterfall Area	16	9.4	1
Total		1,117.5	653.7	100

10.3.4 Groundwater Supply

Annual Groundwater Extractable (ha.m)	Annual Groundwater Extraction (ha.m)	Stage of Ground-water Extraction	Groundwater Extraction Category
4,498	5,960	132.50 %	Over Exploited

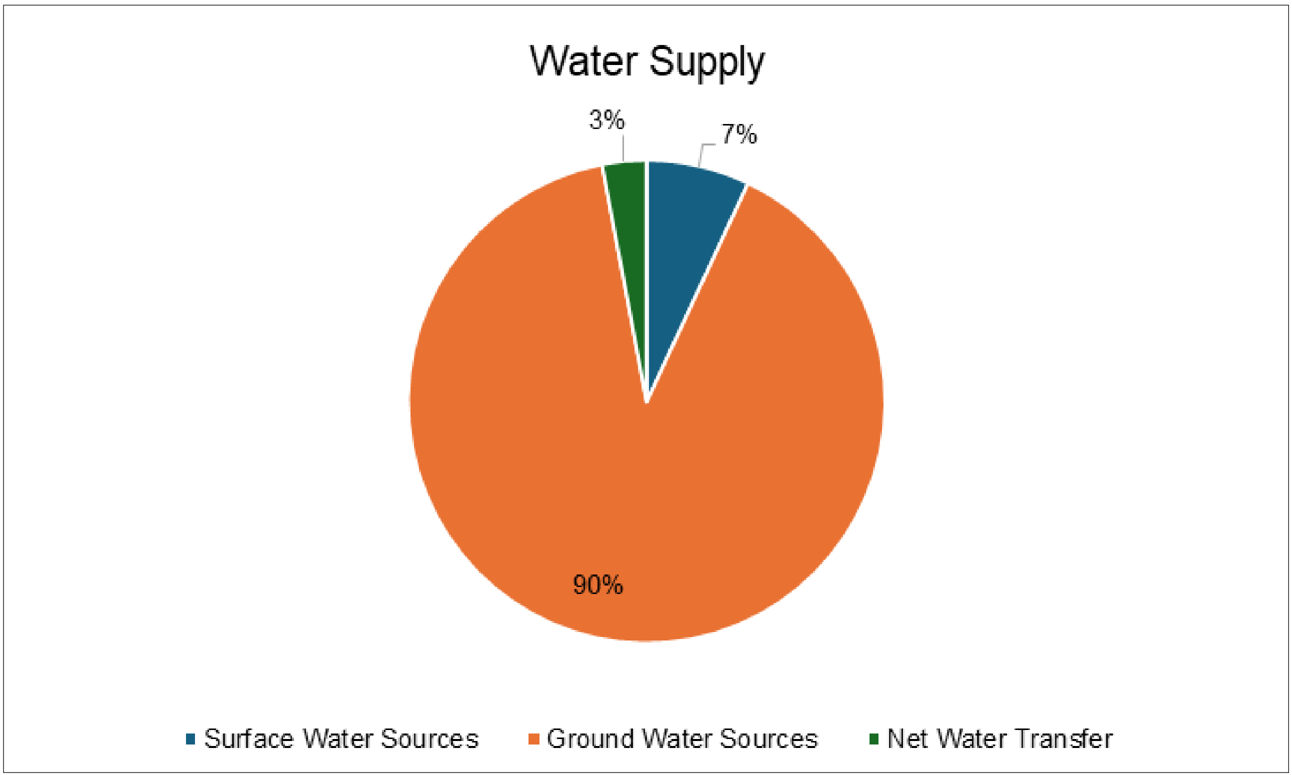
10.3.5 Water Transfer

S. No	Water Use	Inward Transfer (ha.m)	Outward Transfer (ha.m)	Net Transfer (Inwards-Outwards) ha.m
1	Agriculture	126.8	0	126.8
2	Domestic	44.16	0	44.16
3	Industry	0	0	0
Total		170.96	0	170.96

10.3.6 Amount of Run-off

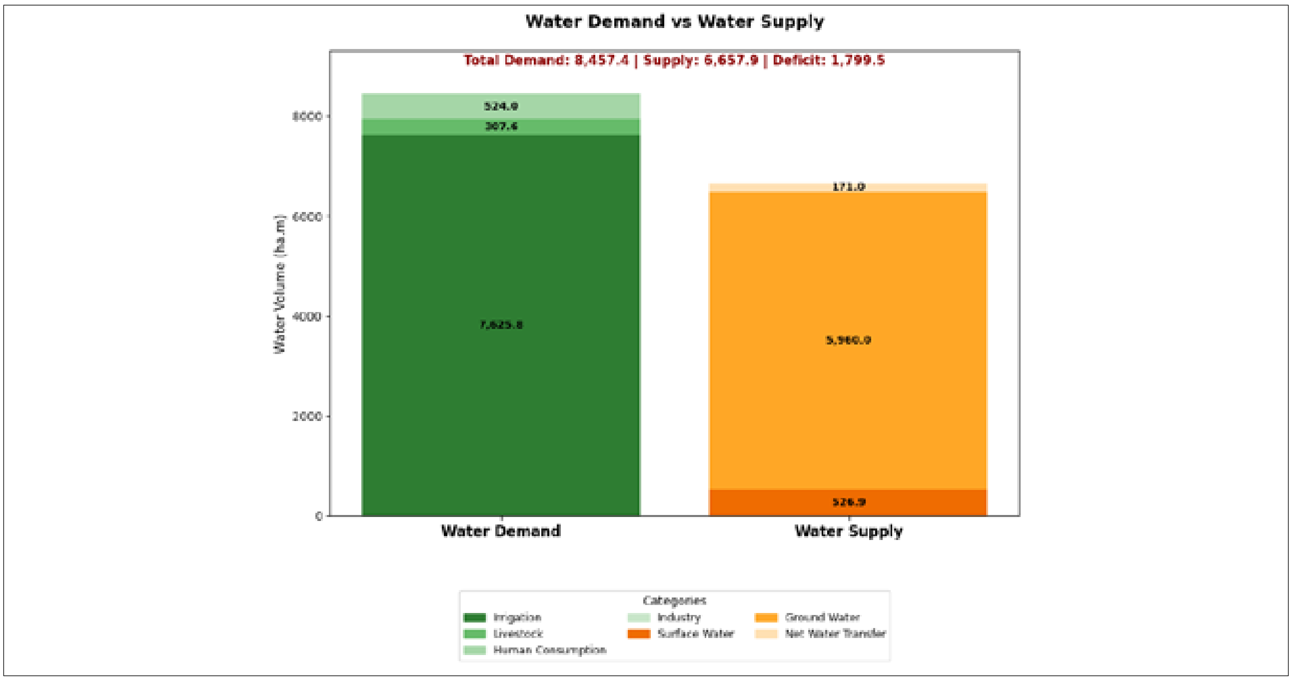
The Kotri block belongs to the Central Plateau and Hills Region of India and the land use pattern data reveals that major parts of the block geography are undulating and for non-cultivation purposes. The block has an average of 753 **mm** rainfall and has a potential of harvesting 12,522.8 ha.m run-off annually.

Types of Run-offs	Area (ha)	Run-off (cu.m per ha)	Run-off	
			In ha.m	In %
Good Catchment Area	22,732.5	1,972.5	4,484.0	36
Average Catchment Area	23,634.7	1,477.5	3,492.0	28
Poor Catchment Area	46,277.6	982.5	4,546.8	36
Total	92,644.8		12,522.8	100



10.4 Water Budgeting at Block Level

S. No	Description	Volume	
		In ha.m	In %
A. Water Demand			
1	Water for Irrigation	7,625.8	90
2	Water for Livestock	307.6	4
3	Water for Human Consumption	524.0	6
4	Water for Industry	0	0
5	Block Wise Water Required	8,457.4	100
B. Water Supply			
6	Local Surface Water Sources	526.9	7
7	Groundwater Sources	5,960.0	90
8	Net Water Transfer	171.0	3
9	Total Supply	6,657.9	100
C. Water Budgeting			
10	Water Deficit/Surplus	-1,799.5	21
D. Potential for Rainwater Harvesting/GW Augmentation (in ha.m)			
11	Available Run-off from Rainwater	12,522.8	
12	Harvested Run-off	10,328.30	
E. Potential for Groundwater Development			
13	Potential Runoff Available for Harvesting/GW Augmentation	Nil	
14	Stage of Groundwater Development (from IN-GRES portal)	132.50	
15	Groundwater Development Category (from IN-GRES portal)	Over Exploited	



10.4.1 Annotations

(i) The Kotri block, Bhilwara district belongs to the central parts of Rajasthan and is dominated by arable areas (more than 60%).

(ii) The Banas River passes through the block area and carries water from larger catchment areas.

(iii) The Bhilwara district being of the major Groundwater over exploited district, the block area is also over exploited (132.50 %).

(iv) The Kotri block has **8,457.4** ha.m water requirements for all purposes out of this 90% for irrigation needs only. Secondly, 90% of the total water needs of the block are served by Groundwater sources.

(v) The block also has some small & medium irrigation projects catering to irrigation water needs up to 7%.

(vi) As the available run-off (12,522.8 ha.m) of the block is significantly high and block did excellent efforts for creating surface storage capacities to cater to available run-off up to 82.5 % (10,328.30 ha.m).

(vii) The block is water deficit by 21% (1,779.5 ha.m).

10.4.2 Recommendations

(i) The block area is highly dependent on Groundwater; hence it is important to enhance surface water availability and focus on improving water productivity.

(ii) The block has enhanced the surface water harvested capacities over the years, yet not able to optimally use the available surface water sources (only 5% is being utilised), therefore, it is critical to optimally utilise surface water storage capacities.

10.4.3 Takeaways for Rural Drinking Water Supply

(i) The JJM coverage is 97.65% as on March 2025.

(ii) Of the 30 PWS schemes in the block, 25 (83%) are SVS and 5 (17%) are MVS. Hence, the block is mainly dependent on Groundwater for rural drinking water supply.

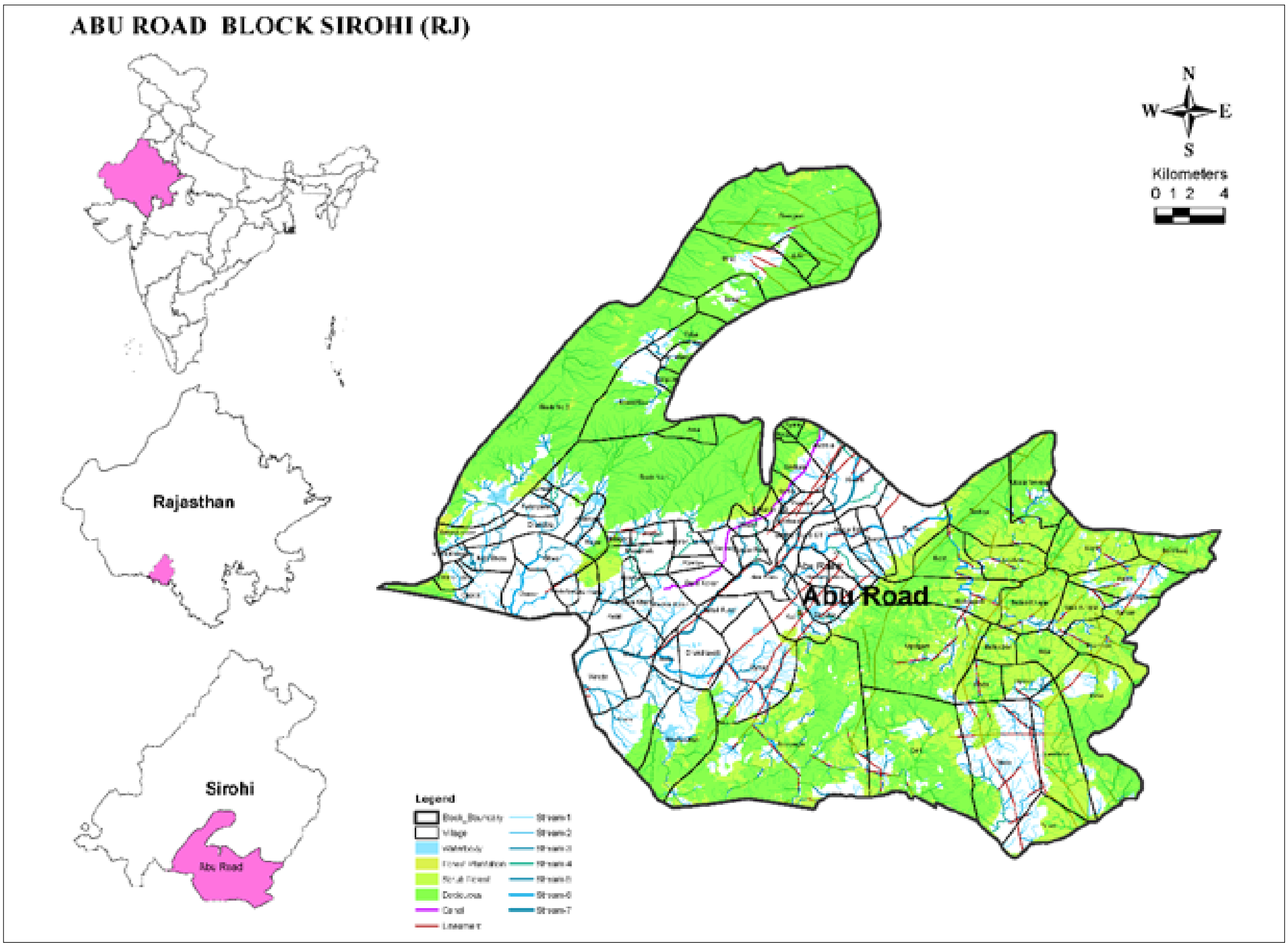
(iii) Surface water is required to meet the current and future drinking water demands.

(iv) Measures to be taken to protect the Groundwater quality and GW augmentation.

11. Abu Road Block, Sirohi District, Rajasthan

11.1 Introduction

State	District	Block	Number of villages	Number of Urban centres
Rajasthan	Sirohi	Abu Road	87	2



11.2 Demand Side Management

11.2.1 Water Requirements for Human Consumption

#	Total Population			Population Growth	Water Demand (lpcd)	Annual Water Requirements (ha.m)
	Female	Male	Total			
Rural	66,765	69,911	1,36,676	1,70,845	55	411.6
Urban	40,870	46,858	87,728	1,09,660	150	720.5
Total	1,07,635	1,16,769	2,24,404	2,80,505		1,132.0

11.2.2 Water Requirement for Livestock Consumption

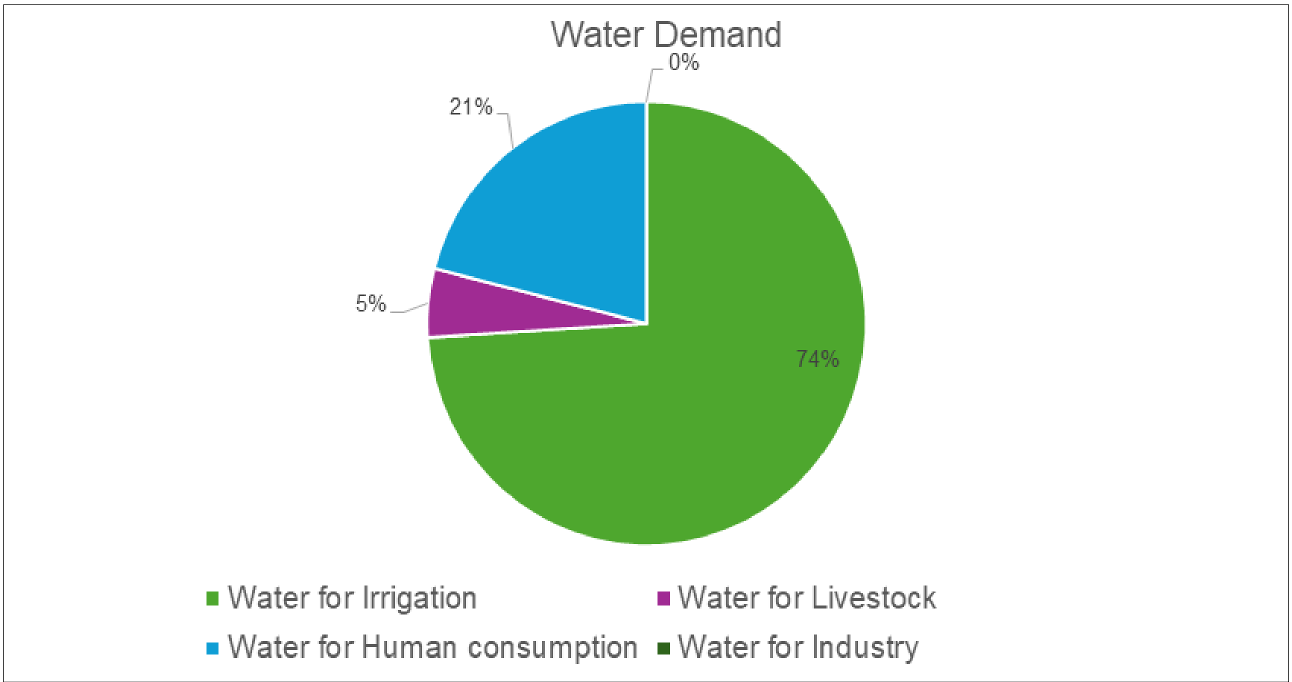
S. No	Type of Animal	Number of Animals	Water Req. (ha.m)
1	Cow/Cattle	61,614	150.7
2	Buffaloes	25,584	62.6
3	Goat	1,38,734	35.4
4	Sheep	29,79	0.8
5	Pigs	61	0.05
6	Horses	0	0
7	Camels	0	0
8	Poultry	0	0
Total		2,25,993	249.55

11.2.3 Irrigation Water Requirement

Irrigated Area (in ha)	Water Required per Hectare (ha.m)	Irrigation Water Requirement (ha.m)
1	1	2 = (1*2)
8,070.9	0.5	4,035.4

11.2.4 Industrial Water Requirement

The block has reported that there are no industries.



11.3 Supply Side Management

11.3.1 Information on Land Use

As per census 2011, the Abu Road block has 89,352.9 hectares areas under different uses.

S. No	Classification	Area	
		In ha	In %
1	Forest Area	56,938.2	64
2	Area under Non-Agricultural Uses (Rural +Urban)	8,520.2	10
3	Total Unirrigated Land Area	7,585.7	8
4	Area Irrigated by Source	6,898.2	8
5	Barren & Un-cultivable Land Area	5,439.1	6
6	Permanent Pastures and Other Grazing Land Area	1,320.0	1
7	Fallows Land other than Current Fallows Area	1,241.7	1
8	Current Fallows Area	906.1	1
9	Culturable Waste Land Area	475.7	0.9
10	Land Under Miscellaneous Tree Crops etc. Area	28	0.1
Total		89,352.9	100

11.3.2 Surface Water Bodies

The block is part of the Central Plateau and Hills Region of Rajasthan.

S. No.	Names of Structures	Number of Structures	Storage Capacity	
			In ha.m	In %
1	Reservoir	9	1,420.7	79
2	Lakes	11	264.5	15
3	Ponds	43	104.7	6
4	Tanks/WCS	26	15.6	1
5	Water harvesting Structure	4	0.5	0.001
6	Other	0	0	0
Total		93.00	1,806	100

11.3.3 Surface Water Supply

S. No	Type	Area Irrigated (ha)	Local Surface Water Sources	
			In ha.m	In %
1	Canals Area	271.3	158.71	92
2	Tanks/Lakes Area	23.7	13.86	8
3	Waterfall Area	0.0	0	0
4	Other Source	0.0	0	0
Total		295.0	172.58	100

11.3.4 Groundwater Supply

Annual Groundwater Extractable (ha.m)	Annual Groundwater Extraction (ha.m)	Stage of Ground-water Extraction	Groundwater Extraction Category
2,653	3,024	113.98 %	Over Exploited

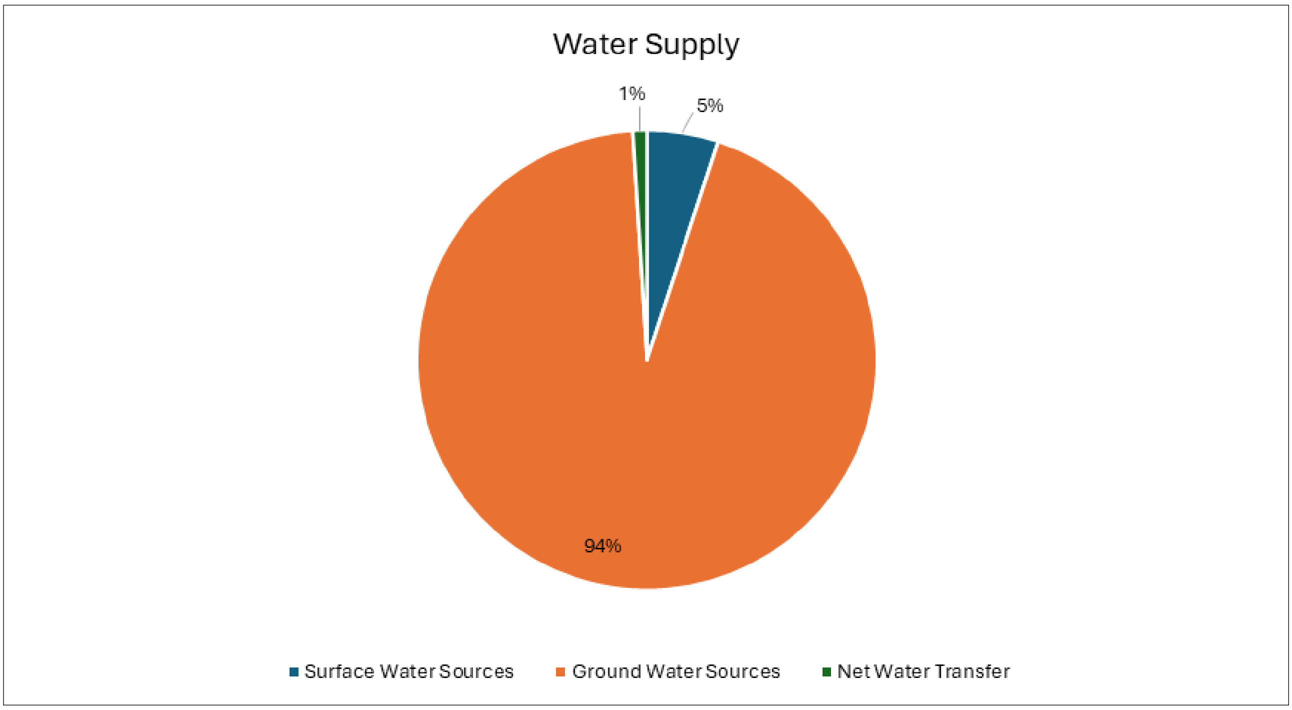
11.3.5 Water Transfer

S. No	Water Use	Inward Transfer (ha.m)	Outward Trans-fer (ha.m)	Net Transfer (Inwards-Outwards) (ha.m)
1	Domestic	20.7	0	20.7
2	Agriculture	0	0	0
3	Industry	0	0	0
Total		20.7	0	20.7

11.3.6 Amount of Run-off

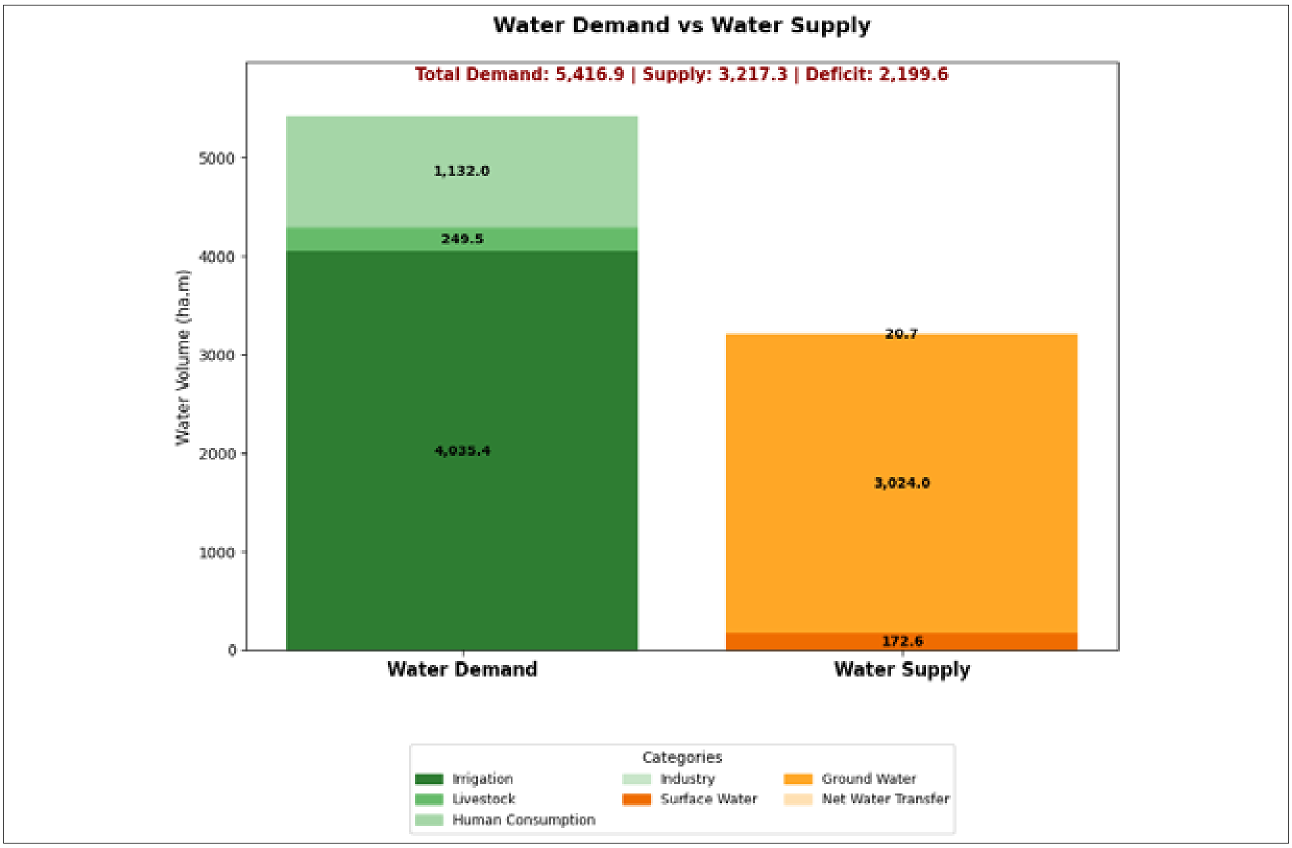
The Abu Road block belongs to the Central Plateau and Hills Region and the land use pattern data reveals that major parts of the block geography are undulating and used for non-cultivation purpose. The block has an average of **769 mm** rainfall, and it has the potential of 15,888 ha.m rainwater for harvesting and Groundwater augmentation.

Types of Run-Off	Area (ha)	Run-off (cum per ha)	Run-off	
			In ha.m	In %
Good Catchment Area	70,897.5	1,972.5	13,984.5	88
Average Catchment Area	1,823.7	1,477.5	269.5	2
Poor Catchment Area	16,631.7	982.5	1634.1	10
Total	89,352.9		15,888.0	100%



11.4 Water Budgeting at Block Level

S. No	Description	Volume	
		In ha.m	In %
A. Water Demand			
1	Water for Irrigation	4,035.4	74
2	Water for Animal	249.5	5
3	Water for Human Consumption	1,132.0	21
4	Water for Industry	0	0
5	Block Wise Water Required	5,417.0	100
B. Water Supply			
6	Supply from Local Surface Water Sources	172.6	5
7	Supply from Groundwater Sources	3,024.0	94
8	Net Water Transfer	20.7	1
9	Total Supply	3,217.3	100
C. Water Budgeting			
10	Water Deficit/Surplus	-2,199.7	41
D. Potential for Rainwater Harvesting/GW Augmentation			
11	Available Run-off from Rainwater	15,888.0	
12	Harvested Run-off	1,806.00	
13	Potential Run-off Available for Harvesting/GW Augmentation	11,916.0	
E. Potential for Groundwater Development			
14	Stage of Groundwater Development (from IN-GRES portal)	113.98	
15	Groundwater Development Category (from IN-GRES portal)	Over Exploited	



11.4.1 Annotations

(i) The Abu Road block, Sirohi district belongs to the southern part of Rajasthan and shares a boarder with north Gujarat.

(ii) The major parts of the block area are covered by hills and undulating terrains, which is also reflected in the land use pattern of the block and almost two-thirds part (64%) of the block is notified as forest land. And hardly, 16% areas are arable.

(iii) The West Banas River passes through the block area and carries water from larger catchment areas.

(iv) The Abu Road block area is over-exploited (113.98 %), as the block has two major urban settlements, hence, water demands for human consumption is considerably high.

(v) The block has **5,417.** ha.m water requirements for all purposes out of this 74 % for irrigation needs only. Secondly, more than ninety percent (94%) of the total water needs of the block is served by Groundwater sources.

(vi) The block also has some small & medium irrigation projects catering to irrigation water needs up to 5%.

(vii) The block is water deficit by 41% (2,199.7 ha.m)

11.4.2 Recommendations

(i) The block area is highly dependent on Groundwater; hence, it is important to enhance surface water availability and focus on improving water productivity.

(ii) As the available run-off (15,888.ha.m) of the block is significantly high and it has huge potential to increase surface water harvesting capacities, as currently, the surface water bodies are hardly harvesting 11.4 % of the available run-off (1,806 ha.m).

(iii) The block must enhance the efficient use of available surface water storage because currently it is using less than 10 percent (9.6%), therefore, it is critical to optimally utilise surface water storage capacities.

11.4.3 Takeaways for Rural Drinking Water Supply

(i) JJM coverage is 46.03% as of March 2025.

(ii) Of the 137 PWS schemes in the block, 132 (96%) are SVS and 5 (4%) are MVS. Hence, the block is majorly dependent on Groundwater for the rural drinking water supply.

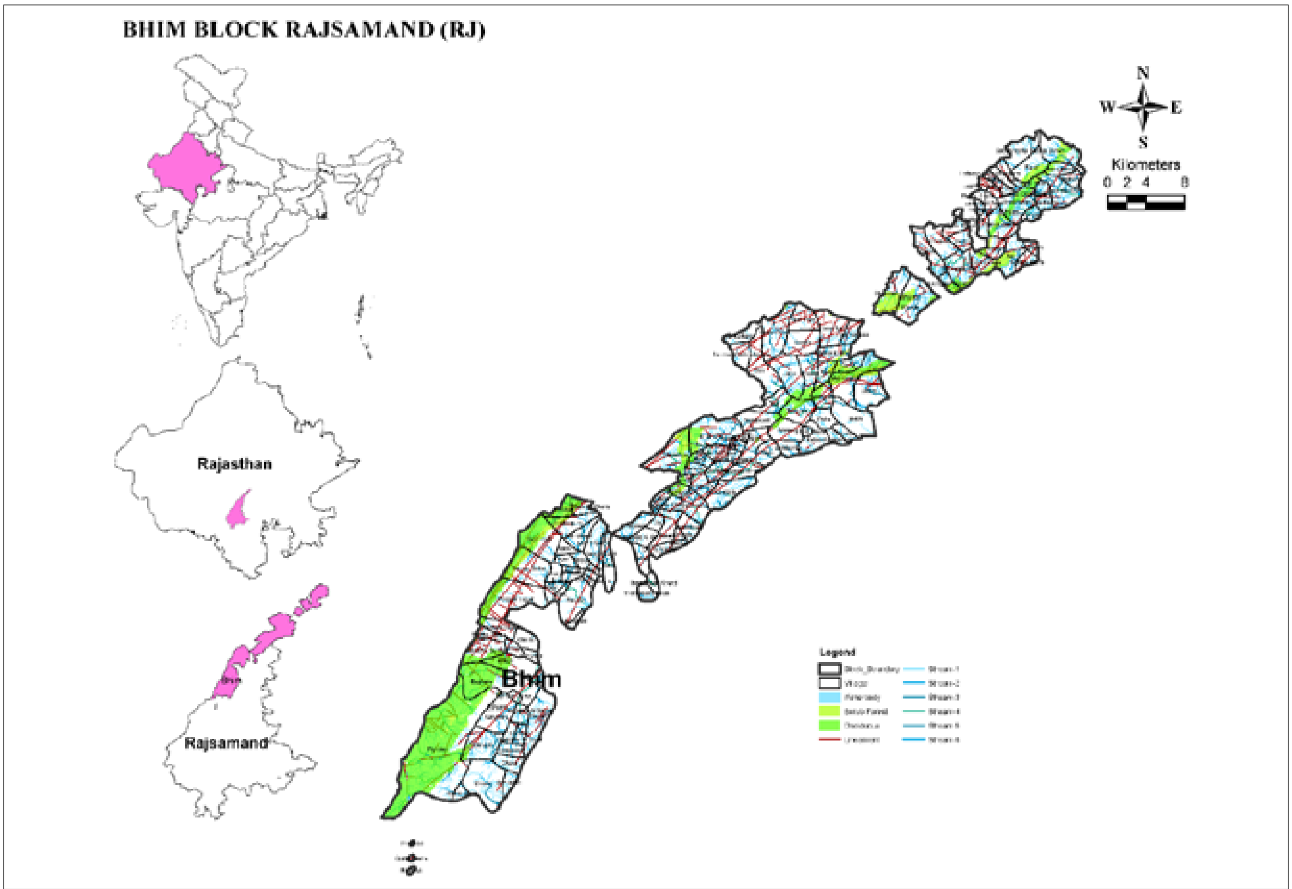
(iii) Surface water is required to meet the current and future drinking water demands.

(iv) Measures to be taken to protect the Groundwater quality and GW augmentation.

12. Bhim Block, Rajsamand district, Rajasthan

12.1 Introduction

State	District	Block	Number of villages	Number of Urban centres
Rajasthan	Rajsamand	Bhim	121	0



12.2 Demand Side Management

12.2.1 Water Requirements for Human Consumption

#	Total Population			Population Growth	Water Demand (lpcd)	Annual Water Requirements (ha.m)
	Female	Male	Total			
Rural	78,965	80,490	1,59,455	1,99,319	55	480.2
Urban	0	0	0	0	150	0.0
Total	78,965	80,490	1,59,455	1,99,319		480.2

12.2.2 Water Requirements for Livestock Consumption

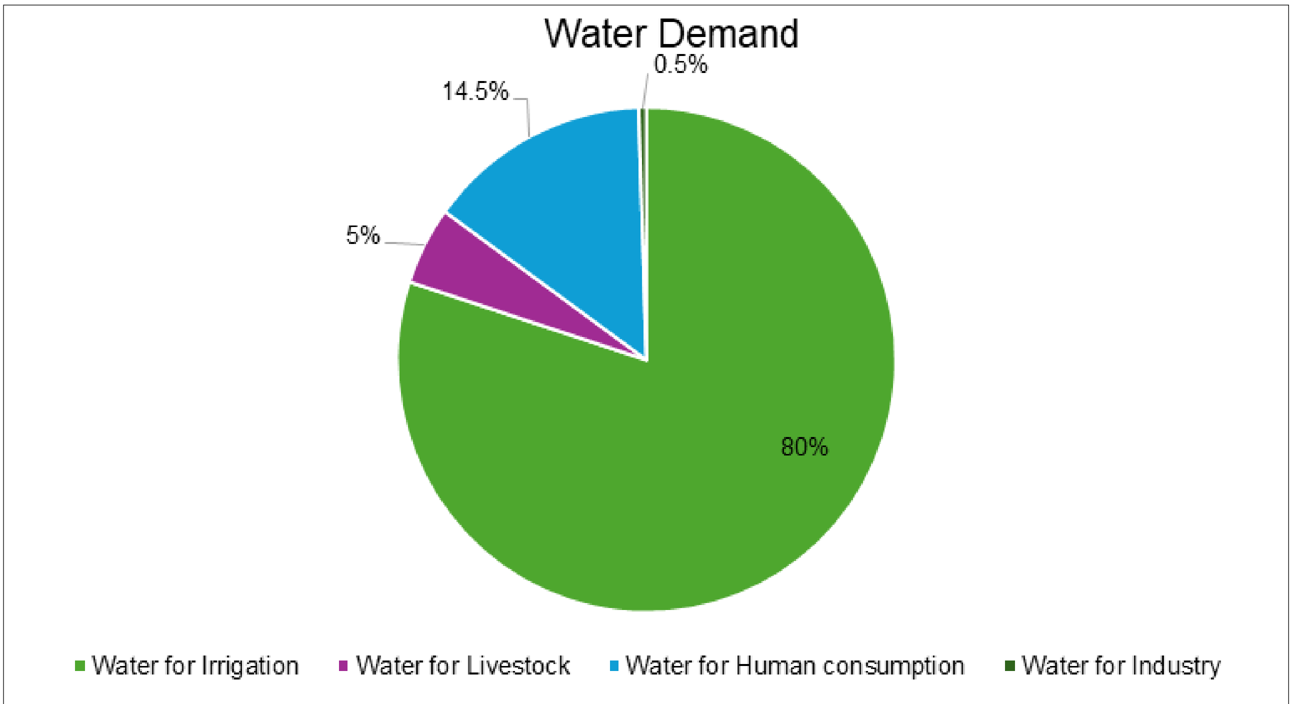
S. No	Type of Animal	Number of Animals	Water Req. (ha.m)
1	Cow/Cattle	27,722	67.8
2	Buffaloes	21,311	52.1
3	Goat	1,41,886	36.3
4	Sheep	22,666	5.8
5	Pigs	185	0.1
6	Horses	0	0
7	Camels	0	0
8	Poultry	0	0
Total		2,13,770	162.1

12.2.3 Irrigation Water Requirement

Irrigated Area (in ha)	Water Required Per Hectare (ha.m)	Irrigation Water Requirement (ha.m)
1	2	3 = (1*2)
5,351.5	0.5	2,675.7

12.2.4 Industrial Water Requirement

Type of Industry	Number of Industrial Units	Annual Water Demand (ha.m)
Furniture & Fittings	1	11.57



12.3 Supply Side Management

12.3.1 Information on Land Use

As per census 2011, the Bhim block has 67,338.6 hectares areas for various purposes.

S. No	Classification	Area	
		In ha.m	In %
1	Barren & Un-cultivable Land Area	17,508.2	26
2	Forest Area	14,824.3	22
3	Permanent Pastures and Other Grazing Land Area	8,488.2	13
4	Area under Non-Agricultural Uses (Rural +Urban)	6,685.9	10
5	Culturable Waste Land Area	5,885.8	9
6	Area Irrigated by Source	4,573.9	7
7	Total Unirrigated Land Area	4,565.9	7
8	Fallows Land other than Current Fallows Area	3,946.2	6
9	Current Fallows Area	844.2	1
10	Land Under Miscellaneous Tree Crops etc. Area	16	0.02
Total		67,338.6	100

12.3.2 Surface Water Bodies

The block is part of is part of the Central Plateau and Hills Region of India.

S. No.	Names of Structures	Number of Structures	Storage Capacity	
			In ha.m	In %
1	Reservoir	18	1,795.3	52
2	Lakes	59	1,507.9	44
3	Ponds	56	133.8	4
4	Tanks/WCS	16	11.1	0.3
5	Water harvesting Structure	10	0.9	0.03
6	Other	0	0	0
Total		159	3,449	100

12.3.3 Surface Water Supply

S. No	Type	Area Irrigated (ha)	Water Supply	
			In ha.m	In %
1	Canals Area	828	484.4	74
2	Other Source (Water from outside)	216.8	126.8	19
3	Tanks/Lakes Area	56.7	33.2	5
4	Waterfall Area	16	9.4	1
Total		1,117.5	653.7	100

12.3.4 Groundwater Supply

Annual Groundwater Extractable (ha.m)	Annual Groundwater Extraction (ha.m)	Stage of Ground-water Extraction	Groundwater Extraction Category
969	1,407	145.24 %	Over Exploited

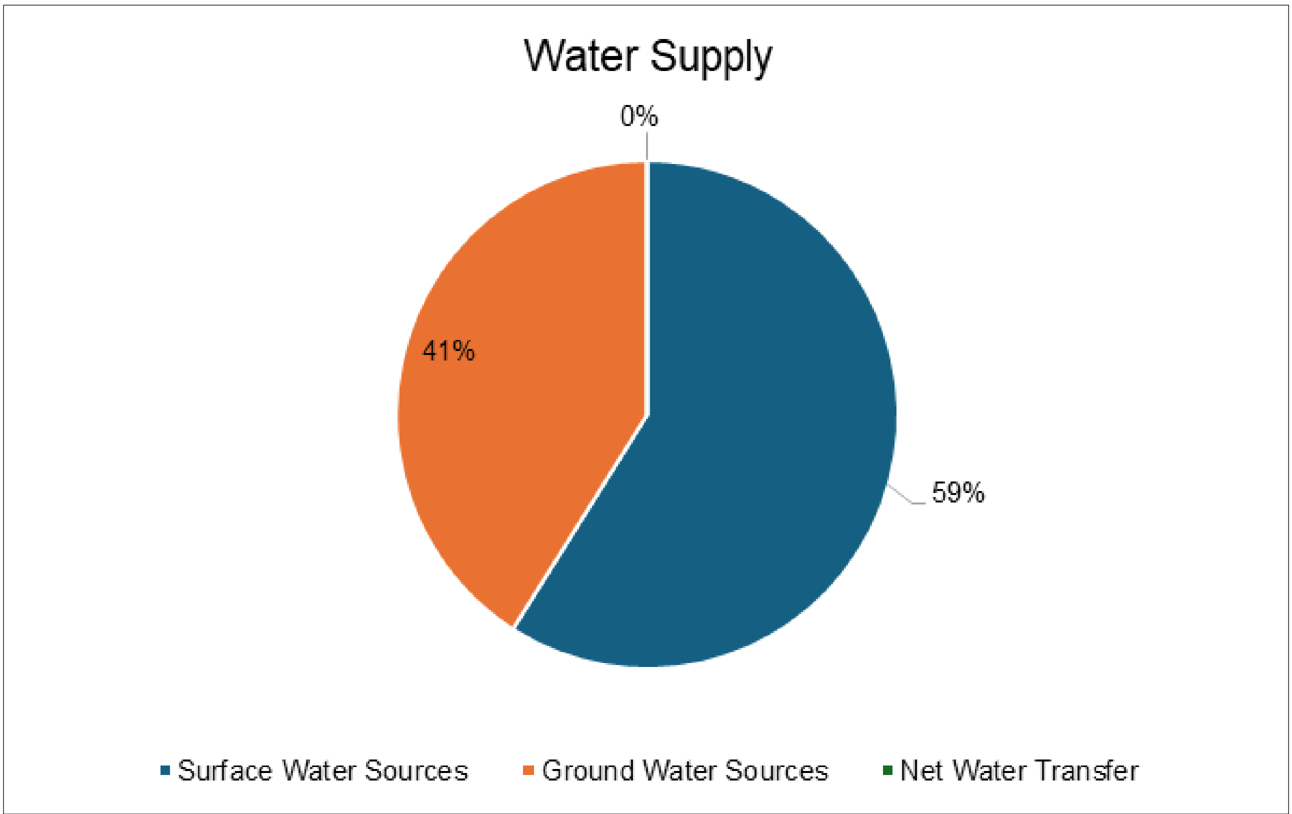
12.3.5 Water Transfer

The block has reported that there are no inward or outward water transfers.

12.3.6 Amount of Run-off

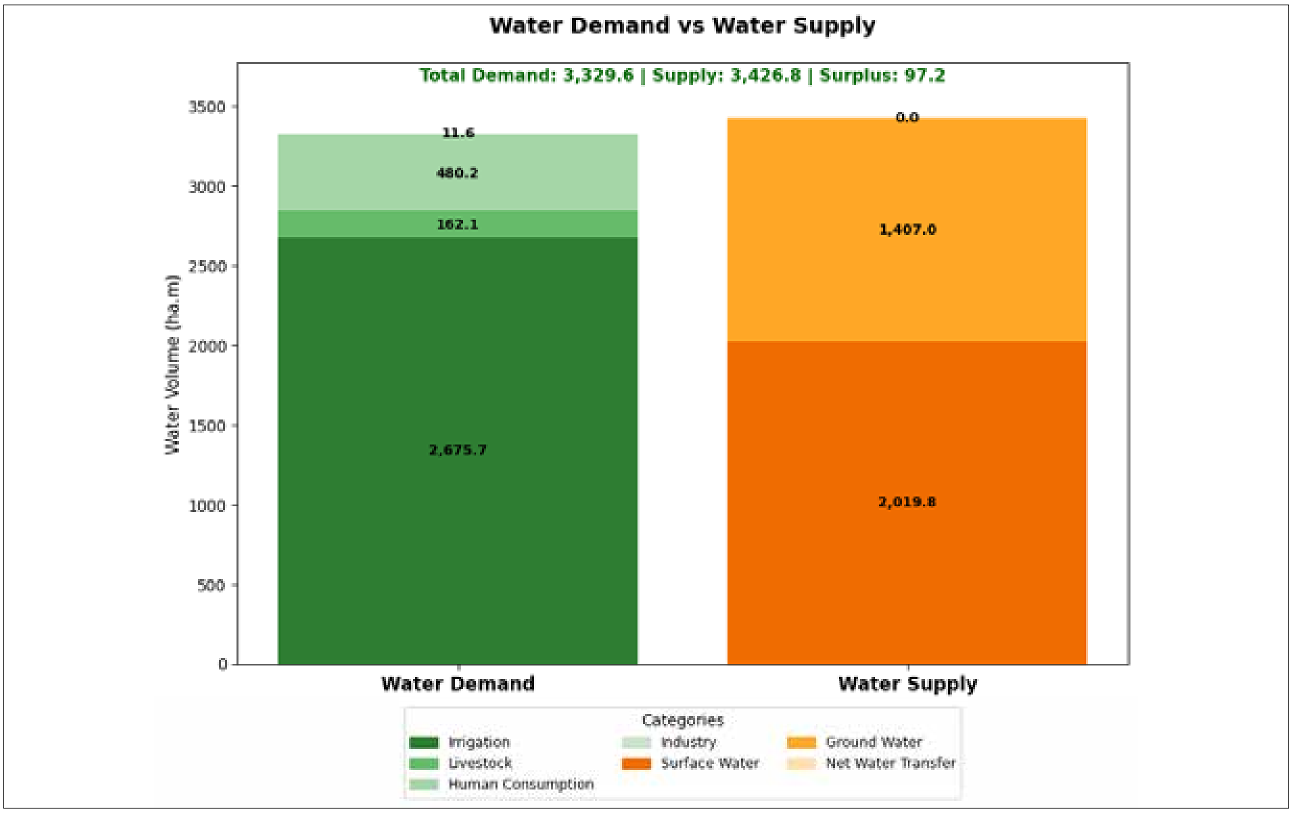
The Bhim block belongs to the Central Plateau and Hills Region of India and the land use pattern data reveals that major parts of the block geography are undulating and under non-cultivation purposes. The block has an average of **568 mm** rainfall and the potential for harvesting run-off annually is 5,392.5 ha.m.

Types of Run-offs	Area (ha)	Run-off (cu.m per ha)	run-off	
			In ha.m	In %
Good Catchment Area	39,018.4	951.5	3,712.6	69
Average Catchment Area	14,390	709.5	1,021.0	19
Poor Catchment Area	13,930.2	473	658.9	12
Total	67,338.6		5,392.5	100



12.4 Water Budgeting at Block Level

S. No	Description	Volume	
		In ha.m	In %
A. Water Demand			
1	Water for Irrigation	2,675.7	80
2	Water for Livestock	162.1	5
3	Water for Human Consumption	480.2	14.5
4	Water for Industry	11.57	0.5
5	Block Wise Water Required	3,329.6	100
B. Water Supply			
6	Supply from Local Surface Water Sources	2,019.8	59
7	Supply from Groundwater Sources	1,407.0	41
8	Net Water Transfer	0.0	0
9	Total Supply	3,426.8	100
C. Water Budgeting			
10	Water Deficit/Surplus	97.2	3
D. Potential for Rainwater Harvesting/GW Augmentation			
11	Available Run-off from Rainwater	5,392.5	
12	harvested Run-off	3,449.00	
13	Potential Run-off Available for Harvesting/GW Augmentation	595.4	
E. Potential for Groundwater Development			
14	Stage of Groundwater Development (from IN-GRES portal)	145.24	
15	Groundwater Development Category (from IN-GRES portal)	Over Exploited	



12.4.1 Annotations

(i) The Bhim block, Rajsamand district belongs to the central part of Rajasthan and is dominated by forest (22%) & Barren and Un-cultivable Land Area landscape (26%).

(ii) The Bhim block has 3,329.6 ha.m water requirements for all purposes, out of this 80 % from irrigation needs. Secondly, 59% of the total water needs of the block is served by Local Surface Water Sources.

(iii) As the available run-off (5,392.5 ha.m) of the block is significantly high and block did excellent efforts for creating surface storage capacities to cater to available run-off up to 64% (3,449 ha.m).

(iv) The block is water surplus by 3% (97.2 ha.m).

(v) The block still has availability of 595 ha.m potential runoff for harvesting/ GW augmentation.

12.4.2 Recommendations

(i) The block has enhanced the surface water harvested capacities over the years and optimally utilised the available surface water sources up to 59%, and there is scope to utilise surface water storage capacities of the block.

(ii) It is important to optimise the efficient use of surface water sources to fulfil local water demands.

(iii) It is important to focus more on identifying opportunities to improve water use efficiency in terms of surface water application for various purposes, as the Stage of Groundwater development is in Over Exploited (145.24 %)

12.4.3 Takeaways for Rural Drinking Water supply

(i) The JJM coverage is 34.91%.

(ii) Of the 76 PWS schemes in the block, 69 (91%) are SVS and 7 (9%) are MVS. Hence, the block is mainly dependent on Groundwater for rural drinking water supply.

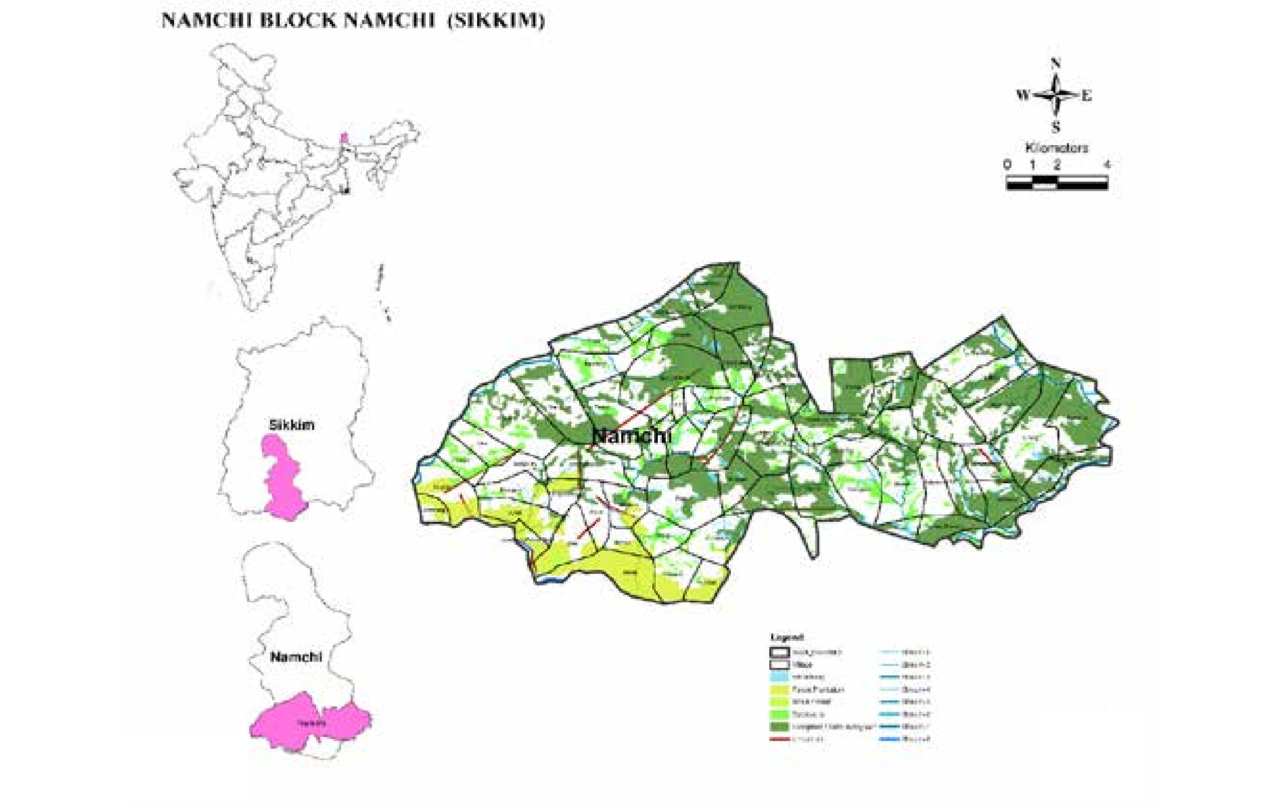
(iii) Surface water is required to meet the current and future drinking water demands.

(iv) Measures to be taken to protect the Groundwater quality and GW augmentation.

13. Namchi Block, Namchi District, Sikkim

13.1 Introduction

State	District	Block	Number of villages	Number of Urban centres
Sikkim	Namchi	Namchi	28	1



13.2 Demand Side Management

13.2.1 Water Requirements for Human Consumption

#	Total Population			Population Growth	Water Demand (lpcd)	Annual Water Requirements (ha.m)
	Female	Male	Total			
Rural	28,392	28,392	56,784	70,980	55	171.0
Urban	6,097	6,097	12,194	15,243	150	100.1
Total	34,489	34,489	68,978	86,223		271.1

13.2.2 Water Requirements for Livestock

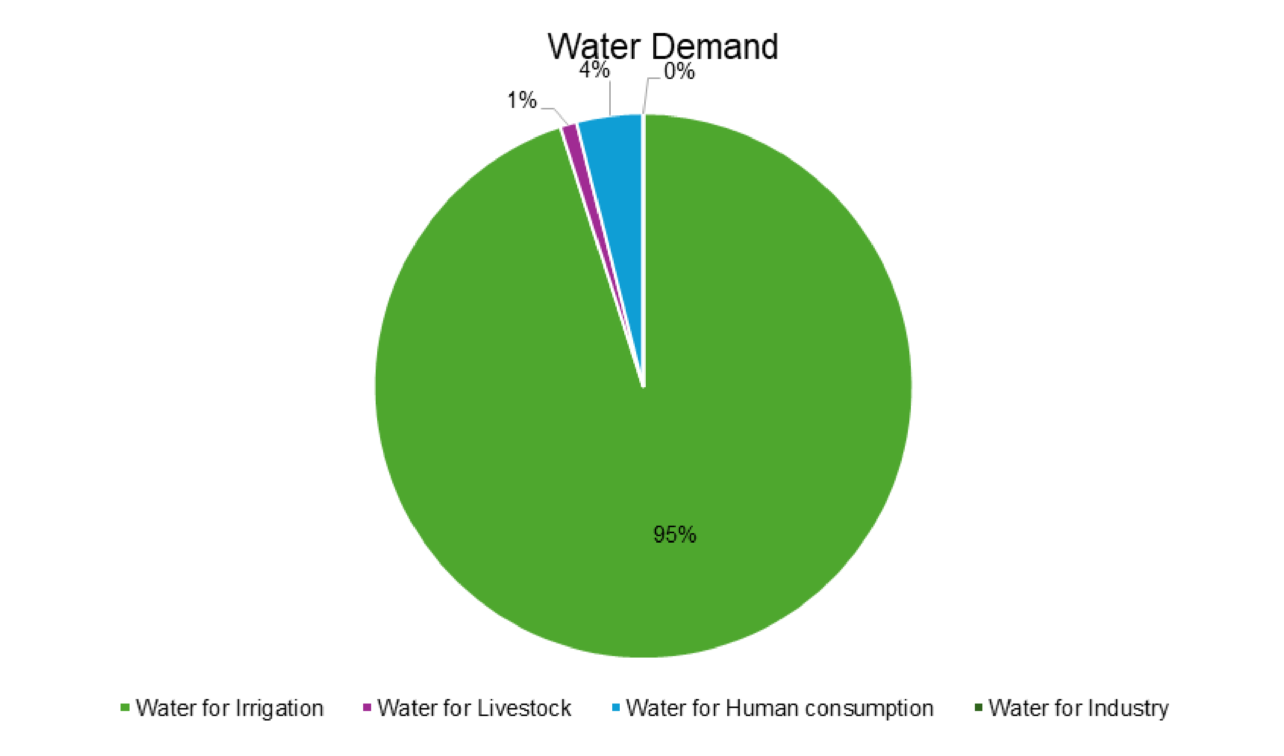
S. No	Type of Animal	Number of Animals	Water Req. (ha.m)
1	Cow/Cattle	21,874	53.5
2	Pigs	4,863	3.9
3	Goat	13,924	3.6
4	Buffaloes	87	0.2
5	Sheep	114	0.03
6	Horses	0	0
7	Camels	0	0
8	Poultry	0	0
	Total	40,862	61.23

13.2.3 Irrigation Water Requirement

Irrigated Area (in ha)	Water Required Per Hectare (ha.m)	Irrigation Water Requirement (ha.m)
1	2	3 = (1*2)
12,378.3	0.5	6,189.1

13.2.4 Industrial Water Requirement

There are no industries in this block



13.3 Supply Side Management

13.3.1 Information on Land Use

As per census 2011, the Namchi block has 24,090.9 hectares area for different uses.

S. No	Classification	Area	
		In ha	In %
1	Forest Area	10,927.8	45
2	Area Irrigated by Source	10,579.7	44
3	Barren & Un-cultivable Land Area	857.3	4
4	Area under Non-Agricultural Uses (Rural +Urban)	714	3
5	Total Unirrigated Land Area	650.2	3
6	Land Under Miscellaneous Tree Crops etc. Area	350.8	1.5
7	Culturable Waste Land Area	11.1	0.5
8	Permanent Pastures and Other Grazing Land Area	0	0
9	Fallows Land other than Current Fallows Area	0	0
10	Current Fallows Area	0	0
Total		24,090.9	100

13.3.2 Surface Water Bodies

S. No.	Names of Structures	Number of structures	Storage Capacity	
			In ha.m	In %
1	Lakes	18	410.7	70
2	Reservoir	2	122.5	21
3	Ponds	17	47.4	8
4	Tanks/WCS	5	3.8	1.95
5	Water harvesting Structure	4	0.3	0.005
6	Other	0	0	0
Total		46	584.7	100

13.3.3 Surface Water Supply

The Namchi block has very limited scope for Groundwater extraction. So that, water requirements could be fulfilled through alternative sources of surface irrigation like water bodies and springs. The Namchi block is endowed with springs within the block. The 100% irrigation areas of the block are dependent on surface water sources through utilisation of springs.

Type	Area Irrigated (ha)	Water Supply in ha.m
Canals Area	650.2	380.4
Tanks/Lakes Area	0.0	0.0
Waterfall Area	0.0	0.0
Other Source (Water from outside)	0.0	0.0
Total	650.2	380.4

13.3.4 Groundwater Supply

Annual Groundwater Extractable (ha.m)	Annual Groundwater Extraction (ha.m)	Stage of Groundwater Extraction	Groundwater Extraction Category
486	36	7.42 %	Safe

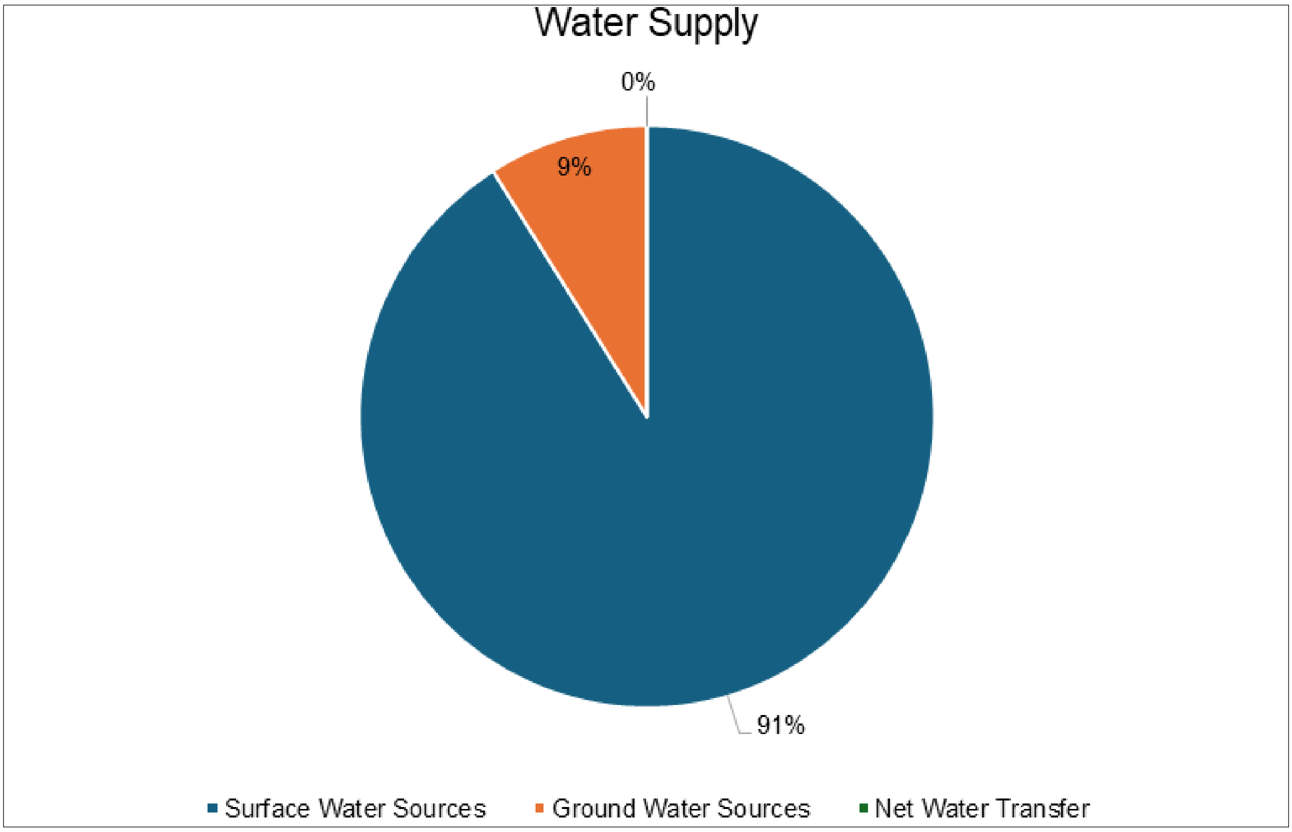
13.3.5 Water Transfer

There is no water transfer (both inwards and outwards) for this block.

13.3.6 Amount of Run-off

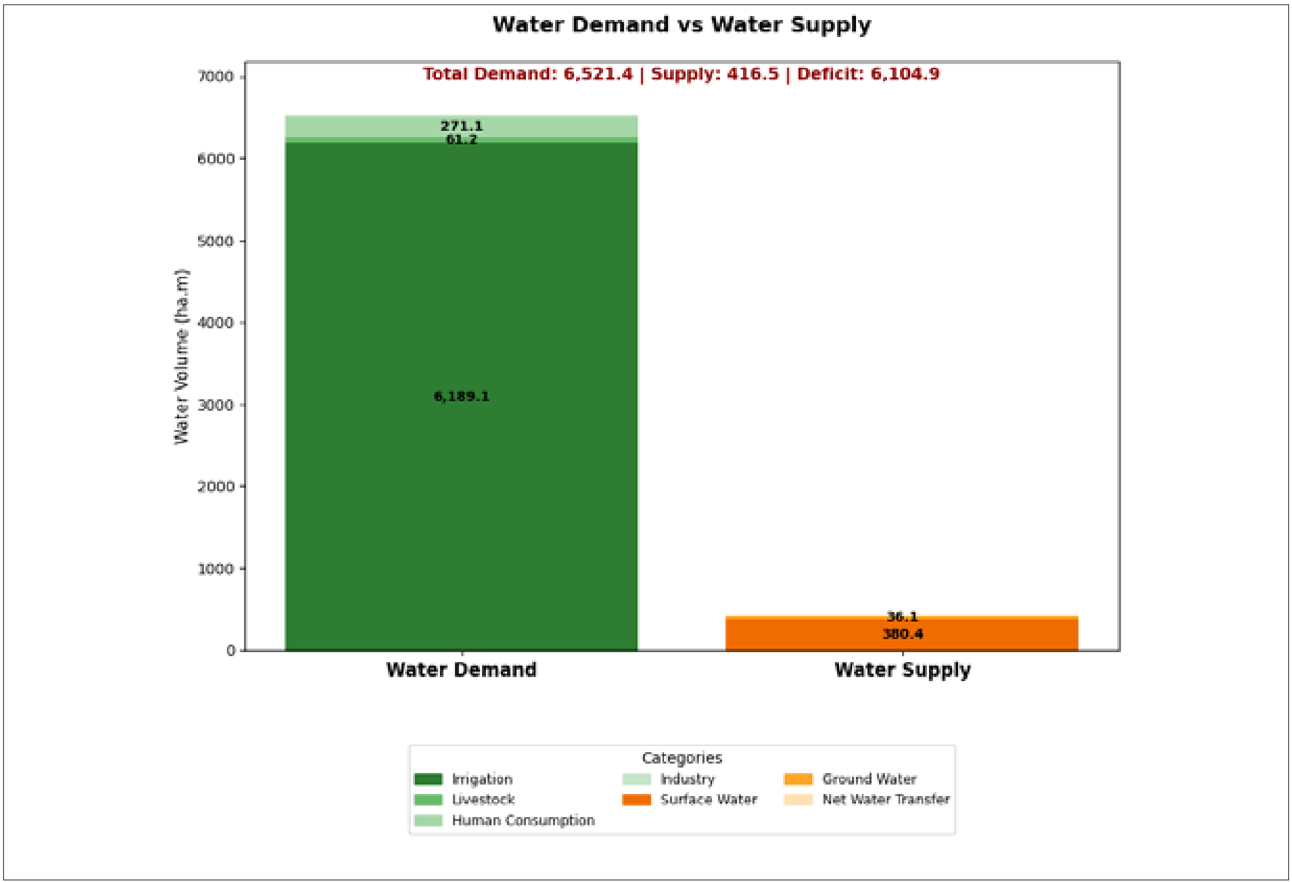
The Namchi block belongs to the Eastern Himalayan region of India and the land use pattern data reveals that major parts of the block geography are undulating and under non-cultivation uses. The block has an average of 2,203 mm rainfall and has potential for harvesting 16,546.9 ha.m run-off annually.

Types of Run-offs	Area (ha)	Run-off (cu.m per ha)	Run-off	
			In ha.m	In %
Good Catchment Area	12,499.1	9,000	11,249.2	68
Average Catchment Area	361.9	6,750	244.3	1
Poor Catchment Area	11,229.9	4,500	5,053.5	31
Total	24,090.9		16,546.9	100



13.4 Water Budgeting at Block Level

S. No	Description	Volume	
		In ha.m	In %
A. Water Demand			
1	Water for Irrigation	6,189.1	95
2	Water for Livestock	61.2	1
3	Water for Human Consumption	271.1	4
4	Water for Industry	0	0
5	Block Wise Water Required	6,521.5	100
B. Water Supply			
6	Surface Water Sources	380.4	91
7	Groundwater Sources	36.1	9
8	Net Water Transfer	0.0	0
9	Total Supply	416.5	100
C. Water Budgeting			
10	Water Deficit/Surplus	-6,105.0	94
D. Potential for Rainwater Harvesting/GW Augmentation (in ha.m)			
11	Available Run-off from Rainwater	16,546.9	
12	Harvested Run-off	584.70	
13	Potential Runoff Available for Harvesting/GW Augmentation	11,825.5	
E. Potential for Groundwater Development			
14	Stage of Groundwater Development (from IN-GRES portal)	7.42	
15	Groundwater Development Category (from IN-GRES portal)	Safe	



13.4.1 Annotations

(i) The Namchi block, being part of the Lower Himalayan region, the land use pattern is unique, dominated by forest landscape (45%) as evident from the table above.

(ii) As the block belongs to the lower Himalayan region, it is highly dependent on spring water for diverse water needs and the same is reflected in the land use pattern, which shows a high proportion of irrigated areas which are mostly catered by spring waters.

(iii) In the case of the lower Himalayan region, water from springs plays an important role to cater to local water needs, however it is difficult to reflect in the water budgeting process, due to the limitation of required datasets.

(iv) The Namchi block is well-known for spring-shed (Dhara Vikas) management, which clearly reveals the priorities of the region in terms of ensuring water security.

(v) The lower Himalayan region is also known for the reliance on spring water however due to inadequate availability of datasets pertaining to glacier water, it is difficult to incorporate into the water budgeting process.

(vi) The Namchi block has **6,521.5** ha.m water requirements for all purposes, out of this 95% is for irrigation only.

(vii) The block has **416.5** ha.m (92% surface water + 8% Groundwater + 0% outside the block) of supply from all sources.

(viii) The block is water deficit by 94% (**6,105.0** ha.m).

(ix) The Stage of Groundwater development is in the safe category (7.42 %).

(x) The block still has availability of 11,825.5 ha.m potential run-off for harvesting/GW augmentation.

13.4.2 Recommendations

(i) The geomorphology of the block shows that it is dependent on unconfined aquafer, so it becomes important to protect these subsurface water sources from contamination.

13.4.3 Takeaways for Rural Drinking Water Supply

(i) The JJM coverage is 89.9% as of March 2025.

(ii) Of the 144 PWS schemes in the block, 142 (99%) are SVS and 2 (1%) are MVS. Hence, the block is majorly dependent on Groundwater for rural drinking water supply.

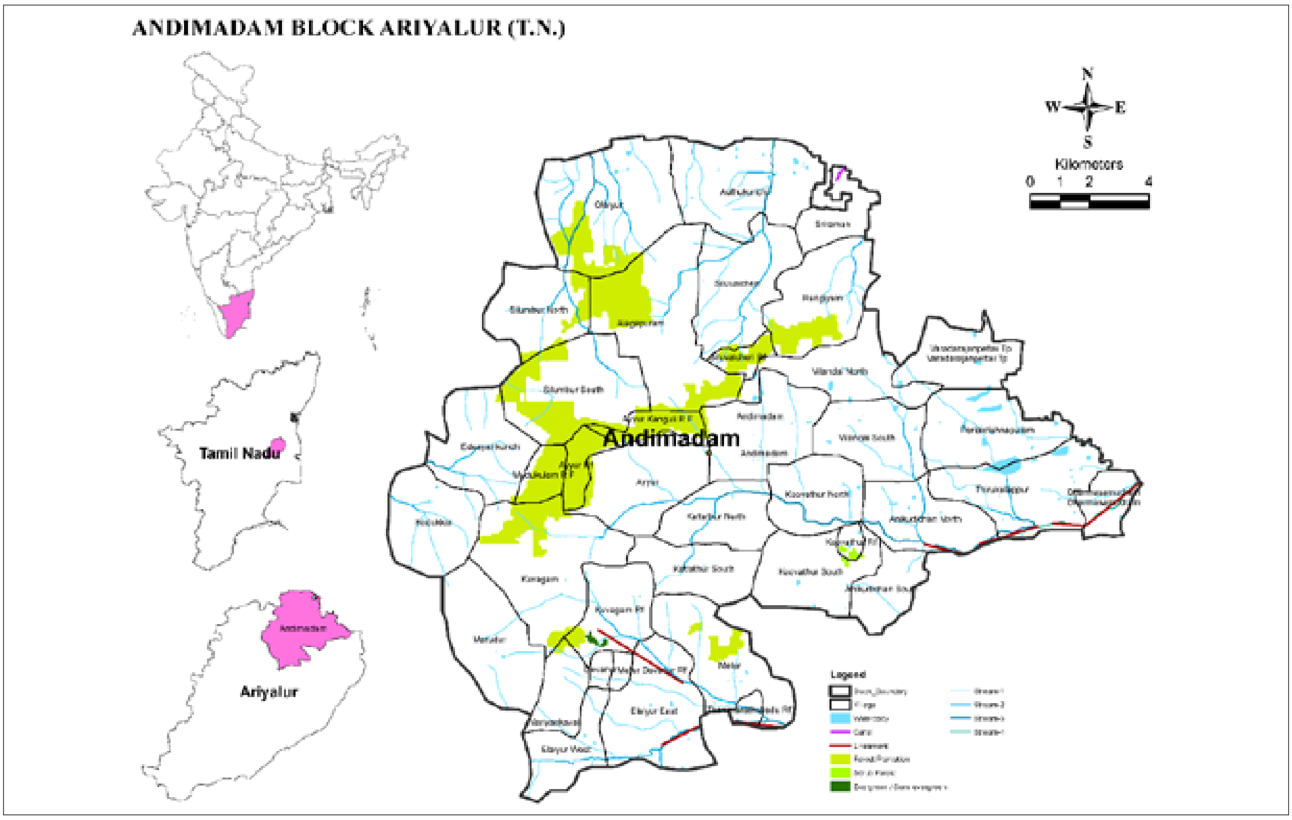
(iii) Sub-Surface water (Springs) is required to meet the current and future drinking water demands.

(iv) Measures to be taken to protect the spring water quality.

14. Andimadam Block, Ariyalur District, Tamil Nadu

14.1 Introduction

State	District	Block	Number of Villages	Number of Urban Centres
Tamil Nadu	Ariyalur	Andimadam	37	2



14.2 Demand Side Management

14.2.1 Water Requirements for Human Consumption

#	Total Population			Population Growth	Water Demand (lpcd)	Annual Water Requirements (ha.m)
	Female	Male	Total			
Rural	87,954	87,238	1,75,192	2,18,990	55	527.5
Urban	21,395	20,809	42,204	52,755	150	346.6
Total	1,09,349	1,08,047	2,17,396	2,71,745		874.1

14.2.2 Water Requirements for Livestock Consumption

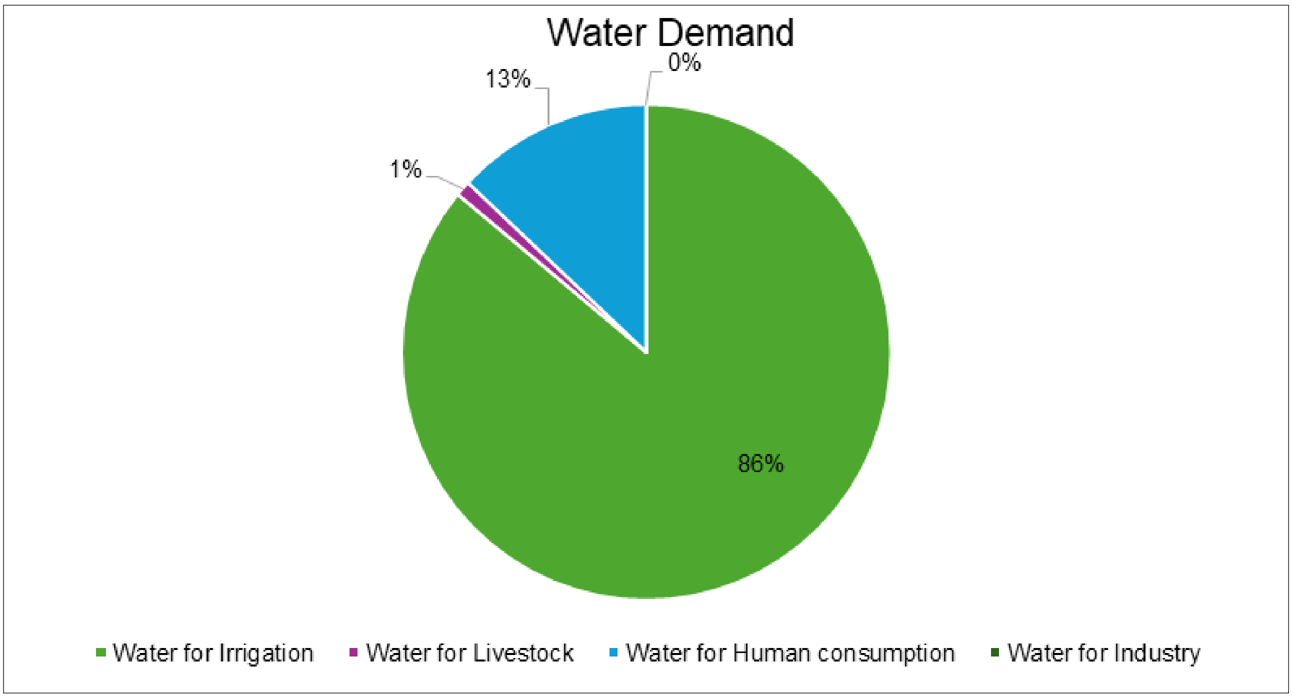
S. No	Type of Animal	Number of Animals	Water Req. (ha.m)
1	Cow/Cattle	20,763	50.8
2	Goat	27,135	6.9
3	Buffaloes	681	1.7
4	Sheep	3,049	0.8
5	Pigs	282	0.2
6	Horses	0	0
7	Camels	0	0
8	Poultry	0	0
	Total	51,910	60.4

14.2.3 Irrigation Water Requirement

Irrigated Area (in ha)	Water Required Per Hectare (ha.m)	Irrigation Water Requirement (ha.m)
1	2	3 = (1*2)
7,171.05	0.5	3,585.5

14.2.4 Industrial Water Requirement

There are no industries in the block.



14.3 Supply Side Management

14.3.1 Information on Land Use

As per census 2011, the Andimadam block has 42,853.1 hectares area for various uses.

S. No	Classification	Area	
		In ha	In %
1	Total Unirrigated Land Area	22,139.0	52
2	Land Under Miscellaneous Tree Crops etc. Area	6,425.6	15
3	Area Irrigated by Source	6,129.1	14
4	Area under Non-Agricultural Uses (Rural +Urban)	4,700.6	11
5	Current Fallows Area	2,068.4	5
6	Barren & Un-cultivable Land Area	601.4	1
7	Culturable Waste Land Area	406.1	1
8	Forest Area	260.6	1
9	Fallows Land other than Current Fallows Area	91.2	0.21
10	Permanent Pastures and Other Grazing Land Area	31.1	0.07
Total		42,853.1	100

14.3.2 Surface Water Bodies

S. No.	Names of Structures	Number of structures	Storage Capacity	
			In ha.m	In %
1	Reservoir	4	388.9	51
2	Lakes	15	229.2	30
3	Ponds	80	115.2	15
4	Tanks/WCS	32	22.7	3.6
5	Water harvesting Structure	33	2.7	0.4
6	Other	0	0	0
	Total	164	758.7	100

14.3.3 Surface Water Supply

Type	Area Irrigated (ha)	Water Supply	
		In ha.m	In %
Tanks/Lakes Area	517.1	302.5	74
Canals Area	152.9	89.4	22
Other Source (Water from outside)	26.9	15.7	4
Waterfall Area	0	0	0
Total	696.9	407.7	100

14.3.4 Groundwater Supply

Annual Groundwater Extractable (ha.m)	Annual Groundwater extraction (ha.m)	Stage of Groundwater extraction	Groundwater extraction category
3,013	2,147	71.26 %	Semi Critical

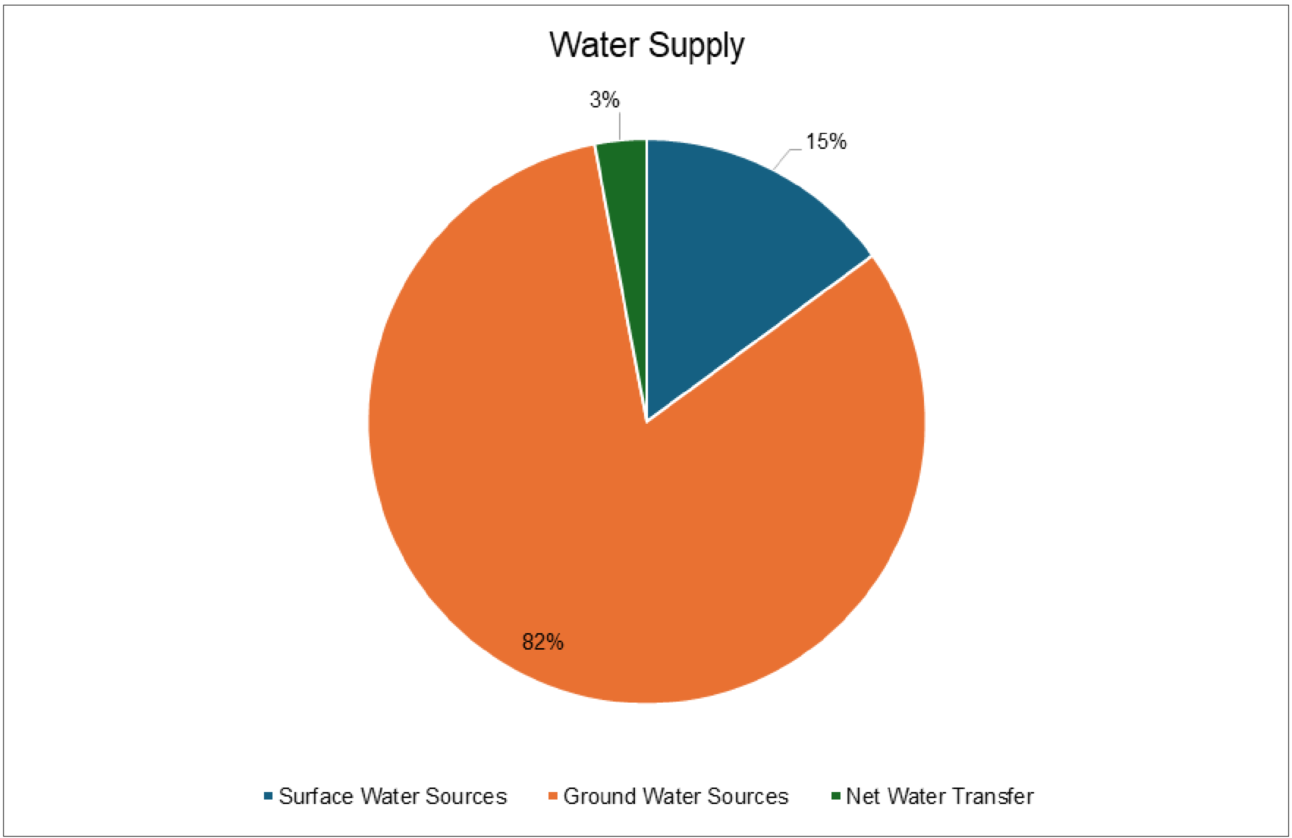
14.3.5 Water Transfer

Water Use	Inward Transfer (ha.m)	Outward Transfer (ha.m)	Net Transfer (Inwards-Outwards) ha.m
Domestic	51.05	0	51.05
Agriculture	15.7	0	15.7
Industry	0	0	0
Total	66.75	0	66.75

14.3.6 Amount of Run-off

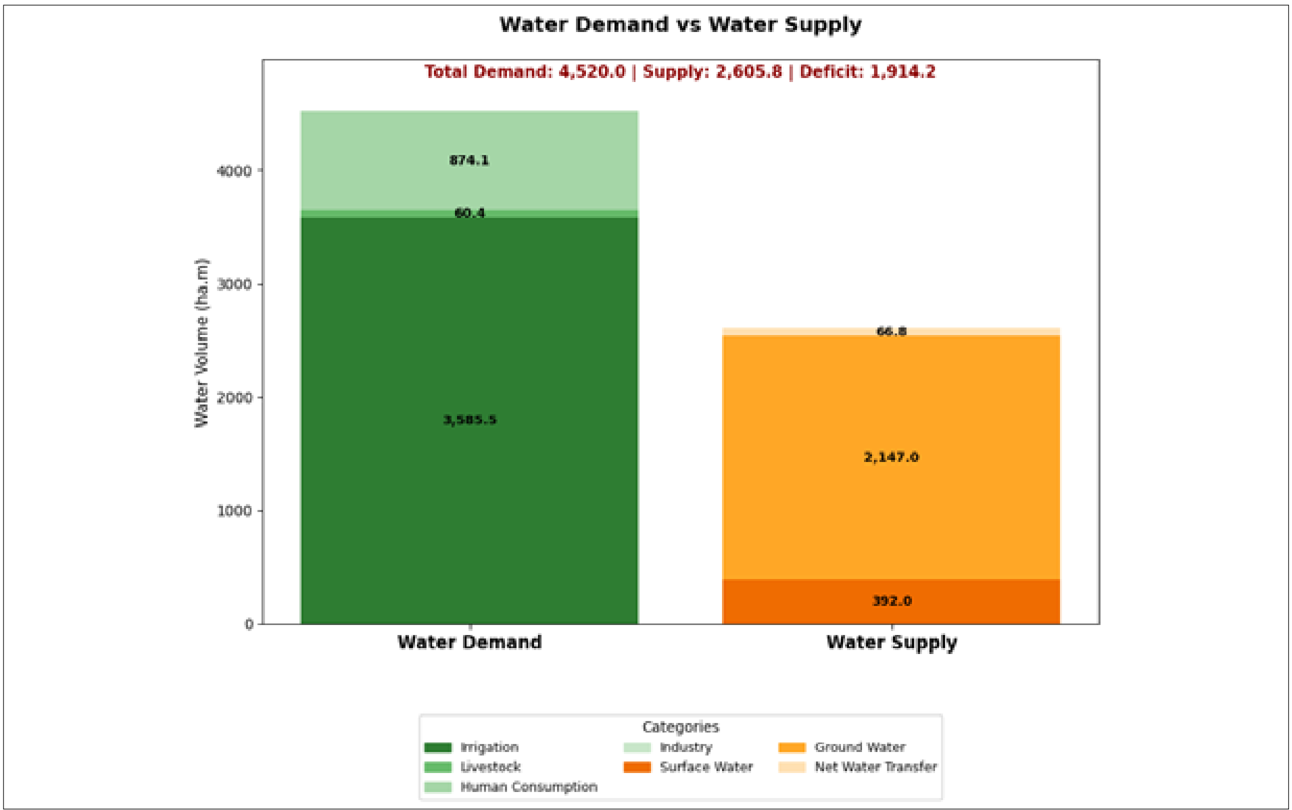
The Andimadam block belongs to the East Coast Plains and Hills region of India. The block has an average of 1,078 mm rainfall and has a potential of harvesting 9704.4 ha.m run-off annually.

Types of Run-offs	Area (ha.)	Run-off (cu.m per ha)	Run-off	
			In ha.m	In %
Good Catchment Area	5,562.6	3,750	2,086.0	21
Average Catchment Area	6,862.8	2,810	1,928.4	20
Poor Catchment Area	30,427.7	1,870	5,690.0	59
Total	42,853.1		9,704.4	100



14.4 Water Budgeting at Block Level

S. No	Description	Volume (Ha M)	
		In ha.m	In %
A. Water Demand			
1	Water for Irrigation	3,585.5	86
2	Water for Livestock	60.4	1
3	Water for Human Purpose	874.1	13
4	Water for Industry	0	0
5	Block Wise Water Required	4,520.1	100
B. Water Supply			
6	Surface Water Sources	392.0	15
7	Groundwater Sources	2,147.0	82
8	Net Water Transfer	66.8	3
9	Total Supply	2,605.7	100
C. Water Budgeting			
10	Water Deficiency/Surplus	-1,914.3	42
D. Potential for Rainwater Harvesting/GW Augmentation (in ha.m)			
11	Available Run-off from Rainwater	9,704.4	
12	Harvested Run-off	758.70	
13	Potential Run-off Available for Harvesting/GW Augmentation	6,519.6	
E. Potential for Groundwater Development			
14	Stage of Groundwater Development (from IN-GRES portal)	71.26	
15	Groundwater Development Category (from IN-GRES portal)	Semi Critical	



14.4.1 Annotations

(i) The Andimadam block of Ariyalur District, Tamil Nadu, belongs to the East Coast Plains and Hilly region of India.

(ii) The block is dominated by arable landscape and almost two-thirds (66%) of the total geographical area, is under agricultural use.

(iii) The block has **4,520.1** ha.m water requirements for all purposes, out of this, 86% from irrigation needs only. Secondly, 82% of the total water needs of the block are served by Groundwater sources. The block has already reached the semi-critical category (71.26 %).

(iv) The block has two major urban settlements, hence, water demand for human consumption is considerably high (13%).

(v) The block also has a tank-based irrigation system that caters to irrigation water needs up to 15%.

(vi) The block is water deficit by 42% (**1,914.3** ha.m)

(vii) The available run-off (9,704.4 ha.m) of the block is significantly high, however block surface storage capacities are very less, and the block is able to harvest only 7.8% (758.70 ha.m) of available runoff. The block still has availability of 6,519.6 ha.m potential run-off for harvesting/GW augmentation.

14.4.2 Recommendations

(i) The block area is highly dependent on Groundwater; hence it is important to enhance surface water availability and focus on improving water productivity.

(ii) Secondly, the block is able to use 52% of the available surface water, however with enhanced surface water capacities, it would further reduce dependence on Groundwater, which is important.

(iii) The block is part of the coastal plain and the risk of sea water ingression can affect the Groundwater quality. Hence, it is necessary to protect the Groundwater quality.

14.4.3 **Takeaways for Rural Drinking Water Supply**

(i) JJM coverage is 100% as of March 2025.

(ii) Of the 578 PWS schemes in the block, 576 (99.5%) are SVS and 2 (0.5%) are MVS. Hence, the block is mainly dependent on Groundwater for rural drinking water supply

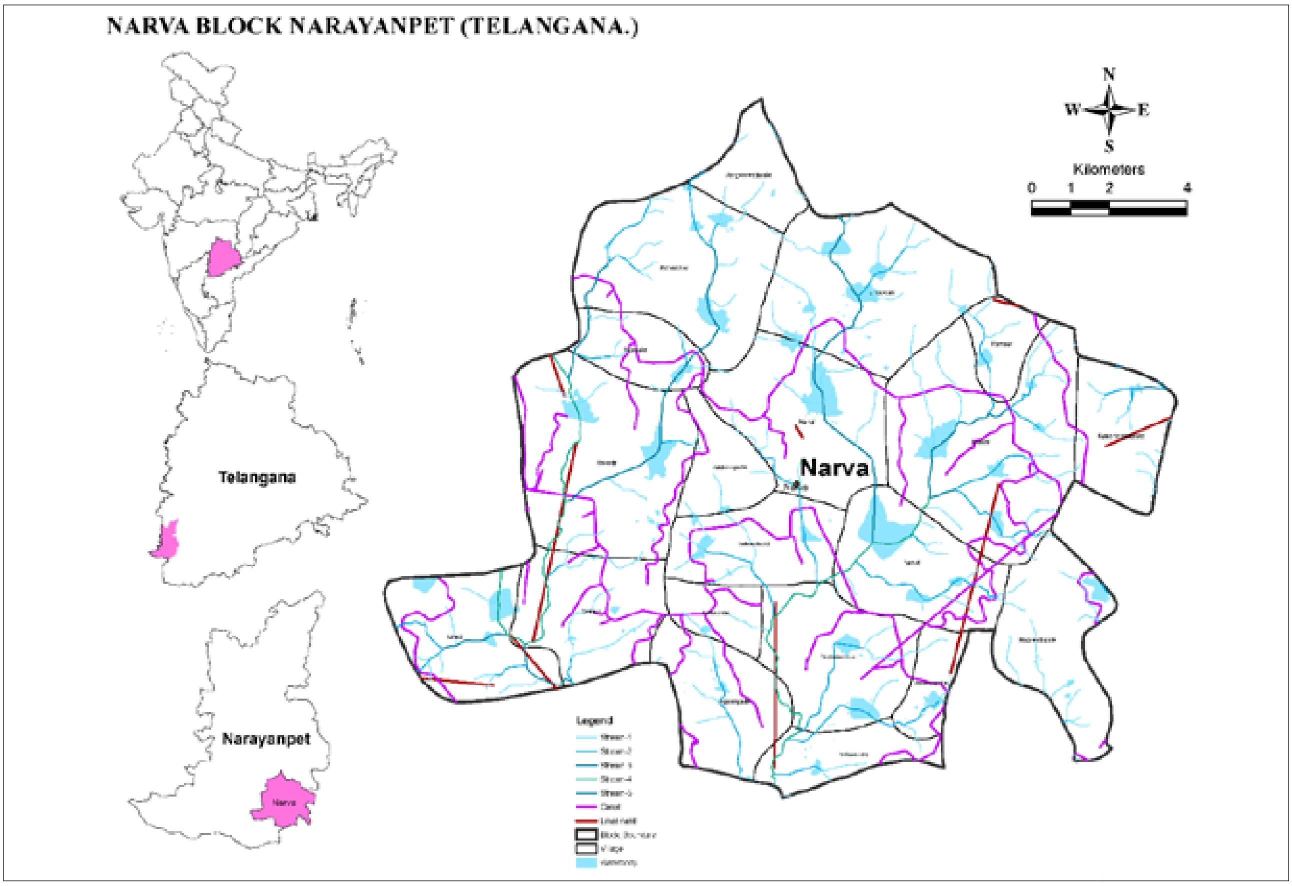
(iii) Surface water is required to meet the future drinking water demands.

(iv) Measures to be taken to protect the Groundwater quality and GW augmentation.

15. Narva Block, Narayanpet, Telangana

15.1 Introduction

State	District	Block	Number of villages	Number of Urban centres
Telangana	Narayanpet	Narva	19	0



15.2 Demand Side Management

15.2.1 Water Requirements for Human Consumption

#	Total Population			Population Growth	Water Demand (lpcd)	Annual Water Requirements (ha.m)
	Female	Male	Total			
Rural	15,001	15,240	30,241	37,801	55	91.1
Urban	0	0	0	0	150	0.0
Total	15,001	15,240	30,241	37,801		91.1

15.2.2 Water Requirements for Livestock Consumption

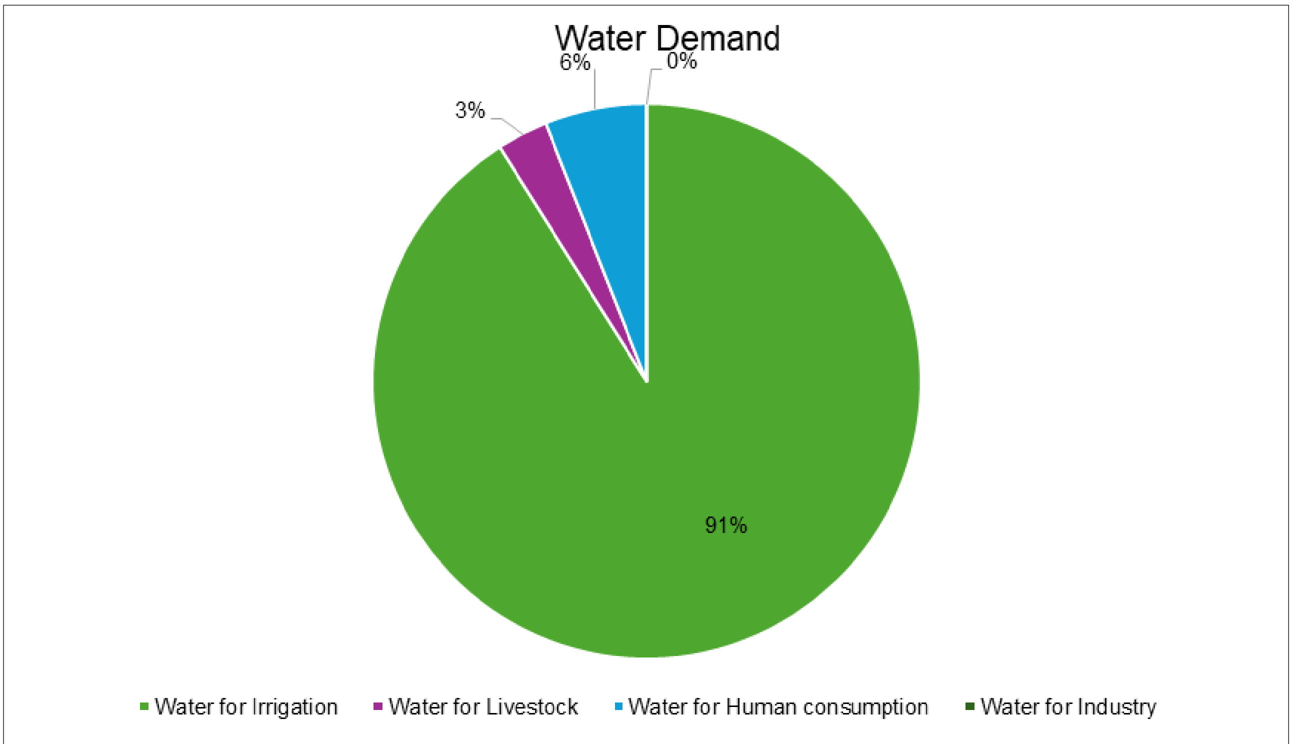
S. No	Type of Animal	Number of Animals	Water Req. (ha.m)
1	Sheep	1,08,160	27.6
2	Cow/Cattle	5,921	14.5
3	Buffaloes	2,367	5.8
4	Goat	5,156	1.3
5	Pigs	905	0.7
6	Poultry	17,694	0.2
7	Horses	0	0
8	Camels	0	0
	Total	1,40,203	49.9

15.2.3 Irrigation Water Requirement

Irrigated Area (in ha)	Water Required Per Hectare (ha.m)	Irrigation Water Requirement (ha.m)
1	2	3 = (1*2)
2,972.3	0.5	1,486.1

15.2.4 Industrial Water Requirement

There are no industries in this block.



15.3 Supply Side Management

15.3.1 Information on Land Use

As per census 2011, the Narva block has 20,316.3 hectares area under different uses.

S. No	Classification	Area	
		In ha	In %
1	Total Unirrigated Land Area	9,919.2	49
2	Area Irrigated by Source	2,540.4	13
3	Culturable Waste Land Area	1,873.5	9
4	Forest Area	1340	7
5	Fallows Land other than Current Fallows Area	1234	6
6	Barren & Un-cultivable Land Area	1,012.3	5
7	Area under Non-Agricultural Uses (Rural +Urban)	899.6	4
8	Current Fallows Area	779.3	4
9	Land Under Miscellaneous Tree Crops etc. Area	433	2
10	Permanent Pastures and Other Grazing Land Area	285	1
Total		20,316.3	100

15.3.2 Surface Water Bodies

S. No.	Names of Structures	Number of Structures	Storage Capacity	
			In ha.m	In %
1	Other	3	19,860.0	85.0
2	Reservoir	22	2949.9	12.6
3	Lakes	20	472.5	2.0
4	Ponds	55	58.4	0.2
5	Tanks/WCS	38	22.7	0.1
6	Water Harvesting Structure	90	8	0.0
Total		228.00	23,371.5	100

15.3.3 Surface Water Supply

S. No	Type	Area Irrigated (ha)	Water Supply	
			In ha.m	In %
1	Tanks/Lakes Area	686.3	401.5	62
2	Canals Area	425.0	248.6	38
3	Waterfall Area	0.0	0.0	0
4	Other Source (Water from outside)	0.0	0.0	0
Total		1,111.3	650.1	100

15.3.4 Groundwater Supply

Annual Groundwater Extractable (ha.m)	Annual Ground Water Extraction (ha.m)	Stage of Groundwater Extraction	Groundwater Extraction Category
3,710	1,513	40.78 %	Safe

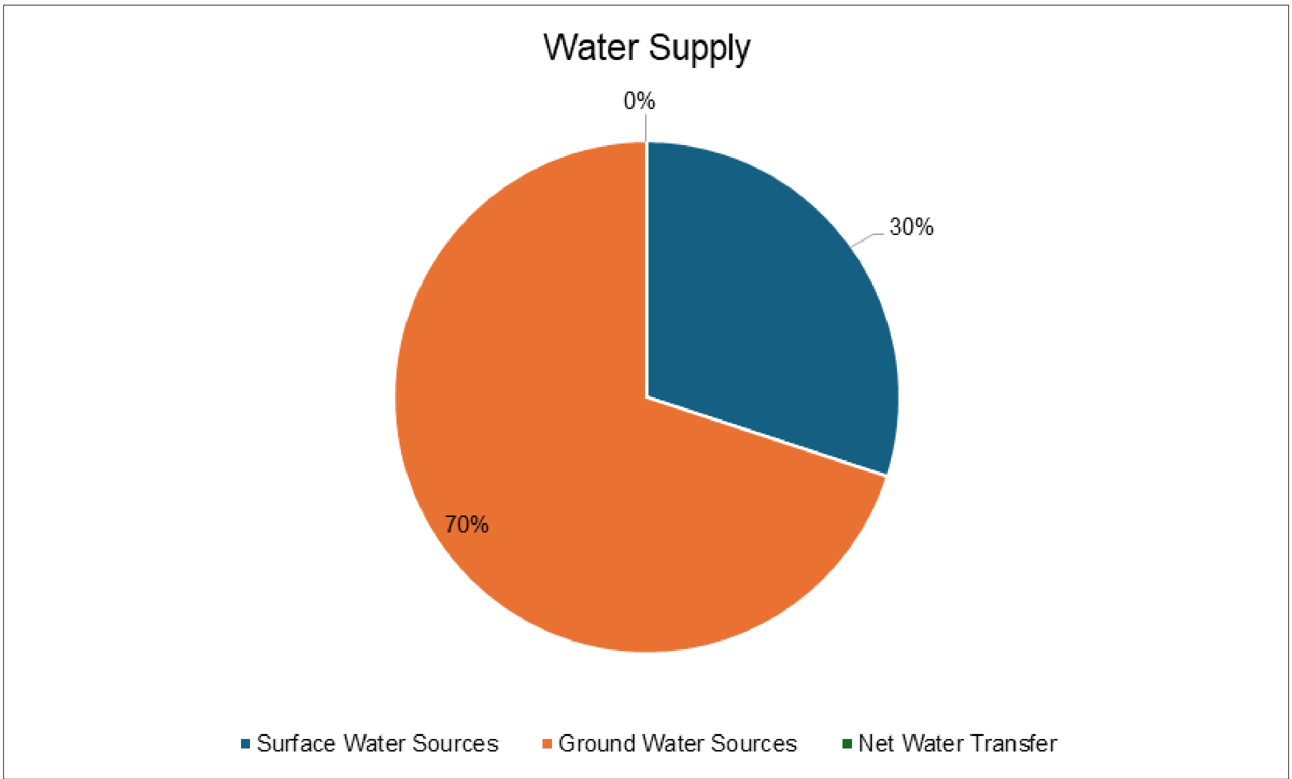
15.3.5 Water Transfer

There is no water transfer (inwards or outwards) in this block.

15.3.6 Amount of Run-off

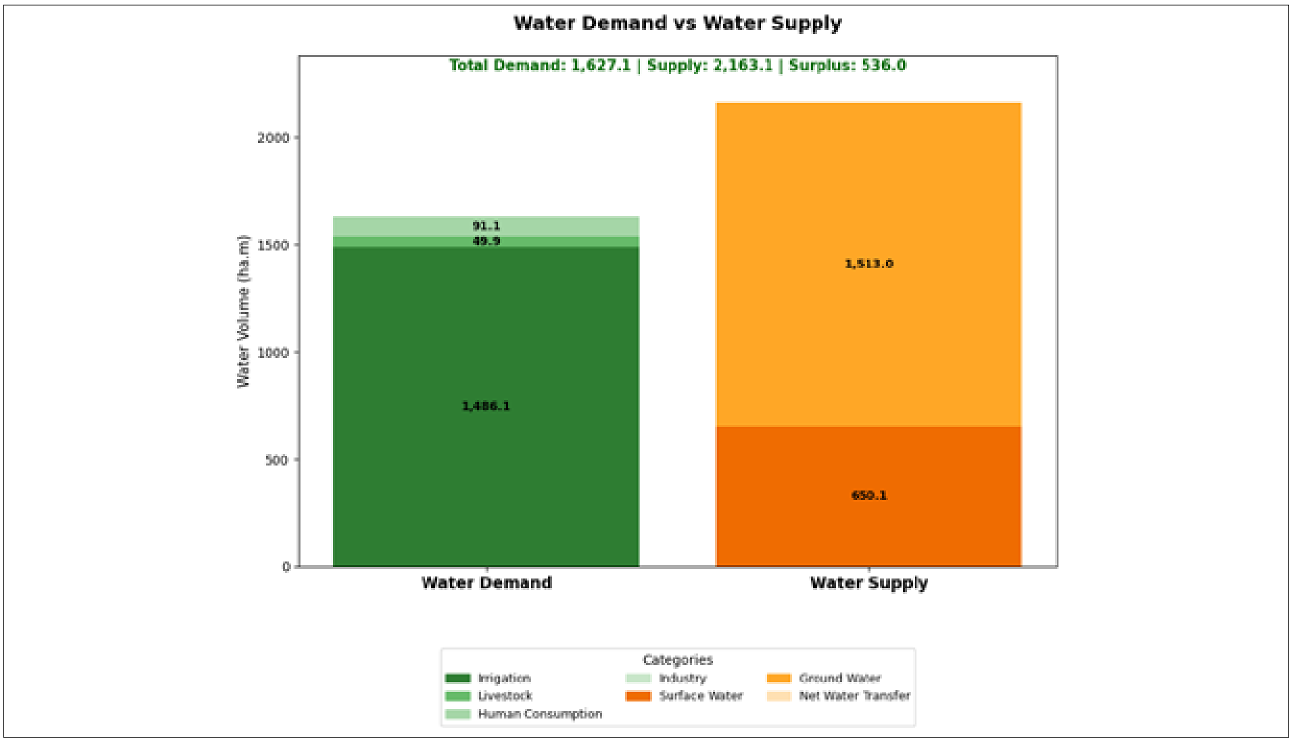
The Narva block belongs to the southern plateau and hills region of India. The block has an average of 524 mm rainfall and has potential for harvesting 951.6 ha.m run-off annually.

Types of Run-offs	Area (ha)	Run-off (cum per ha)	Run-off	
			In ha.m	In %
Good Catchment Area	3,251.9	800	260.2	27
Average Catchment Area	2,591.5	562.5	145.8	16
Poor Catchment Area	14,472.9	377	545.6	57
Total	20,316.3		951.6	100



15.4 Water Budgeting at Block Level

S. No	Description	Volume	
		In ha.m	In %
A. Water Demand			
1	Water for Irrigation	1,486.1	91
2	Water for Livestock	49.9	3
3	Water for Human Consumption	91.1	6
4	Water for Industry	0	0
5	Block Wise Water Required	1,627.1	100
B. Water Supply			
6	Surface Water Sources	650.1	30
7	Groundwater Sources	1,513.0	70
8	Net Water Transfer	0.0	0
9	Total Supply	2,163.1	100
C. Water Budgeting			
10	Water Deficiency/Surplus	536.0	33
D. Potential for Rainwater Harvesting/GW augmentation (in ha.m)			
11	Available Run-off from Rainwater	951.6	
12	Harvested Run-off	23,371.50	
13	Potential Run-off Available for Harvesting/GW Augmentation	Nil	
E. Potential for Groundwater Development			
14	Stage of Groundwater Development (from IN-GRES portal)	40.78	
15	Groundwater Development Category (from IN-GRES portal)	Safe	



15.4.1 Annotations

(i) The Narva block Narayanpet, Telangana belongs to the southern plateau and the hills region of India and is dominated by arable areas (more than 70%).

(ii) The block also has some small & medium irrigation projects catering to irrigation water needs up to 30%.

(iii) The block has 1,627.1 ha.m water requirements for all purposes, out of this 91% from irrigation needs only. Secondly, 70% of the total water needs of the block is served by Groundwater sources.

(iv) The block is water surplus by 33% (536 ha.m).

(v) The block is comparatively smaller in size coupled with agricultural dominated landscape, the runoff generation within the block is very less (951.6 ha.m), however, the block is receiving significantly high run-off from outside the block catchment areas.

(vi) On the other hand, the block is able to harvest 23,371.50 ha.m water in surface water bodies, it is indicated that it is using the run-off received from other areas efficiently.

(vii) The Narva block has **1,627.1** ha.m water requirements for all purposes, out of this 91% is for irrigation only.

15.4.2 Recommendations

(i) Due to availability of surface water sources, the block is still in safe category (40.78%), however it is necessary to minimise the Groundwater extraction at current level by enhancing surface water availability and focusing on improving water productivity.

15.4.3 Takeaways for Rural Drinking Water supply

(i) The JJM coverage is 100% as on March 2025.

(ii) Of the 56 PWS schemes in the block, 55 (98%) are SVS and 1 (2%) are MVS. Hence, the block is mainly dependent on Groundwater for rural drinking water supply.

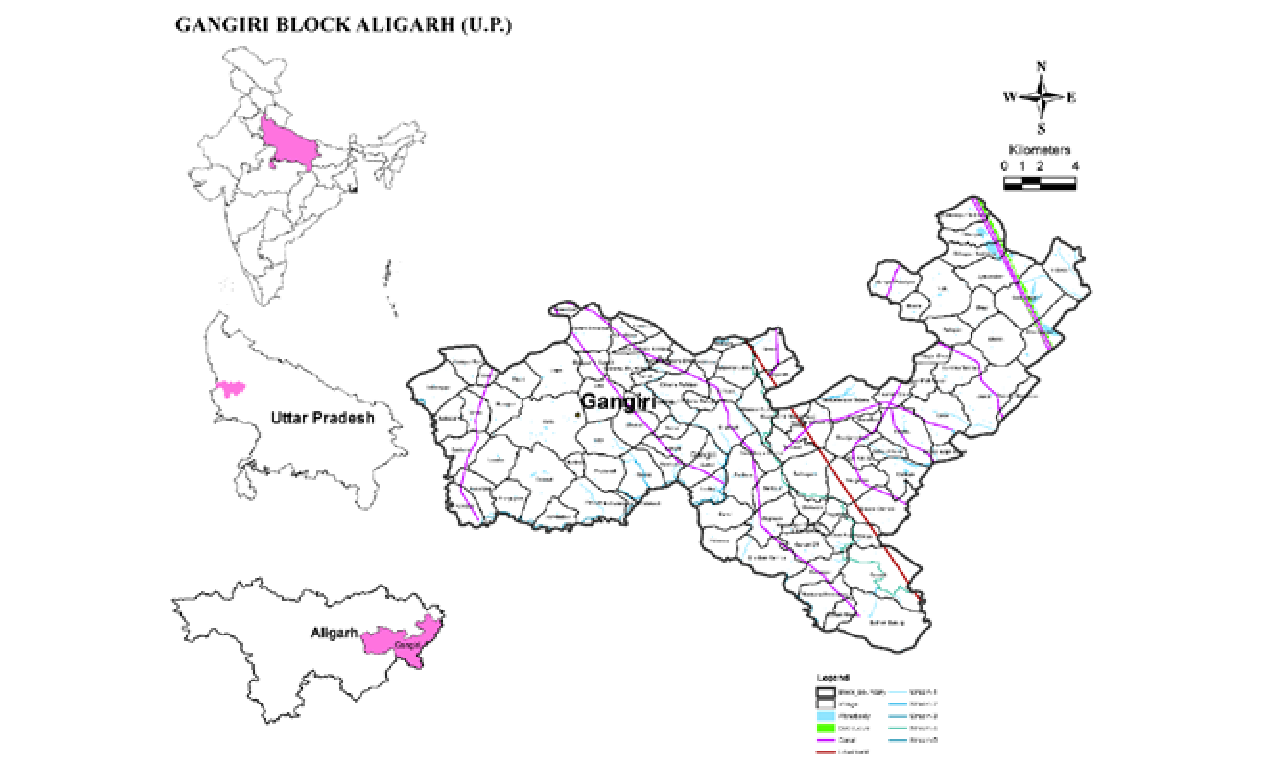
(iii) Adequate surface and Groundwater is available to meet the future drinking water demands.

(iv) Measures to be taken to protect the Groundwater quality and GW augmentation.

16. Gangiri Block, Aligarh District, Uttar Pradesh

16.1 Basic Details

State	District	Block	Number of villages	Number of Urban centres
Uttar Pradesh	Aligargh	Gangiri	101	0



16.2 Understanding Water Demand Side

16.2.1 Water Requirements for Human Consumption

#	Total Population			Population Growth	Water Demand (lpcd)	Annual Water Requirements (ha.m)
	Female	Male	Total			
Rural	1,23,105	1,40,114	2,63,219	3,29,024	55	792.6
Urban	0	0	0	0	150	0.0
Total	1,23,105	1,40,114	2,63,219	3,29,024		792.6

16.2.2 Water Requirement for Livestock Consumption

S. No	Type of Animal	Numbers of Animals	Water Req. (ha.m)
1	Buffaloes	1,11,287	272.15
2	Cow/Cattle	21,899	53.55
3	Goat	17,318	4.42
4	Pigs	180	0.14
5	Sheep	176	0.04
6	Poultry	250	0.002
7	Horses	0	0
8	Camels	0	0
Total		1,51,110	330.322

16.2.3 Irrigation Water Requirement

Irrigated Area (in ha)	Water Required Per Hectare (ha.m)	Irrigation Water Requirement (ha.m)
1	2	3 = (1*2)
34,756.7	0.5	17,378.4

16.2.4 Industrial Water Requirement

Type of Industry	Number of Industrial Units	Annual Water Demand (ha.m)
Agriculture Processing	1	0.2

16.3 Understanding Water Supply side

16.3.1 Information on Land Use

As per census 2011, the Gangiri block has 42,799.24 hectares areas for different purposes.

S. No	Classification	Area	
		In ha	In %
1	Area Irrigated by Source	29,706.6	69.4
2	Area under Non-Agricultural Uses (Rural +Urban)	8,046.20	18.8
3	Current Fallows Area	3,090.6	7.2
4	Culturable Waste Land Area	661.09	1.5
5	Fallows Land other than Current Fallows Area	466.44	1.1
6	Barren & Un-cultivable Land Area	321.2	0.8
7	Total Unirrigated Land Area	295.6	0.7
8	Permanent Pastures and Other Grazing Land Area	162.9	0.4
9	Land Under Miscellaneous Tree Crops etc. Area	48.61	0.1
10	Forest Area	0	0
Total		42,799.24	100

16.3.2 Surface Water Bodies

S. No	Names of Structures	Number of Structures	Storage Capacity	
			In ha.m	In %
1	Reservoir	4	410.1	57
2	Lakes	6	160.8	22
3	Ponds	101	100.5	14
4	Tanks/WCS	67	41.4	6
5	Water Harvesting Structure	140	10.7	1
6	Other	0	0	0
Total		318.00	723.5	100

16.3.3 Surface Water Supply

S. No	Type	Area Irrigated (ha)	Supply from Surface Water Sources	
			In ha.m	In %
1	Other Source (Water from outside)	740.5	433.2	77
2	Canals Area (local source)	218.6	127.9	23
3	Tanks/Lakes Area	0	0	0
4	Waterfall Area	0	0	0
Total		959.1	561.1	100

16.3.4 Groundwater Supply

Annual Groundwater Extractable (ha.m)	Annual Groundwater Extraction (ha.m)	Stage of Ground-water Extraction	Groundwater Extraction Category
7,873	6,894	87.57%	Semi-Critical

16.3.5 Water Transfer

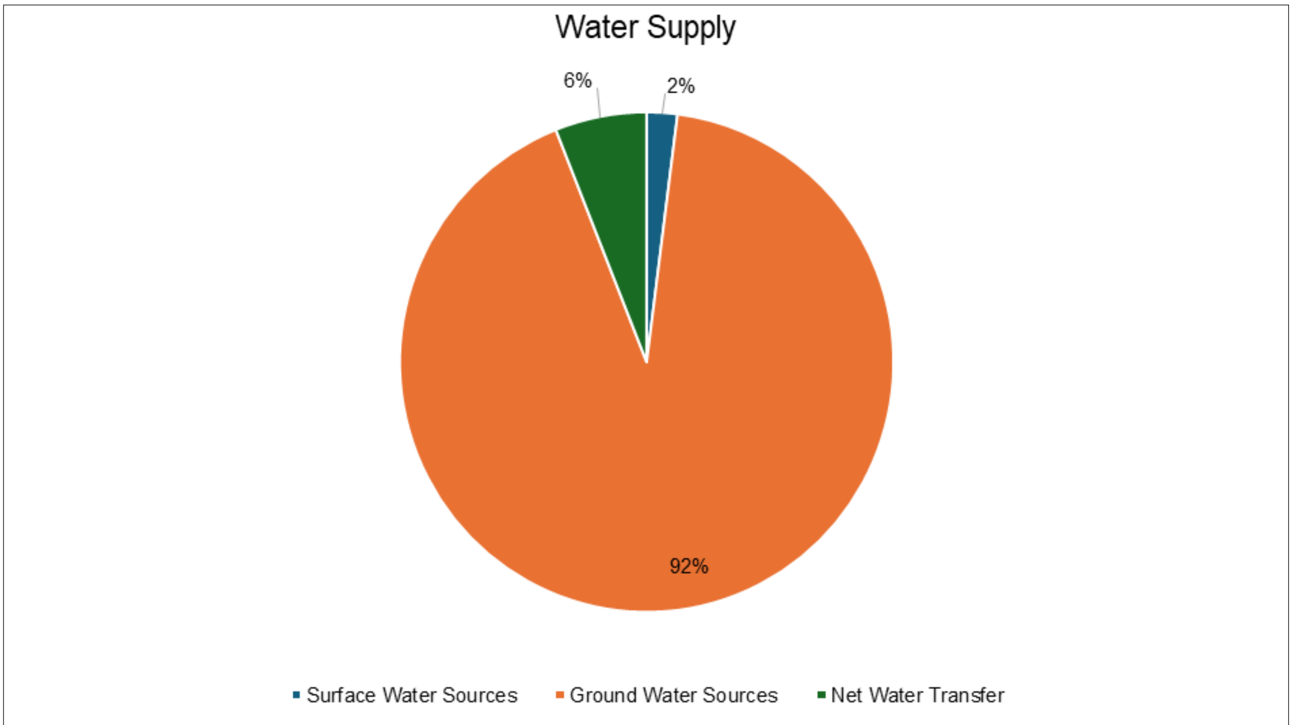
The block receives water from Ganga Canal network to meet irrigation water requirements.

Water Use	Inward Transfer (ha.m)	Outward Transfer (ha.m)	Net Transfer (Inwards-Outwards) ha.m
Agriculture	433.2	0	433.2
Industry	0.2	0	0.2
Domestic	0	0	0
Total	433.4	0	433.4

16.3.6 Rainwater Run-off

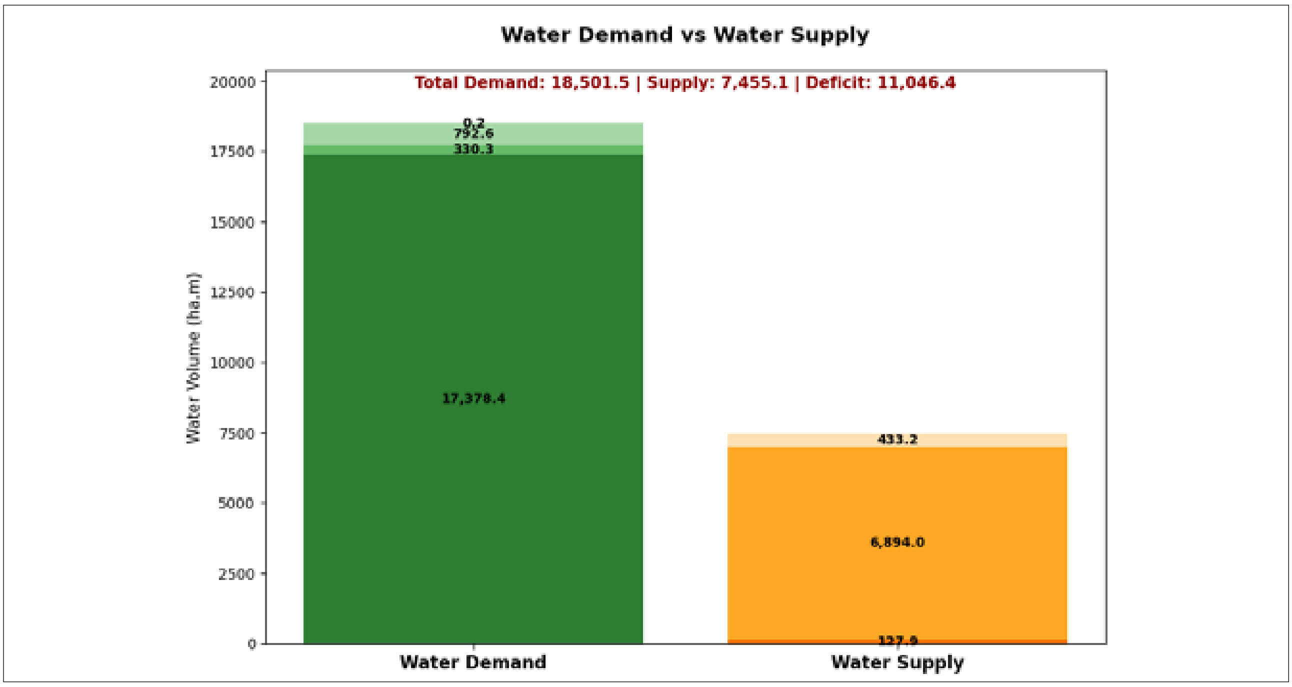
The Gangiri block belongs to the Gangetic plains and the land use pattern data reveals that major parts of the block geography are plain areas under cultivation. The block has an average of 667 mm rainfall, thus, the potential for harvesting the rainwater is equivalent to 3,655.8 ha.m of run-off annually.

Types of Run-offs	Area (ha)	Run-off (cum per ha)	Run-off	
			In ha.m	In %
Good Catchment Area	8,367.4	1,417	1,185.7	32
Average Catchment Area	872.6	1,059.5	92.5	3
Poor Catchment Area	33,559.24	708.5	2,377.7	65
Total	42,799.24		3,655.8	100



16.4 Water Budgeting for Gangiri Block

S. No	Description	Volume	
		In ha.m	In %
A. Water Demand			
1	Water for Agriculture	17,378.4	94
2	Water for Animal	330.3	2
3	Water for Human Consumption	792.6	3
4	Water for Industry	0.2	0.001
5	Block Wise Water Required	18,501.5	100
B. Water Supply			
6	Supply from Local Surface Water Sources	127.9	2
7	Supply from Local Groundwater Sources	6,894.0	92
8	Net Water Transfer	433.4	6
9	Total Supply	7,455.1	100
C. Water Budgeting			
10	Water Deficit/Surplus	-11,046.4	60
D. Potential for Rainwater Harvesting/GW Augmentation (in ha.m)			
11	Available Run-off from Rainwater	3,655.8	
12	Harvested Run-off	723.50	
13	Run-off Available for Harvesting/GW Augmentation	2,018.3	
E. Potential for Groundwater Development			
14	Stage of Groundwater Development (from IN-GRES portal)	87.57	
15	Groundwater Development Category (from IN-GRES portal)	Semi-Critical	



16.4.1 Annotations

(i) The Gangiri block, Aligarh District, Uttar Pradesh area belongs to the Gangetic plain region and most parts of the block are under crop lands (78.4%).

(ii) Although, the large parts of the blocks are under agricultural uses but due to being part of Gangetic region the soil moisture regime is good, hence, the irrigation water demands are reasonably well-aligned with the national average.

(iii) Water needs for the Gangiri block are 18,501.5 ha.m, of which 94% are solely for irrigation, and 92% are satisfied by Groundwater sources. Six percent of the water supply is obtained from another source, which is located outside the block.

(iv) The block is water deficit by 60% (11,046 ha.m) and the stage of Groundwater development is a semi-critical category (87.57 %).

(v) As the block geography belongs to plain landscape, the run-off generated is comparatively lesser, which is 3,655.8 ha.m. However, the block is using only 20 percent (19.8%) of available run-off.

16.4.2 Recommendations

(i) The surface water storage capacities need to be enhanced along with focusing on minimising the water losses to improve the water productivity since the block is water deficit by 60% (11,046 ha.m).

16.4.3 Takeaway for Rural Drinking Water supply

(i) The JJM coverage is 92.8% as on March 2025.

(ii) Of the 75 PWS schemes in the block, 56 (75%) are SVS and 19 (25%) are MVS. Hence, the block is majorly dependent on Groundwater for rural drinking water supply.

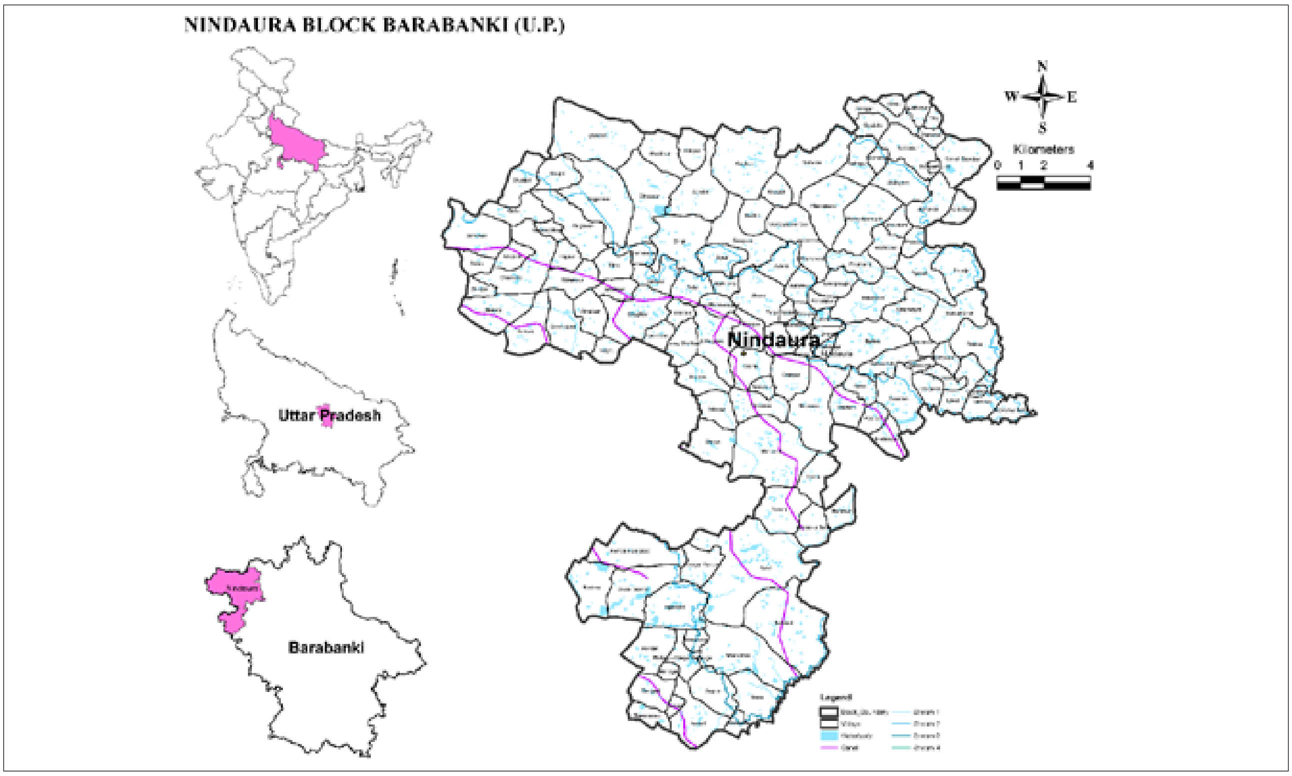
(iii) Surface water is required to meet the future drinking water demands.

(iv) Measures to be taken to protect the Groundwater quality and GW augmentation.

17. Nindaura Block, Barabanki District, Uttar Pradesh

17.1 Basic Details

State	District	Block	Number of villages	Number of Urban areas
Uttar Pradesh	Bara Banki	Nindaura	132	0



17.2 Demand Side Management

17.2.1 Water Requirements for Human Consumption

#	Total Population			Population Growth	Water Demand	Annual Water Requirements (ha.m)
	Female	Male	Total			
Rural	1,07,624	1,19,592	2,27,216	2,84,020	55	684.2
Urban	0	0	0	0	150	0.0
Total	1,07,624	1,19,592	2,27,216	2,84,020		684.2

17.2.2 Water Requirement for Livestock Consumption

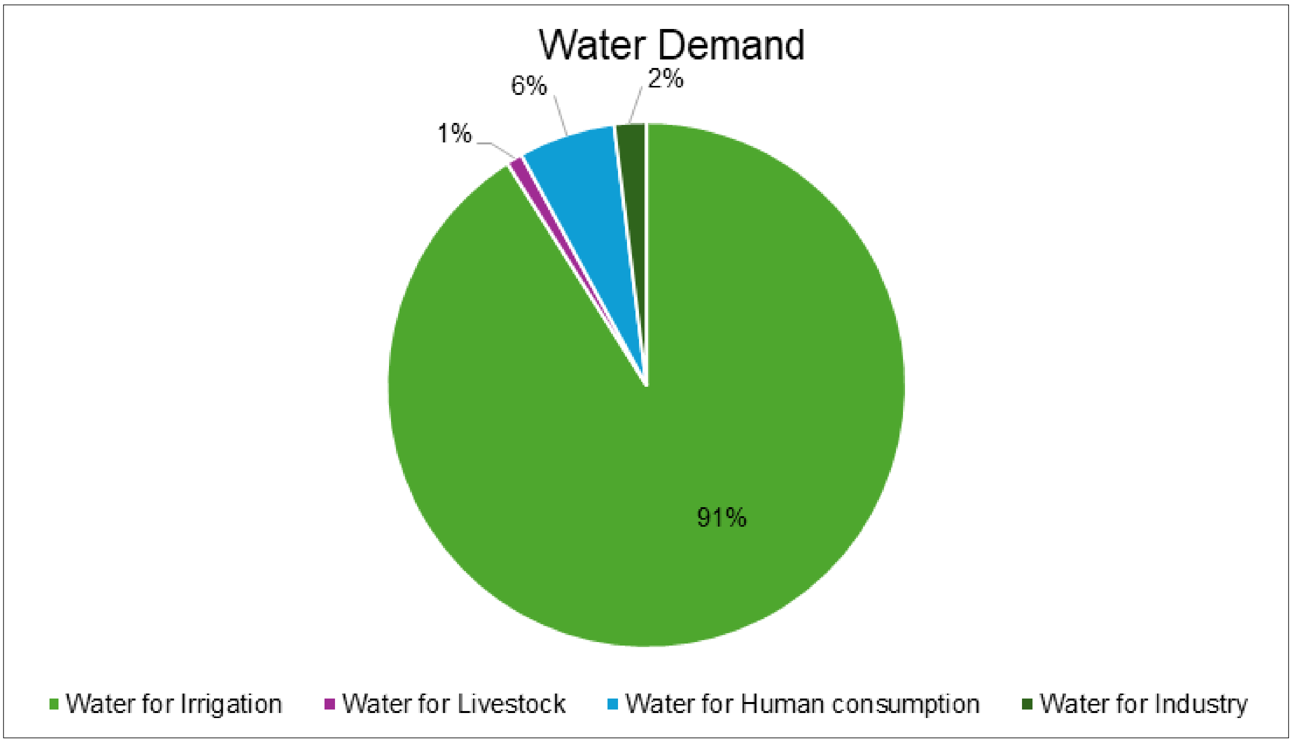
S. No	Type of Animal	Number of Animals	Water Req. (ha.m)
1	Buffaloes	39,087	95.6
2	Cow/Cattle	24,540	60
3	Goat	15,360	3.9
4	Pigs	203	0.2
5	Horses	86	0.1
6	Sheep	2	0
7	Camels	0	0
Total		79,278	159.8

17.2.3 Irrigation Water Requirement

Irrigated Area (in ha)	Water Required Per Hectare (ha.m)	Irrigation Water Requirement (ha.m)
1	2	3 = (1*2)
22,530.2	0.5	11,265.1

17.2.4 Industrial Water Requirement

Type of Industry	Number of Industrial Units	Annual Water Demand (ha.m)
Agriculture Processing	10	239



17.3 Supply Side Management

17.3.1 Information on Land Use

As per census 2011, the Nindaura block has 29,582.8 hectares land area for various purposes.

S. No	Classification	Area	
		In ha.m	In %
1	Area Irrigated by Water Source	19,256.6	65
2	Area under Non-Agricultural Uses (Rural +Urban)	2,654.7	9
3	Current Fallows Area	1,892.0	6
4	Total Unirrigated Land Area	1,623.8	5
5	Fallows Land other than Current Fallows Area	1,408.8	5
6	Culturable Waste Land Area	1,288.7	4
7	Barren & Un-cultivable Land Area	509.4	2
8	Land Under Miscellaneous Tree Crops, etc., Area	438.5	1
9	Forest Area	331.1	1
10	Permanent Pastures and Other Grazing Land Area	179.2	1
	Total	29,582.8	100

17.3.2 Surface Water Bodies

S. No	Type of Structures	Number of Structures	Storage Capacity	
			In ha.m	In %
1	Ponds	676	802.1	37
2	Lakes	29	600.2	28
3	Reservoir	5	378.0	18
4	Tanks/WCS	538	349.8	16
5	Water harvesting Structure	242	20.4	1
6	Other	0	0	0
Total		1,490.00	2,150.5	100

17.3.3 Surface Water Supply

S. No	Type	Area Irrigated (ha)	Supply from Surface Water Sources	
			In ha.m	In %
1	Other Source (Water from Outside)	7,781.5	4,552.2	74
2	Canals Area (Local Source)	2,268.6	1,327.1	21
3	Tanks/Lakes Area	512.9	300.0	5
4	Waterfall Area	0	0	0
Total		10,563	6,179.4	100

17.3.4 Groundwater Supply

Annual Groundwater Extractable (ha.m)	Annual Groundwater Extraction (ha.m)	Stage of Groundwater Extraction	Groundwater Extraction Category
14,278	8,397	58.81 %	Safe

17.3.5 Water Transfer

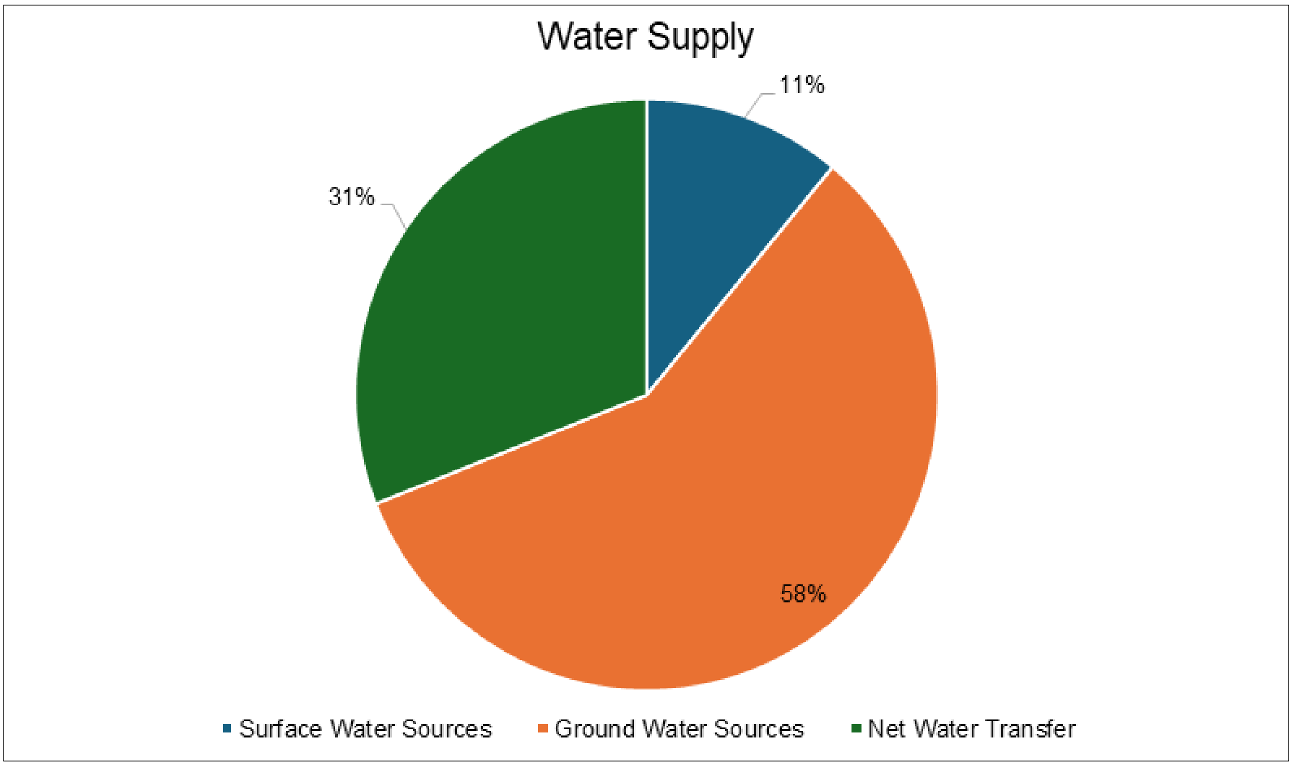
The block receives water from Ganga Canal network to meet the irrigation water requirements.

S. No	Water Use	Inward Transfer (ha.m)	Outward Transfer (ha.m)	Net Transfer (Inwards-Outwards) ha.m
1	Agriculture	4,552.2	0	4,552.2
2	Industry	0	0	0
3	Domestic	15.2	0	15.2
	Total	4,567.4	0	4,567.4

17.3.6 Amount of Run-off

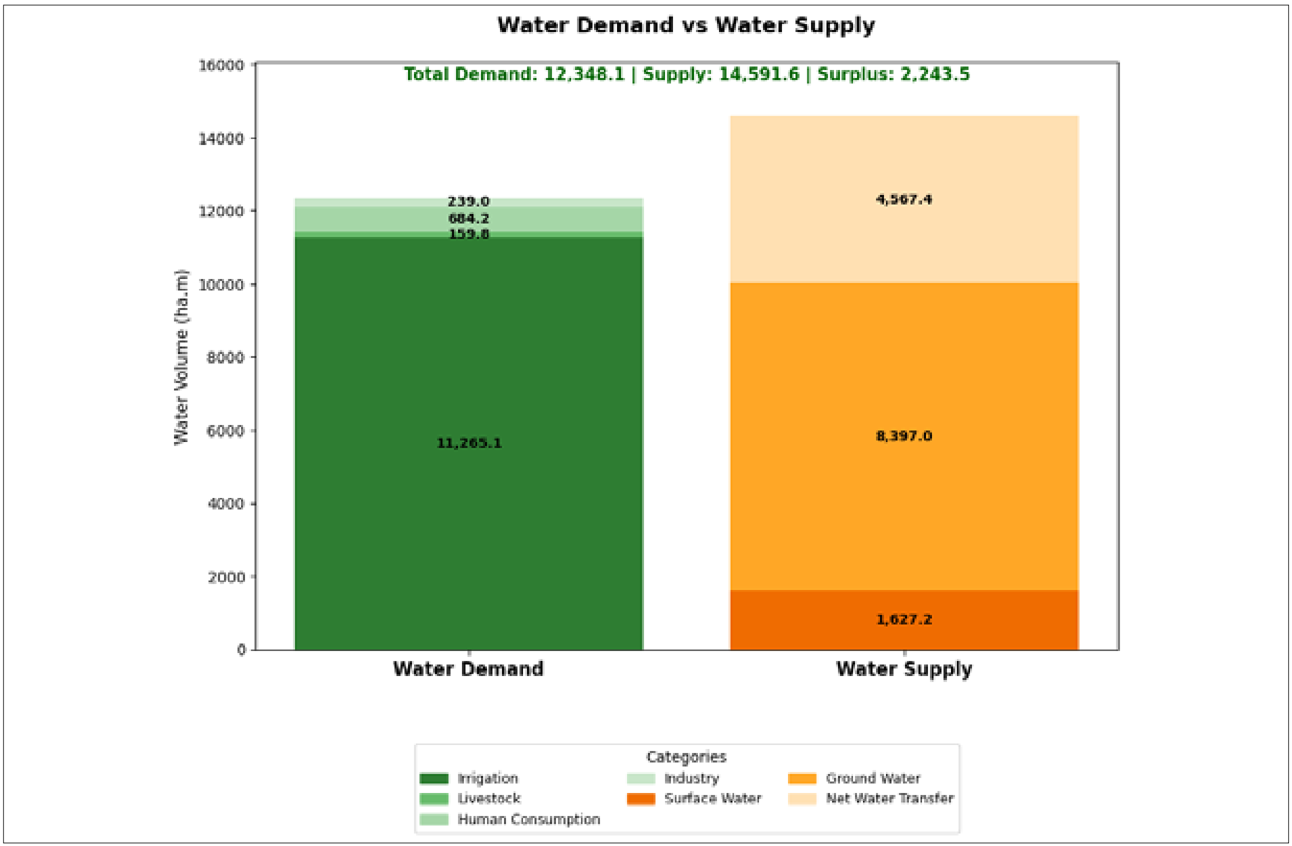
The Nindaura block belongs to Gangetic plains and the land use pattern data reveals that major parts of the block geography are plain areas under cultivation. The block has an average of 978 mm rainfall, so the potential for harvesting is 6037.6 ha.m run-off annually.

S. No	Types of Run-offs	Area (Hect.)	Run-off (cum per ha)	Run-off (ha.m)	
				In ha.m	In %
1	Bad Catchment Area	24,181.2	1,774	4,289.7	71
2	Good Catchment Area	3,495.2	3,549	1,240.4	21
3	Average Catchment Area	1906.4	2,661.75	507.4	8
Total		29,582.8		6,037.6	100



17.4 Water Budgeting at Block Level

S. No	Description	Volume	
		In ha.m	In %
A. Water Demand			
1	Water for Agriculture	11,265.1	91
2	Water for Animal	159.8	1
3	Water for Human Consumption	684.2	6
4	Water for Industry	239	2
5	Block Wise Water Required	12,348.1	100
B. Water Supply			
6	Supply from Local Surface Water Sources	1,627.2	11
7	Supply from Groundwater Sources	8,397.0	58
8	Net Water Transfer	4,567.4	31
9	Total Supply	14,591.6	100
C. Water Budgeting			
10	Water Deficit/Surplus (9-5)	2,243.4	18
D. Potential for Rainwater Harvesting/GW Augmentation (in ha.m)			
11	Available Run-off from Rainwater (Result of Table-6)	6,037.6	
12	Harvested Run-off	2,150.50	
13	Potential Run-off Available for Harvesting/GW Augmentation	2,377.7	
E. Potential for Groundwater Development			
14	Stage of Groundwater Development (from IN-GRES portal)	58.81	
15	Groundwater Development Category (from IN-GRES portal)	Safe	



17.4.1 Annotations

(i) The Nindaura Block, Barabanki District, Uttar Pradesh area belongs to the Gangetic plain region and most parts of the block are under crops lands (81%).

(ii) Although most of the block is used for agriculture, the soil moisture regime is favourable owing to its location in the Gangetic area, and hence irrigation water needs are fairly matched with the national average.

(iii) The Gangetic region is well-known for its canal command area, and it is clear that 11% of irrigation needs are met by surface water sources located locally, while 31% are met by surface water sources outside the region.

(iv) The Nindaura block has **12,348.1** ha.m water requirements for all purposes, out of this 91% is for irrigation only and 58% of water demands is met by Groundwater sources.

(v) The block is water surplus by 18% as it received significant water from the outside geographies.

(vi) The Groundwater development stage in the block is in the safe category (58.81 %%).

17.4.2 Recommendations

(i) The block performs well in terms of harvesting surface run-off up to 35.6% (2,243 ha.m out of 6,037.6 ha.m) and efficient use of surface water sources up to 75% (1,627.2 ha.m out of 2,150.50 ha.m); nevertheless, it should be optimised to guarantee that Groundwater extraction remains at the present level.

17.4.3 **Takeaways for Rural Drinking Water supply**

(i) JJM coverage is 90.54% as of March 2025.

(ii) Of the 225 PWS schemes in the block, 147 (65%) are SVS and 78 (35%) are MVS. Therefore, the block mostly depends on Groundwater for the rural drinking water supply.

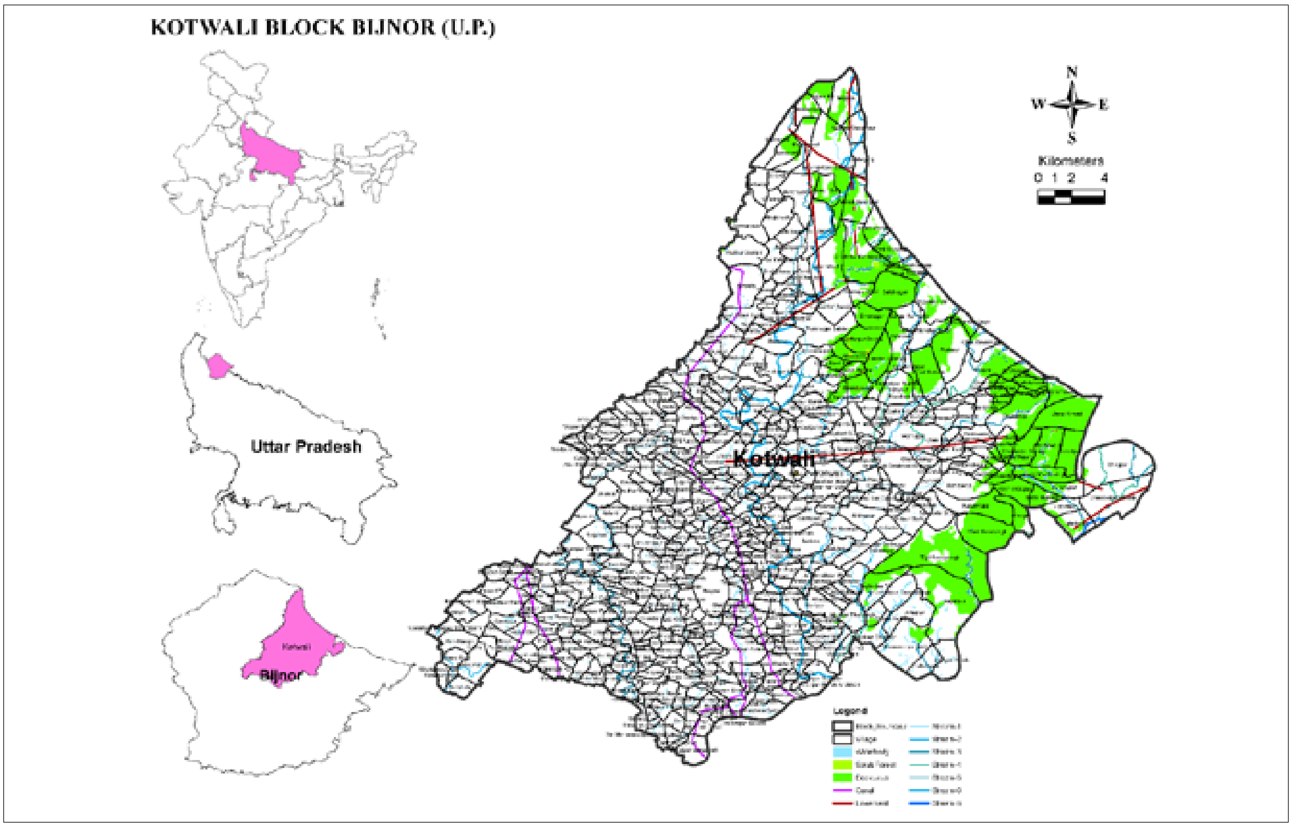
(iii) Adequate ground and Surface water is available to meet the future drinking water demands.

(iv) Measures to be taken to protect the Groundwater quality and GW augmentation.

18 Kotwali Block, Bijnaur District, Uttar Pradesh

18.1 Basic Details

State	District	Block	Number of villages	Number of Urban centres
Uttar Pradesh	Bijnaur	Kotwali	518	4



18.2 Demand Side Management

18.2.1 Human Water Requirements

#	Total Population			Population Growth	Water demand (lpcd)	Annual Water Requirements (ha.m)
	Female	Male	Total			
Rural	1,80,090	1,92,475	3,72,565	4,65,706	55	1,121.9
Urban	92,754	84,125	1,76,879	2,21,099	150	1,452.6
Total	2,72,844	2,76,600	5,49,444	6,86,805		2,574.5

18.2.2 Livestock Water Requirement

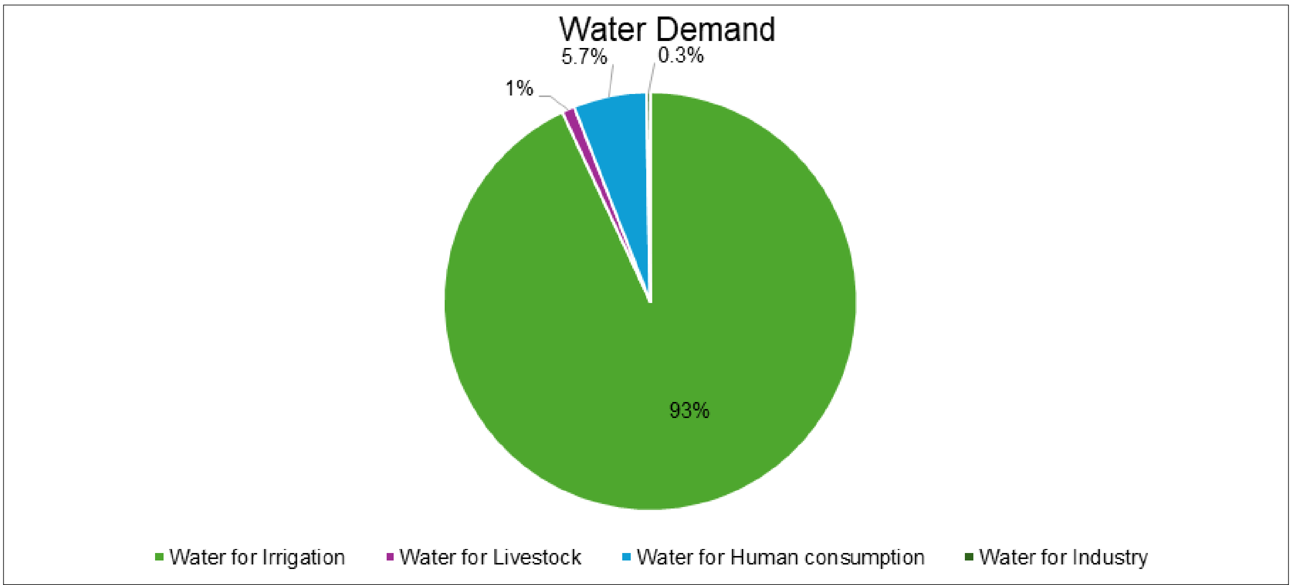
S. No	Type of Animal	Number of Animals	Water Req. (ha.m)
1	Buffaloes	73,248	179.13
2	Cow/Cattle	43,748	106.99
3	Goat	14,741	2.77
4	Poultry	1,50,000	1.37
5	Pigs	1,331	1.07
6	Sheep	948	0.24
7	Horses	96	0.15
8	Camels	0	0
	Total	2,84,112	291.35

18.2.3 Irrigation Water Requirement

Irrigated Area (in ha)	Water Required per Hectare (ha.m)	Irrigation Water Requirement (ha.m)
1	2	3 = (1*2)
85,703.5	0.5	42,851.8

18.2.4 Industrial Water Requirement

S. No	Type of Industry	Number of Industrial Units	Annual Water Demand (ha.m)
1	Food Industry	3	128.80
2	Construction	8	25.07
3	Green Industries	1	1.64
4	handicrafts and Carpet	1	1.36
5	Telecom	1	0.66
Total		14	158.0



18.3 Supply Side Management

18.3.1 Information on Land Use

As per census 2011, the Kotwali block has 1,03,375.5 hectares areas for different purposes.

S. No	Classification	Area	
		In ha	In %
1	Area Irrigated by Source	73,250.9	70.9
2	Forest Area	9,778.8	9.5
3	Area under Non-Agricultural Uses (Rural +Urban)	9,350.5	9.0
4	Total Unirrigated Land Area	3,703.4	3.6
5	Barren & Un-cultivable Land Area	2,122	2.1
6	Current Fallows Area	1,658.5	1.6
7	Land Under Miscellaneous Tree Crops etc. Area	1,612.8	1.6
8	Culturable Waste Land Area	1,536.4	1.5
9	Fallows Land other than Current Fallows Area	238.2	0.2
10	Permanent Pastures and Other Grazing Land Area	124	0.1
Total		1,03,375.5	100

18.3.2 Surface Water Bodies

Although the surface run-off generated during monsoon period is enough to store in surface waterbodies but, the potential for enhancing surface water availability remains limited due to the peculiar landscape and land use pattern.

S. No.	Names of Structures	Number of Structures	Storage Capacity	
			In ha.m	In %
1	Ponds	222	278.2	65
2	Tanks/WCS	154	98.8	23
3	Lakes	3	42.5	10
4	Water harvesting Structure	75	7.5	2
5	Reservoir	0	0	0
6	Other	0	0	0
Total		454	427	100

18.3.3 Surface Water Supply

S. No	Type	Area Irrigated (ha)	Supply from Local Surface Water Sources	
			In ha.m	In %
1	Other Source (Outside Block Area)	40,850.90	23,897.8	90
2	Tanks/Lakes Area	2,108.40	1,233.4	5
3	Canals Area	1,893.60	1,107.8	4
4	Waterfall Area	699	408.9	1
Total		45,551.90	26,647.9	100

18.3.4 Groundwater Supply

Annual Groundwater Extractable (ha.m)	Annual Groundwater Extraction (ha.m)	Stage of Ground-water Extraction	Groundwater Extraction Category
20,635	14,359	69.59 %	Safe

18.3.5 Water Transfer

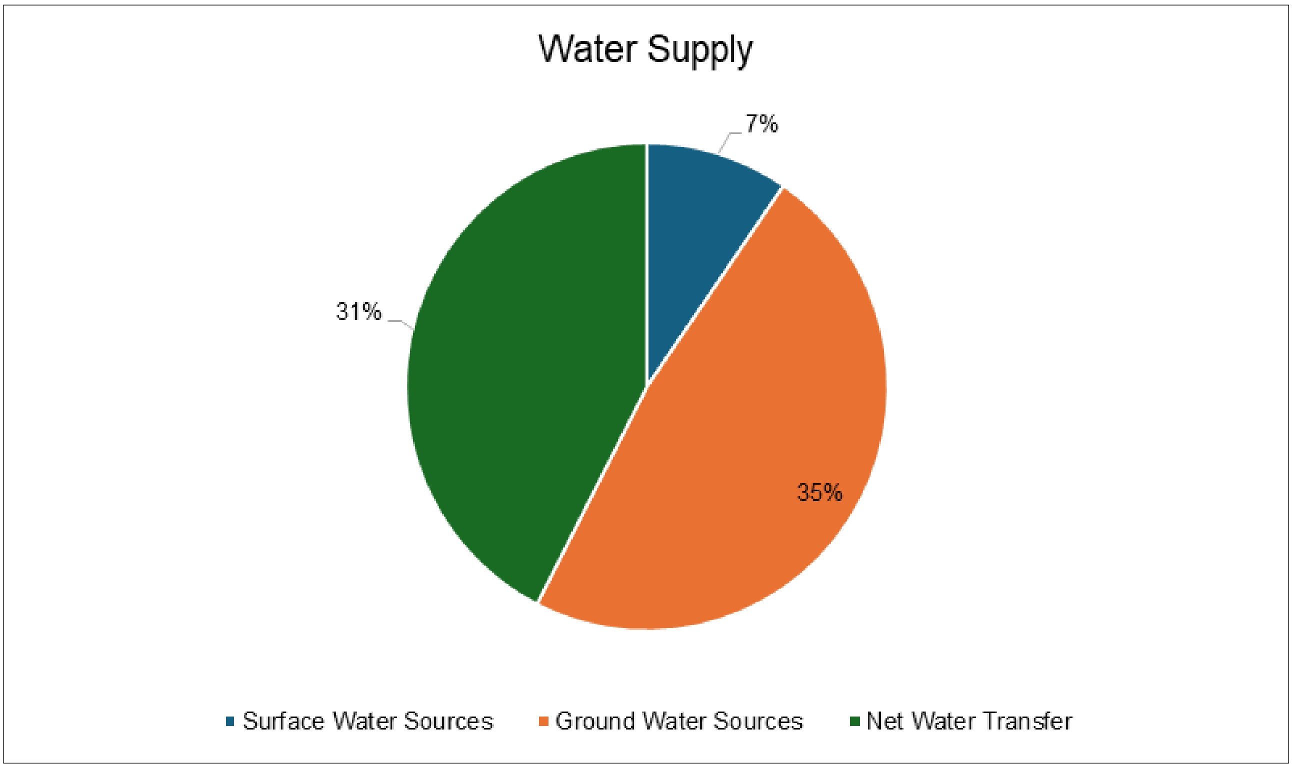
The block receives water from the Ganga Canal network to meet irrigation water requirements.

S. No	Water Use	Inward Transfer (ha.m)	Outward Transfer (ha.m)	Net Transfer (Inwards-Outwards) ha.m
1	Agriculture	23,897.8	0	23,897.8
2	Industry	0	0	0
3	Drinking	2.69	0	2.69
Total		23,900.02	0	23,900.02

18.3.6 Amount of Run-off

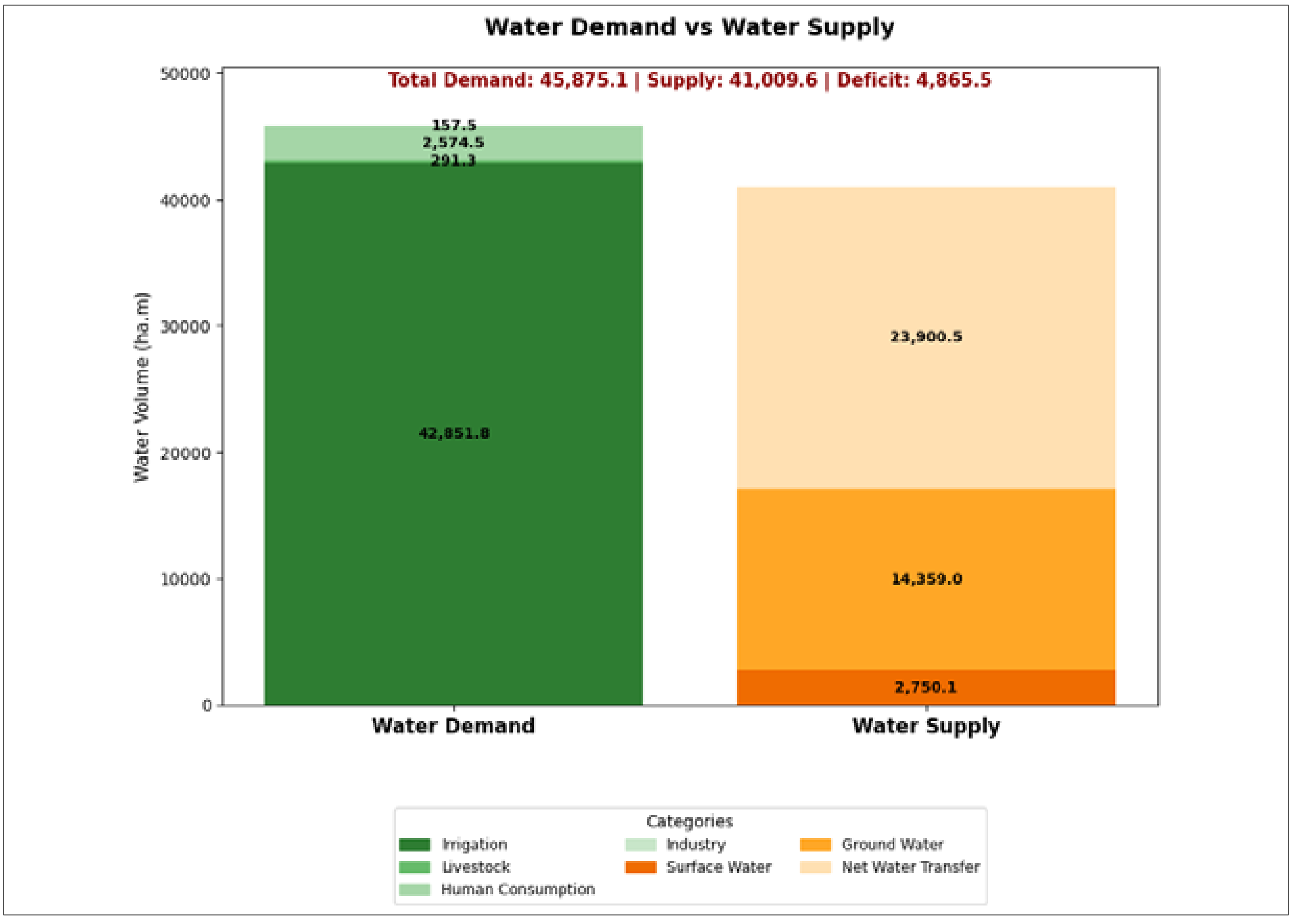
The block has an average of 1,053 mm rainfall, so it has the potential for harvesting 23,634.1 ha.m run-off annually.

S. No	Types of Run-offs	Area (in ha)	Run-off (cu.m per ha)	Run-off	
				In ha.m	In %
1	Good Catchment Area	21,251.3	3,750	7,969.2	34%
2	Average Catchment Area	32,73.2	2,810	919.8	4%
3	Poor Catchment Area	78,851	1,870	14,745.1	62%
Total		1,00,102.30		23,634.1	100%



18.4 Water Budgeting at Block Level

S. No	Description	Volume (ha.m)	
		In ha.m	In %
A. Water Demand			
1	Water for Irrigation	42,851.8	93
2	Water for Livestock	291.3	1
3	Water for Human Consumption	2,574.5	5.7
4	Water for Industry	157.53	0.3
5	Block Wise Water Required	45,875.2	100
B. Water Supply			
6	Supply from Local Surface Water Sources	2,750.1	7
7	Supply from Groundwater Sources	14,359.0	35
8	Net Water Transfer	23,900.5	58
9	Total Supply	41,009.55	100
C. Water Budgeting			
10	Water Deficit/Surplus	-4,865.6	11
D. Potential for Rainwater Harvesting/GW Augmentation (in ha.m)			
11	Available Run-off from Rainwater	23,634.1	
12	Harvested Run-off	427.00	
13	Potential Run-off Available for Harvesting/GW Augmentation	17,298.6	
E. Potential for Groundwater Development			
14	Stage of Groundwater Development (from IN-GRES portal)	69.59 %	
15	Groundwater Development Category (from IN-GRES portal)	Safe	



18.4.1 Annotations

(i) The Kotwali Block, Bijnaur District, Uttar Pradesh area belongs to the Gangetic plain region and most parts of the block are under crops lands (76%).

(ii) Although the majority of the block is used for agriculture, the soil moisture regime is favourable owing to its location in the Gangetic area, and irrigation water needs are fairly matched with national averages.

(iii) The Gangetic region is recognised for its canal command area, and within the block, it is clear that 58% of irrigation needs are satisfied by external surface water sources, complemented by 7% from local surface water sources.

(iv) The Kotwali block has **45,875.2** ha.m water requirements for all purposes, out of this 93% is for irrigation only and 35% of water demands is met by Groundwater sources.

(v) The block is water deficit by 11% (4,865.6 ha.m) and the Groundwater development is in safe category (69.59%). There is risk that the block could become semi-critical.

(vi) Although the block, which is in the Tarai region, has a lot of run-offs (23,634.1 ha.m.), it can only harvest 1.8% (427 ha.m.) of the available run-off.

18.4.2 **Recommendations**

(i) The block should augment surface water storage capacity and use them efficiently to reduce dependence on Groundwater sources.

18.4.3 **Takeaways for Rural Drinking Water supply**

(i) JJM coverage is 83.14% as on March 2025.

(ii) Of the 129 PWS schemes in the block, 33 (26%) are SVS and 96 (74%) are MVS. Hence, the block is majorly dependent on surface water for rural drinking water supply.

(iii) Adequate ground and surface water is available to meet the future drinking water demands.

(iv) Measures to be taken to protect the Groundwater quality and GW augmentation.

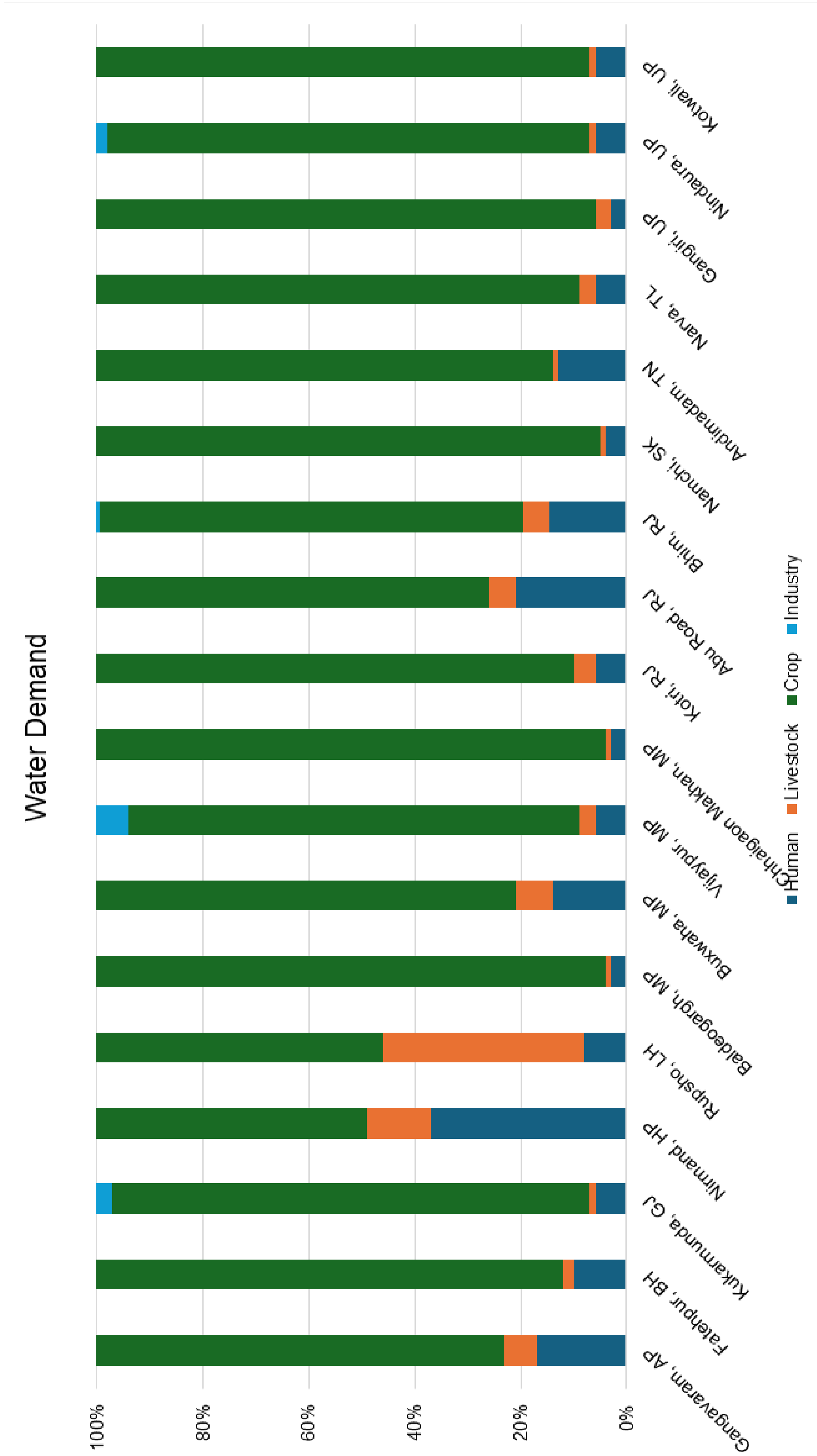
19. Comparative Analysis

(All units in ha.m)

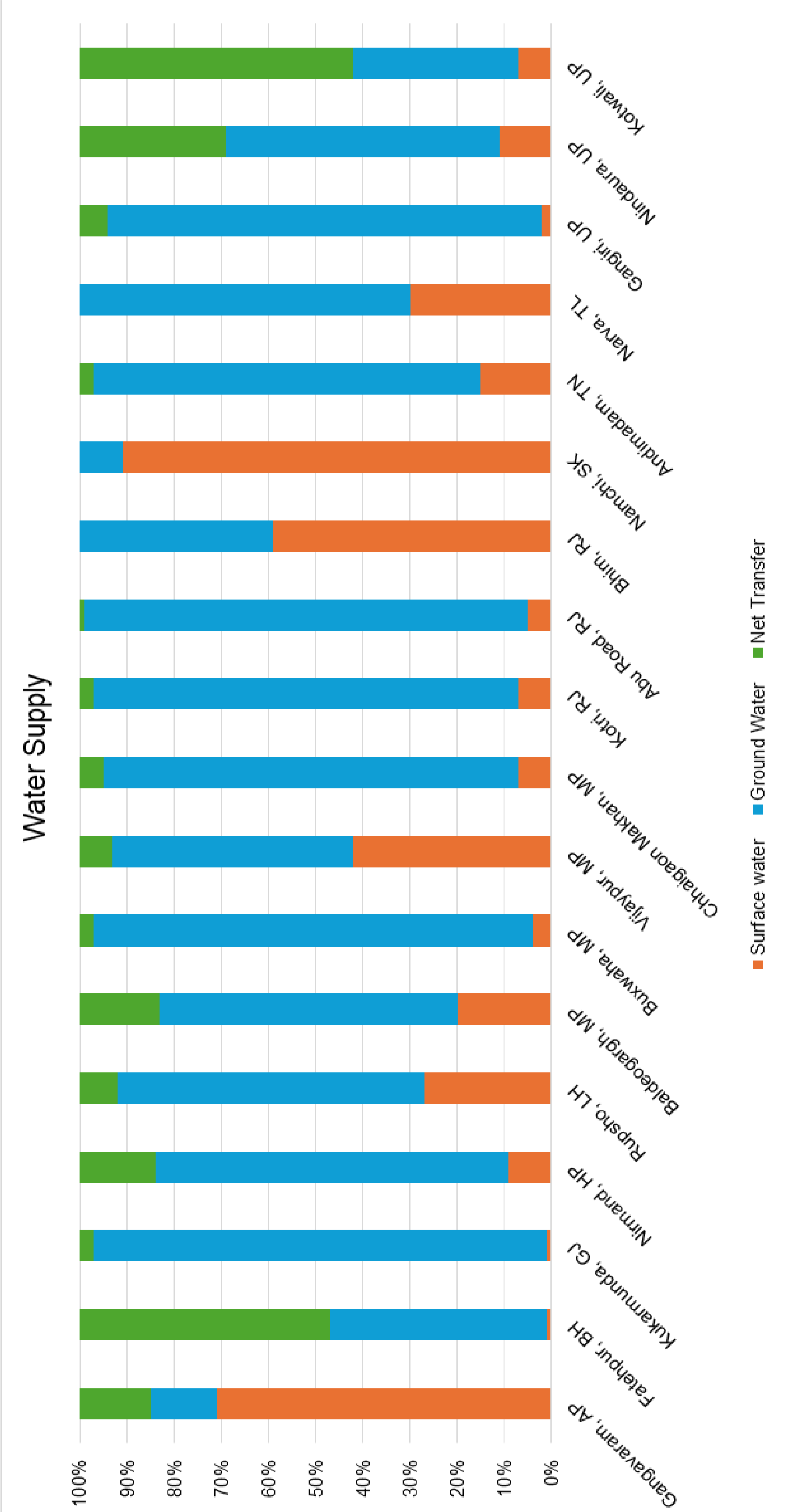
Block Name	Demand Side					Supply Side				Water Budget
	Human	Livestock	Crop	Industry	Total	Surface water	Ground-water	Net Transfer	Total	
Gangavaram, AP	78.0 (17%)	26.5 (6%)	355.5 (77%)	0	460.00	244.6 (71%)	48 (14%)	52 (15%)	344.7	(-) 115.3 (25%)
Fatehpur, BH	709.5 (9%)	183.9 (2%)	6,711.4 (88%)	1.52 (0.02%)	7,606.30	93.0 (1%)	2,943.8 (46%)	3,366.9 (53%)	6,403.70	(-) 1,202.7 (16%)
Kukarmunda, GJ	182.5 (6%)	44.5 (1%)	2,828.2 (90%)	78.44 (3%)	3,133.60	13.7 (1%)	1,921 (96%)	56 (3%)	1,990.60	(-) 1,143 (37%)
Nirmand, HP	159.9 (37%)	49.5 (12%)	214.69 (51%)	0	423.90	122.3 (9%)	1,034 (75%)	228.5 (16%)	1,385.10	(+) 961.2 (227%)
Rupsho, LH	7.0 (8%)	32.7 (38%)	45.9 (54%)	0	85.50	45.9 (27%)	112.4 (65%)	14 (8%)	172.20	(+) 86.7 (101%)
Baldeogargh, MP	719.2 (3%)	134.1 (1%)	20,473.7 (96%)	0	21,327.10	1,984.3 (20%)	6,358.3 (63%)	1,746.9 (17%)	10,089.50	(-) 11,237.5 (53%)
Buxwaha, MP	325.0 (14%)	148.1 (7%)	1,770.1 (79%)	0	2,243.10	249.8 (4%)	5,202.6 (93%)	185.5 (3%)	5,637.90	(+) 3,394.8 (151%)
Vijaypur, MP	786.9 (6%)	316.7 (3%)	10,864 (85%)	750 (6%)	12,717.60	5,565.1 (42%)	6,849 (51%)	898 (7%)	13,312.10	(+) 594.5 (4.7%)
Chhaigaon Makhan, MP	422.2 (3%)	202.5 (1%)	13,233.8 (96%)	0	13,858.50	855 (7%)	10,441 (88%)	605.3 (5%)	11,901.30	(-)1,957.1 (14%)
Kotri, RJ	524 (6%)	307.6 (4%)	7,625.8 (90%)	0	8,457.40	526.9 (7%)	5,960 (90%)	171.0 (3%)	6,657.90	(-) 1,799.5 (21%)

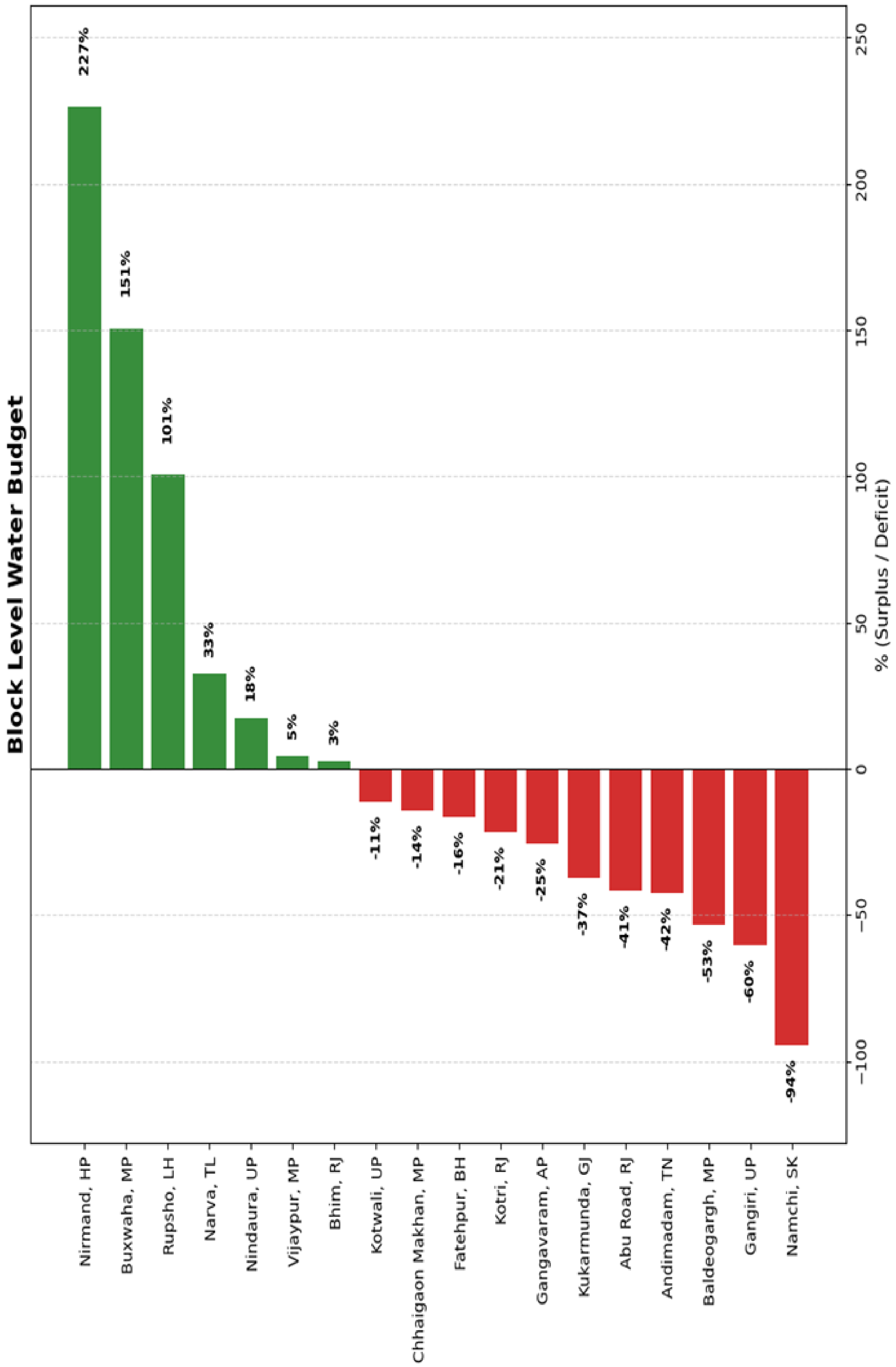
Block Name	Demand Side					Supply Side				Water Budget
Abu Road, RJ	1,132.0 (21%)	249.5 (5%)	4,035.4 (74%)	0	5,417.00	172.6 (5%)	3,024 (94%)	20.7 (1%)	3,217.30	(-) 2,199.7 (41%)
Bhim, RJ	480.2 (14.5%)	162.1 (5%)	2,675.7 (80%)	11.57 (0.5%)	3,329.60	2,019.8 (59%)	1,407 (41%)	0	3,426.80	(+) 97.2 (3%)
Namchi, SK	271.1 (4%)	61.2 (1%)	6,189.1 (95%)	0	6,521.50	380.4 (91%)	36.1 (9%)	0	416.50	(-) 6,105 (94%)
Andimadam, TN	874.1 (13%)	60.4 (1%)	3,585.5 (86%)	0	4,520.10	392 (15%)	2,147 (82%)	66.8 (3%)	2,605.70	(-) 1,914.3 (42%)
Narva, TL	91.1 (6%)	49.9 (3%)	1,486.1 (91%)	0	1,627.10	650.1 (30%)	1,513 (70%)	0	2,163.10	(+) 536.0 (33%)
Gangiri, UP	792.6 (3%)	330.3 (2%)	17,378.4 (94%)	0.2 (0.001)	18,501.50	127.9 (2%)	6,894 (92%)	433.2 (6%)	7,455.10	(-) 11,046.4 (60%)
Nindaura, UP	684.2 (6%)	159.8 (1%)	11,265.1 (91%)	239 (2%)	12,348.10	1,627.2 (11%)	8,397 (58%)	4,567.4 (31%)	14,591.60	(+) 2,243.4 (18%)
Kotwali, UP	2,574.5 (5.7%)	291,3 (1%)	42,851.8 (93%)	157.53 (0.3%)	45,875.20	2,750.1 (7%)	14,359 (35%)	23,900.5 (58%)	41,009.60	(-) 4,865.6 (11%)

Graph -1


Water Demand
100%
80%
60%
40%
20%
0%
Kotwali, UP
Nindaura, UP
Gangiri, UP
Narva, TL
Andimadam, TN
Namchi, SK
Bhim, RJ
Abu Road, RJ
Kotri, RJ
Chhaigaon Makhan, MP
Vijaypur, MP
Buxwaha, MP
Baldeogarh, MP
Rupsho, LH
Nirmand, HP
Kukarmunda, GJ
Fatehpur, BH
Gangavaram, AP
Human
Livestock
Crop
Industry

Graph -2


Water Supply
100%
90%
80%
70%
60%
50%
40%
30%
20%
10%
0%
Gangavaram, AP
Fatehpur, BH
Kukarmunda, GJ
Nirmand, HP
Rupsho, LH
Baldeogarh, MP
Buxwaha, MP
Vijaypur, MP
Chhaigaon Makhan, MP
Kotri, RJ
Abu Road, RJ
Bhim, RJ
Namchi, SK
Andimadam, TN
Narva, TL
Gangiri, UP
Nindaura, UP
Kotwali, UP
Surface water
Ground Water
Net Transfer


Block Level Water Budget
227%
151%
101%
33%
18%
5%
3%
-11%
-14%
-16%
-21%
-25%
-37%
-41%
-42%
-53%
-60%
-94%
250
200
150
100
50
0
−50
−100
% (Surplus / Deficit)
Nirmand, HP
Buxwaha, MP
Rupsho, LH
Narva, TL
Nindaura, UP
Vijaypur, MP
Bhim, RJ
Kotwali, UP
Chhaigaon Makhan, MP
Fatehpur, BH
Kotri, RJ
Gangavaram, AP
Kukarmunda, GJ
Abu Road, RJ
Andimadam, TN
Baldeogargh, MP
Gangiri, UP
Namchi, SK

Graph -3

Annexure 1: Strange Table – Run-off Estimation

Total Monsoon Rainfall (mm)	Good Catchment % of Run-off	Good Catchment Yield per ha (cum)	Average Catchment % of Run-off to Rainfall	Average Catchment Yield per ha (cum)	Bad Catchment % to Rainfall	Bad Catchment Yield per ha (cum)
25	0.1	0.25	0.1	0.25	0.05	0.13
50	0.2	1	0.15	0.75	0.1	0.5
75	0.4	3	0.3	2.25	0.2	1.5
100	0.7	7	0.5	5	0.3	3
125	1	12.5	0.7	8.75	0.5	6.25
150	1.5	22.5	1.1	16.5	0.7	10.5
175	2.1	36.75	1.5	26.25	1	17.5
200	2.8	56	2.1	42	1.4	28
225	3.5	78.75	2.6	53.5	1.7	38.25
250	4.3	107.75	3.2	80	2.1	52.5
275	5.2	143	3.9	107.25	2.6	71.5
300	6.2	136	4.6	138	3.1	93
325	7.2	234	5.4	175.5	3.6	117
350	8.3	290	6.2	217	4.1	143.5
375	9.4	325.5	7	262.5	4.7	176.25
400	10.5	420	7.8	312	5.2	208
425	11.6	493	8.7	369.75	5.8	232
450	12.8	576	9.6	432	6.4	288
475	13.9	660.25	10.4	494	6.9	327.75
500	16	800	11.25	562.5	7.5	377
525	16.1	845.25	12	630	8	420
550	17.3	951.5	12.9	709.5	8.6	473
575	18.4	1058	13.8	793.5	9.2	529
600	19.5	1170	14.6	878	9.7	582
625	20.6	1287.5	15.4	962.5	10.3	643.75
650	21.8	1417	16.3	1059.5	10.9	708.5
675	22.9	1545.75	17.1	1154.25	11.4	769.5
700	24	1618	18	1260	12	840
725	25.1	1819.75	18.8	1363	12.5	906.25
750	26.3	1972.5	19.7	1477.5	13.1	982.5
775	27.4	2123.5	20.5	1580	13.7	1061.75
800	28.5	2218.5	21.3	1704	14.2	1136
825	29.6	2442	22.2	1831.5	14.8	1221
850	30.8	2618	23.1	1963.5	15.4	1309

Total Monsoon Rainfall (mm)	Good Catchment % of Run-off	Good Catch-ment Yield per ha (cum)	Average Catchment % of Run-off to Rainfall	Average Catchment Yield per ha (cum)	Bad Catch-ment % to Rainfall	Bad Catch-ment Yield per ha (cum)
875	31.9	2791.25	23.9	2090.25	15.9	1391
900	33	2917	24.7	2223	16.7	1485
925	34.1	3154.25	25.5	2358.75	17	1572
950	35.2	3324	26.3	2494	17.6	1667
975	36.4	3549	27.3	2661.75	18.2	1774
1000	37.5	3750	28.1	2810	18.7	1870
1125	43.1	4348	32.3	3633.75	21.5	2418
1250	48	6100	36.6	4575	24.4	3050
1375	54.4	7480	40.8	5610	27.7	3740
1500	60	9000	45	6750	30	4500

Disclaimer: High-altitude areas often have unique factors influencing runoff, such as snowmelt, frozen ground, and specific land cover, which may require adjustments or additional considerations when using the Strange's table method.

Annexure 2: Methodology for Crop Water Requirements

Agriculture is the prime water consumer in India hence it is important to understand the water requirement of the agriculture sector. The key pillar is crop water requirement (CWR). ICAR has conducted research studies and determined CWR for different rainfed and irrigated crops. The District Irrigation Plan (DIP) has information area under major crop categories at district level only. However, crop wise acreage information for block and village level is not available in public domain to estimate CWR. Looking at the diverse agroecological and agro-climatic conditions of the country, the CWR for individual crop varies significantly. Therefore, it is not reasonable to universalise CWR coefficient nationwide.

Some of the outputs offered by various agencies have been explored for arriving CWR at block level, however, these tools require specialised expertise, proprietary software, custom configurations and manual input. These limitations lead to restrict offering any sample methodology to mainstream and widespread applicability in diverse scenarios of India.

To offer a simple methodology for applied purposes it is crucial to consider this limitation and provide a simple coefficient for crop water requirement estimation to determine reasonable outputs about water supply demand scenarios and water surplus/deficiency conditions. Based on exploration of various methods and approaches to determine CWR and provide water budget outputs at block level the following methodology is used:

- Water requirement of the country for irrigation in high demand scenario for 2025 and 2050 has been assessed by the National Commission (Integrated Water Resources Development-1999) as 611 BCM (Billion Cubic Metre) and 807 BCM respectively.
- As per the latest Land Use statistics 2022-23 released by Ministry of Agriculture & Farmers Welfare, Department of Agriculture & Farmers Welfare Economics, Statistics and Evaluation Division New Delhi, the Gross Irrigated Area is 122.3 million hectares.
- Accordingly, the crop water requirement is estimated to be 0.50 metres (Total irrigation water demands/Gross Irrigated Area).

As referred above, the diverse scenarios of the country have variable CWR, and the coefficient offered by this study have margin of error to the extent of 5% to 10%. There will be some outlier cases where monocropping is prominent and the high-altitude areas of Himalayas.

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सत्यमेव जयते

NITI Aayog