

COMPENDIUM OF ASSET ACCOUNTS ON WATER RESOURCES

FOR THE YEAR 2021-22



SUPREME AUDIT INSTITUTION OF INDIA
लोकहितार्थ सत्यनिष्ठा
Dedicated to Truth in Public Interest



COMPENDIUM OF ASSET ACCOUNTS ON WATER RESOURCES

FOR THE YEAR 2021-22

An initiative of
Government Accounting Standards Advisory Board
under the aegis of
COMPTROLLER AND AUDITOR GENERAL OF INDIA





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Abbreviations

Sl No.	Abbreviations	
1.	A&E	Accounts and Entitlement
2.	BCM	Billion Cubic Meters
3.	CAG	Comptroller and Auditor General of India
4.	CAD&WM	Command Area Development & Water Management
5.	CGWB	Central Ground Water Board
6.	CWC	Central Water Commission
7.	DDWS	Department of Drinking Water and Sanitation
8.	DNF	Data Not Furnished by the State Government/UT
9.	DoA&FW	Department of Agriculture and Farmers Welfare
10.	DoWR,RD&GR	Department of Water Resources, River Development, and Ganga Rejuvenation
11.	FRL	Full Reservoir Level
12.	GASAB	Government Accounting Standards Advisory Board
13.	GoI	Government of India
14.	GW	Groundwater
15.	HKKP	Har Khet Ko Pani
16.	INTOSAI	International Organisation of Supreme Audit Institutions
17.	JJM	Jal Jeevan Mission
18.	MLD	Million Litres per Day
19.	MoEFCC	Ministry of Environment, Forest and Climate Change of India
20.	MoJS	Ministry of Jal Shakti
21.	MoSPI	Ministry of Statistics and Programme Implementation
22.	NASG	Data Not Available with the State Government/UT
23.	NHP	National Hydrology Project
24.	NRA	Natural Resource Accounting
25.	NWP	National Water Policy
26.	NWIC	National Water Informatics Centre
27.	NWRC	National Water Resources Council
28.	NWM	National Water Mission
29.	PDMC	Per Drop More Crop
30.	RRR	Repair, Renovation, and Restoration
31.	SDG	Sustainable Development Goals
32.	SEEA	System of Environmental-Economic Accounting
33.	SEEA – CF	System of Environmental-Economic Accounting – Central Framework
34.	SMI	Surface Minor Irrigation
35.	SW	Surface Water
36.	TERI	The Energy and Resources Institute
37.	UN	United Nations
38.	UNEP	United Nations Environment Programme
39.	UNFCCC	United Nations Framework Convention on Climate Change
40.	UNSC	United Nations Statistical Commission
41.	UT	Union Territory
42.	WDC	Watershed Development Component
43.	WIMS	Water Information Management System
44.	WRIS	Water Resource Information System
45.	WRM	Water Resources Management



Foreword



**Shri Girish Chandra Murmu,
Comptroller and Auditor General of India**

Globally, there is growing recognition of the urgent need to manage natural resources sustainably, as reflected in the United Nations' Sustainable Development Goals (SDGs). Water is a fundamental resource that sustains life, ecosystems, and economies. However, in the face of rapid population growth, urbanization, and climate change, the availability and quality of water has increasingly become an area of concern. The United Nation is leading the endeavour and has brought out a System of Environmental-Economic Accounting (SEEA) – Central Framework, introduced in 2012, which offers an internationally accepted model for resource accounting, including water resources.

CAG of India is a member of INTOSAI, an international organisation of all Supreme Audit Institutions, which recommended that Supreme Audit Institutions should assist their country in preparing Natural Resource Accounting (NRA). Accordingly, CAG of India decided to take this initiative of compiling Natural Resource Accounting. GASAB, a multi-organisational body functioning under our auspices to offer advice on accounting matters, rose to this challenge.

The Government Accounting Standards Advisory Board (GASAB) of my institution came out with a Concept Paper on Natural Resource Accounting in July 2020, which set out action plans in convergence with the Sustainable Development Goals target of 2030. As per the goals set it was decided to compile Asset Accounts in respect of four major natural resources, namely, Mineral & Energy Resources, Water Resources, Forestry & Wildlife Resources and Land Resources. The two Compendiums of Asset Accounts on Mineral & Energy Resources have been completed.

Water as a resource fundamental to life, the foundation of sustainable development, and a crucial driver of economic growth was selected for next compilation. For a country as vast and diverse as India, ensuring the availability, management, and equitable distribution of water is a formidable challenge.

I am pleased to note the progress being made by GASAB in its work on Natural Resources Accounting for water leading to this “Compendium of Asset Accounts on Water Resource 2021-22”. This Compendium brings out data/information which will assist policy makers in making informed decisions on issues relating to water availability, its use, allocation of water resources, improving water use efficiency and more broadly on Water Resources Management in India. As this Compendium emphasizes, the challenges of water resource management cannot be solved in isolation. They require a coordinated, multi-stakeholder approach involving national, state, local governments and communities.

I wish to express my appreciation to the team for their diligence in preparing the Compendium. I also convey my gratitude to the members of the State Governments for their constant support, without which this Compendium would not have been possible. It is my hope that this Compendium will deepen our understanding of water management and also inspire all stakeholders to work collaboratively towards securing India's water future. The Comptroller and Auditor General of India remains committed to supporting these efforts in working towards management of Natural Resources responsibly and sustainably.

A handwritten signature in black ink, appearing to read 'Girish Chandra Murmu', written in a cursive style.

(Girish Chandra Murmu)

Comptroller and Auditor General of India

November 2024
New Delhi



Message of Minister of State in Ministry of Jal Shakti

वी. सोमण्णा
V. SOMANNA



राज्य मंत्री
जल शक्ति एवं रेलवे मंत्रालय
भारत सरकार
Minister of State
Jal Shakti and Railways
Government of India

Message

I am pleased to extend my heartfelt greetings on the occasion of the release of the first Compendium of Water Resources for the year 2021-22, prepared by the Government Accounting Standards Advisory Board (GASAB). This significant initiative marks a pivotal step in our journey toward sustainable water resource management.

Water is the lifeblood of our communities, ecosystems, and economies. Effective management of this precious resource is not only vital for ensuring the health and well-being of our citizens but also for fostering sustainable development and resilience against climate change. As we face increasing pressures on our water resources, it is imperative that we adopt comprehensive accounting practices to assess, monitor, and manage these resources effectively.

The Compendium of Water Resources serves as a crucial tool in this endeavor, providing us with the data and insights necessary to make informed decisions and implement policies that promote sustainability and equity in water use. It will empower us to identify challenges, allocate resources wisely, and enhance transparency and accountability in our water governance.

I encourage all stakeholders, government agencies, civil society, and the private sector to engage with this compendium actively. Your collaboration will be essential as we strive to implement innovative solutions that ensure the sustainable management of our water resources for generations to come.

Let us work together towards a future where every drop counts. I wish the Compendium great success in its mission to illuminate the path toward effective water resource management.


(V. Somanna)



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Message of Minister of State in Ministry of Jal Shakti

डॉ. राज भूषण चौधरी
Dr. Raj Bhushan Choudhary



सत्यमेव जयते

जल शक्ति राज्य मंत्री
भारत सरकार
नई दिल्ली-110001
MINISTER OF STATE FOR JAL SHAKTI
GOVERNMENT OF INDIA
NEW DELHI - 110001

Message

It gives me immense pleasure to know that the Government Accounting Standards Advisory Board (GASAB) has prepared and released a Concept Paper on Implementing Natural Resource Accounting (NRA) and now NRA is attempting its First Compendium of Water Resources 2021-22.

As we face the pressing challenges of climate change and increasing demand for water, it is crucial to emphasize the significance of effective water resource management. Our water resources are not just essential for our survival; they are vital for economic growth, food security, and environmental sustainability.

The Compendium serves as a pivotal tool in this endeavor. By compiling best practices, innovative solutions, and successful case studies, it highlights sustainable water management practices across various sectors. This initiative empowers stakeholders from policymakers to local communities, to make informed decisions and adopt strategies that ensure the equitable and sustainable use of water.

Together, we can harness the insights from the Compendium to drive initiatives that safeguard our water resources for future generations. I encourage all of you to engage with this valuable resource and to prioritize the sustainable management of our water systems.

I wish all the grand success of the endeavors of all the members of the Organizing Committee.

Raj Bhushan Choudhary
(Dr. Raj Bhushan Choudhary)

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From the desk of the Deputy CAG (GA) & Chairperson (GASAB)



The Government Accounting Standards Advisory Board (GASAB) was established in August 2002 by the Comptroller & Auditor General of India with the support of the Government of India. In addition to its endeavour to formulate Government Accounting Standards, GASAB has also been working on Natural Resource Accounting for nearly four years.

The Concept Paper released in 2020 envisaged a three-pronged action plan to prepare Asset Accounts on targeted resources, namely mineral and energy resources, water resources, forestry, and wildlife and land resources.

The efforts by the Government Accounting Standards Advisory Board (GASAB), in collaboration with the State Governments/Union Territories and several other key stakeholders has culminated in this Compendium of Asset Accounts on Water Resource (2021-22). The initiative to develop Natural Resource Accounting (NRA) for water resources, in alignment with the System of Environmental-Economic Accounting – Central Framework (SEEA-CF), is a step forward in the context of India's commitment to the Sustainable Development Goals (SDGs). Through the preparation of water asset accounts, this Compendium seeks to quantify and assess the availability and use of water resources. This endeavour will enable policymakers to take more informed decision at the national and state levels in managing this finite valuable resource by all stakeholders—Government, industries, civil society, and the general public.

I would like to place on record my appreciation for the effort put in by the GASAB team, especially Shri Pramod Kumar, Additional Deputy CAG (Staff & GASAB) and Dr. Jayaraj Naik, Principal Director (GASAB-III) in the finalization of this Compendium. I would also like to record my appreciation for the collective efforts of all the State Governments, the members of the Consultative Committee and the technical experts for their active participation and contribution in the preparation of Asset Accounts on water resources.

As we move forward, it is my hope that this Compendium will serve as an inspiration for continued efforts in the realm of water resource management by all stakeholders—policy-makers, researchers, environmentalists, and citizens alike, as we collectively work towards building a water-secure future for India. I sincerely hope the stakeholders will find the Compendium useful and it acts as a stimulus for further work on the subject. I request that the States and other authorities in Government of India take the opportunity to look into the observations and offer their suggestions. I am sure that this document will also aid in optimising revenue realisation and ensuring sustainability in economic management of the resources.

November 2024
New Delhi


(Jayant Sinha)
Deputy CAG (GA) & Chairperson (GASAB)



Subject Matter Expert's Take



Shri Mukul Sanwal
IAS 1971 (Retd.)
Hon'ble Member of Consultative Committee on NRA

Water is essential to life. The Supreme Court has ruled that the right to water is part of the right to life guaranteed under the Constitution. Water covers three-quarters of the Earth's surface. Up to 60 percent of the human adult body is water. Usage will increase tremendously as urbanization increases from the present levels of less than 50 percent to 75 per cent as we move to becoming a developed country by 2047. The adverse impact of climate change on India will largely be felt in terms of water, not temperature or sea level rise. Increased variability of the Monsoon is likely and will affect the entire population.

India's prosperity throughout civilization has depended on its unique geography and the monsoon. The regularity of precipitation enabled two, even three, crops without irrigation over the continental landmass. The only such case in the world. Climate assessments show that total monsoon precipitation will not decrease, it may even increase in the Western part. The distribution is expected to be subject to variability pointing to the need for water conservation to conserve the runoff.

The essence of these transformations has been captured in the Compendium of Water Resources. It is an example of cooperative federalism in one of the most divisive areas of our federal structure, sharing river water flows. Water accounting adds a new dimension to water availability, usage and distribution or sharing by bringing out the data gaps. When plugged there may well be a situation where water availability is enhanced with conservation of monsoon runoff to provide for better sharing of available water and reduced friction. The call for uniform reporting standards is foundational for comprehensive development of States as an essential element of national development re-defining cooperative federalism to enable India to become a developed country by 2047.

With urbanization, digital data centers and increased requirement for food and other crops the demand for water is going to increase substantially requiring enhanced cooperation between States and between them and the Central Government. Evidence-based decision-making needs leads to evidence based sharing of a scarce resource as well agreed measures to conserve surface and underground water and monsoon flows. Efforts to add to surface flows by water conservation is the most effective measure to deal with sharing river waters. All these elements have been captured in these accounts.

The accounting framework is an improvement over the current systems. The exercise has highlighted the lack of common definitions, methodologies and sector-specific usage reporting. Standardization will be an essential tool for cooperative federalism.

The message of the report is that, as in the case of GST, for sharing a scarce and essential resource a common frame is needed for sharing data to cover all water available. The water accounts make water a national concern without getting into questions of territorial and sector jurisdiction. Filling the data gaps will identify national priorities that will benefit the end users, the States. Cooperative federalism works best where States see tangible benefits in an area of local concern.

Subject Matter Expert's Take



Shri Nitin Desai,
Member Audit Advisory Board
Office of C&AG of India

The Compendium on Water Resources 2021-22 is a very important advance in the promotion of Natural Resource Accounting. Water is a resource essential for survival of life, as we know it. It is a shared resource and, in many places, a scarce resource. Moreover, water is a strategic resource for sustainability. It touches every aspect of growth and equity.

Understanding and managing the hydrological cycle in all its dimensions—precipitation, run off, freshwater flow, ground water, recharge and drainage—is the key to flood and drought protection and meeting water demands for agricultural, domestic and industrial use. Conserving water and ensuring safe drainage is essential for protecting the living environment. If water is used for production rationally and in a manner consistent with its availability, then economic advancement is promoted. If water is shared equitably, social justice is ensured. If water quality is maintained and improved, good health follows. That is why water is a strategic resource for development – get water management right at the local level and a lot else falls in place.

Water accounting is crucial because in India water shortages are emerging. The annual precipitation of water in India is 4000 billion cubic metres (cum); but utilisable water is much less 1123 billion cum, (690 billion cum surface water and 433 billion cum groundwater). The water availability may change over time because of the impact of climate change on the monsoon and glacier melt. But with rising population the per capita availability will come down. Hence regular and reliable accounting of water availability and use is crucial for determining the permitted extraction and use of water. That is why the development of water accounting is very welcome as a crucial part of Natural Resource Accounting and for promoting sustainable development.



Message of Director General (TERI)



Smt. Vibha Dhawan
Director General
The Energy and Resources Institute (TERI)

Water scarcity poses the 21st century's most pressing challenges driven by escalating demand, inefficiencies, pollution, and the impacts of climate change. India has about 18% of the global population, however, just 4% of the world's freshwater resources. India's net available water resources are estimated at 1,123 billion cubic meters (BCM), comprising 690 BCM of surface water and 436 BCM of groundwater. A considerable segment of the population still experiences high to extreme water stress, and the nation ranks 120th out of 122

countries in the water quality index (NITI Aayog). Projections indicate that by 2050, water demand could reach 1,180 BCM in a high-use scenario, significantly outstripping current supplies. The increasing water demand-supply gap, exacerbated by pollution and climate change, necessitates integrating water management strategies into the country's development roadmap to ensure a water-secure and climate-resilient future.

TERI has been at the forefront of promoting the sustainable and efficient use of water resources through provisions of innovative solutions and policy inputs, across the key sectors viz. agriculture, domestic (urban & rural), and industrial sectors. Through its various water audits and research studies, TERI has helped various water-intensive industries such as thermal power plants, pulp & paper, iron & steel, textile etc. to reduce their specific water consumption and increase their water use efficiency. TERI contributed to the development of State Specific Action Plans (SSAP) under the initiative of the National Water Mission (NWM), Ministry of Jal Shakti to facilitate better accounting and management of water resources by the Indian states. There is a growing need for better database and monitoring mechanisms both on water quantity and quality not just for the agriculture, domestic, and industrial sectors, but also for the natural ecosystem. Water management plans must include the climate change adaptation & mitigation strategies along with regular monitoring & evaluation mechanisms, at national, state, and local levels.

It is important that the interventions, policies and programs on water management have the last mile connectivity overcoming the challenges of inefficiencies, inequity, and scale to bring about transformative impacts for India's water security. Water sector requires prioritized investments and innovative financing mechanisms to upscale market-ready technological solutions with inclusive programs, public-private partnerships (PPPs), and widescale stakeholder engagement. In doing so, cooperative federalism must be considered to have consensual planning and implementation of programs between the Center and the States.

I take this opportunity to compliment and thank the Government Accounting Standards Advisory Board (GASAB) under the aegis of Comptroller and Auditor General of India for pioneering the implementation of Natural Resource Accounting (NRA). This is a remarkable step in gauging the impact of developmental activities on nature which will help in informed policy making. It is indeed a matter of great accomplishment that GASAB, with its collaborative engagement with the States, has come out with the first "Compendium on Water Resources 2021-22" that provides an overview of the surface and groundwater resources of the country. The accounting and management practices elaborated in the compendium, including the System of Environmental-Economic Accounting (SEEA) in the water sector, shall play a significant role in promoting sustainable practices in the water sector and strengthening water resource accounting and management in India. TERI with its multidisciplinary strength in natural resources management would be happy to partner with GASAB in this endeavor.

I, once again, laud the release of this Compendium which will go a long way in disseminating sustainable water management practices, changing conventional thinking, and encouraging innovation. This outstanding initiative has the potential to transform the landscape of water management, fostering a new era of environmental stewardship.



Preface



Natural Resource Accounting (NRA) aims to capture the critical interconnections between various elements of the natural environment and the economy, facilitating improved resource management while quantifying the environmental impacts of economic development.

The Concept Paper on Natural Resource Accounting, prepared by GASAB, was released in July 2020, establishing a strategic roadmap/goal for implementing NRA for four major resources across India. Water is the second major resource to be taken by GASAB after Mineral & Energy Resources. SEEA-Central Framework (CF), an internationally accepted standard, supports the nation's commitment to achieving the Sustainable Development Goals (SDGs) by 2030.

Following this roadmap, the tabular formats along with questionnaires were issued to State Accountants General Offices in March 2023. The information was sought from States through State Accountants General Offices to facilitate the preparation of Asset Accounts for Water Resources for the year 2021-22.

Consultative committee meeting was held in September 2024 to support States/UTs in filling out templates accurately and to collect inputs for this Compendium. This meeting included both State Accountants General and State Government officials from the concerned Department, promoting a collaborative and cohesive approach to this ambitious initiative.

These collective efforts have yielded positive results, enabling the completion of the Asset Accounts for Water Resources for the year 2021-22 across 31 States/Union Territories. The data within these accounts has been validated by the State Governments for accuracy.

I am confident that this innovative effort to compile Asset Accounts for Water Resources for the year 2021-22 will be continued with commitment by both Union and State Governments, setting a strong foundation as envisioned by the SEEA framework for new entrants in this domain.

I extend my sincere gratitude to my GASAB Secretariat & team led by Dr. Jayaraj Naik, Principal Director (GASAB-III), the State Government Departments, the offices of the Accountants General, and all other stakeholders whose dedication has made this significant initiative possible. I am hopeful that these efforts will continue and evolve in the coming years, strengthening India's journey toward sustainable water resource management.

A handwritten signature in black ink, appearing to read 'Pramod Kumar', with a horizontal line underneath.

(Pramod Kumar)

Additional Deputy CAG (Staff & GASAB)

November 2024
New Delhi



Officers associated with the project

COMPENDIUM OF ASSET ACCOUNTS ON WATER RESOURCES (2021-22)

1. Shri Jayant Sinha, Deputy C&AG (GA) & Chairperson (GASAB)
2. Shri Pramod Kumar, Additional Deputy C&AG (Staff & GASAB)
3. Dr. Jayaraj Naik, Principal Director (GASAB-III)
4. Smt. Minakshi Khushu, Sr. Admn. Officer(GASAB)
5. Shri Rahul Vats, Asstt. Admn. Officer(GASAB)
6. Associated GASAB team



Disclaimer

The preparation of Asset Accounts is part of a four-stage implementation strategy outlined by the System of Environmental-Economic Accounting – Central Framework (SEEA-CF), which aligns with India's commitments to the Sustainable Development Goals (SDGs).

The Government Accounting Standards Advisory Board (GASAB), under the guidance of the Comptroller and Auditor General of India (CAG), has provided support to the State Governments in this endeavour. The compilation of the Asset Accounts on Water Resources, as reflected in this report, has been based solely on the data provided by the concerned State Governments to the respective State Accountants General Offices and the data as available on the websites of concerned Ministry/Department/Agencies. The responsibility for the accuracy of the information rests with the concerned State Governments/Ministry and its Agencies. The views/recommendations in this compilation should neither be understood as professional advice in any manner nor interpreted as policies of the organisation.

GASAB and CAG of India do not assume any liability for errors, omissions, or discrepancies in the data or the conclusions drawn from it. The report is intended to provide a general understanding of Water Resource Management issues, and while every effort has been made to ensure the reliability of the information, it is recommended that readers verify facts from original sources before making any decisions based on the content of this book.

This disclaimer aligns with the objective of the book, clarifying the roles and responsibilities of CAG, State Governments and the GASAB, in the preparation and validation of the data presented.



Executive Summary

Background

There is growing recognition of the urgent need to manage and conserve water resources sustainably, as reflected in the United Nations' Sustainable Development Goals (SDGs) at global level. To support this, System of Environmental-Economic Accounting – Central Framework (SEEA-CF), introduced in 2012, offers an internationally accepted model for resource accounting, including water resources. Government Accounting Standards Advisory Board (GASAB) under the aegis of CAG's Office had come out with a Concept Paper on Natural resource Accounting (NRA) in India in July 2020. The Paper inter-alia, envisaged a plan for implementation of Natural Resource Accounting in consonance with the strategy enshrined in the System of Environmental-Economic Accounting – Central Framework (SEEA-CF) of the United Nations. Preparation of Asset Account of Water Resources was one of the goal set out in the Concept Paper.

To carry out the goal set out for preparing Natural Resource Account for Water, GASAB constituted a Consultative Committee consisting of stakeholder Ministries in Government of India, regulatory agencies, environmental resource centres, State Governments, and subject experts to take forward the work of resource accounting for water. The Tables of Asset Accounts on Water Resources were circulated in March 2023 for data collection to all the States and UTs.

Based on the data provided by the State & UTs Governments on the various aspects of Water Resources the Compendium of Asset Accounts on Water Resources for the year 2021-22 has been prepared. The Compendium provides an analysis of the multifaceted issues concerning India's water resources, including the growing scarcity of fresh water, the degradation of water quality, overexploitation of groundwater, unequal distribution and the rising complexities of inter-state water disputes. These issues, if left unaddressed, would not only impact the economy but also the health and livelihoods of the people.

Collection of Data

Work towards preparation of Natural Resource Accounts for water was initiated as per what was envisioned in the Concept Paper in July of 2020. In this connection, the SEEA – CF also allows flexibility to generate and design the framework keeping in view country specific needs. Accordingly, while designing the tables/questionnaire for Asset Accounts of Water Resources, some more information have been embedded into the framework to aid the policy makers with decision making.

The key elements to be captured by the tables designed are:

Table 1: Availability of Water resources

- Total availability of water resources in rivers and canals including inflows from other territories, precipitation, returns
- Total water available in reservoirs
- Total water available in tanks and ponds
- Total water available in flood plain lakes and derelict water bodies
- Brackish water
- Total annual extractable ground water

Table 2: Usage of water resources

- Natural discharge
- Natural disasters
- Man-made disasters
- Irrigation supplies
- Power generation
- Industrial usage
- Domestic usage (Urban & Rural)
 - Surface water
 - Water supplies
 - Underground water
- Outflow to other province/sea etc.
- Total volume of water usage during the period
- Gap with the availability of water resources (+/-)

Table 3: Details of cost and revenues on supply / extraction of water for 3 sectors

- Type of user
- Cost of supply / cost of water in INR per unit (if available)
- Water charges / rates recovered in INR per unit

The work on preparation of the Asset Accounts in the States commenced with joint efforts of the Accountants General Offices and the State Governments with formation of State NRA Cells. Presently, State NRA Cells are functional in all States and UTs. GASAB continued to handhold the States through meetings to ensure that all States complete the exercise within the stipulated timeline. The joint effort bore results as all States and UT collected and compiled the data on water resources.

Resources Depiction in the Compendium

The Compendium deals with multiple types of water resources, typically categorized based on their sources and usability. The primary types of water covered are:

1. Surface Water

- **Sources:** Rivers, lakes, reservoirs, and ponds.
- **Usage:** Primarily for agriculture, drinking water supply, industrial use, and power generation. Surface water is also crucial for ecological balance and biodiversity.

2. Groundwater

- **Sources:** Underground aquifers, wells, and boreholes.
- **Usage:** Extensively used for agriculture (especially in areas with limited surface water), domestic supply in rural and urban areas, and certain industries. Groundwater depletion is a significant issue, especially in over-exploited regions.

3. Recycled or Treated Wastewater

- **Sources:** Treated wastewater from domestic, industrial, or agricultural activities.
- **Usage:** Primarily used for non-potable purposes such as irrigation, industrial processes, and landscaping. Recycled water reduces the demand for freshwater and is a key part of sustainable water management.

4. Brackish Water

- **Sources:** Found naturally in estuaries, coastal aquifers, and certain groundwater sources.
- **Usage:** After treatment, brackish water can be used for industrial purposes and sometimes for desalination. Brackish water management is particularly relevant in coastal areas where saline intrusion affects groundwater quality.

Each type of water resource has unique characteristics and specific applications, making a diverse and comprehensive resource strategy necessary for effective management and

sustainable usage.

The following are key aspects of the water accounting exercise and these provide critical data for understanding water management at both state and national levels:

- a) **Annual Water Availability by State/UT (2021-22):** Table 1 in chapter 6, presents an overview of water availability per state and UT, broken down into surface and groundwater components.
- b) **Sectoral Water Usage (Agriculture, Industry, and Domestic):** Table 2 in chapter 6, illustrates the distribution of water usage across major sectors in each state, showcasing the demands placed on water resources by different industries.
- c) **Water price/cost assessment:** Table 3 in chapter 6, illustrates the Price/Cost of water usage in various sectors.

Highlights of the Compendium

The Asset Accounts on water resources are designed to aid in decision-making and good governance for all stakeholders.

The highlights of this Compendium are:

- **Detailed Water Accounts:** The document features structured tables and questionnaire for tracking water availability, demand, and usage across sectors (e.g., agriculture, industry, domestic use). This enables clear visibility into where water is being consumed and highlights areas of imbalance or overuse.
- **Integrated Water Resource Management:** The document emphasizes the importance of a coordinated approach to water resource management, combining data from different sectors and regions to create a comprehensive picture of India's water needs, challenges, and resources.
- **Alignment with Sustainable Development Goals (SDGs):** It aligns with SDG 6 (Clean Water and Sanitation), focusing on sustainable practices, equitable access, and quality control to ensure safe and sufficient water resources for all.

Some observations and way forward

- ❖ The Government of India and State/UTs Governments have launched several initiatives to manage and conserve its water resources, addressing challenges like water scarcity, pollution, and overuse. Jal Jeevan Mission (JJM), Namami Gange Programme (NGP), Pradhan Mantri Krishi Sinchayee Yojana (PMKSY), Jal Samvardhan Yojna Tumakuru District, Karnataka, Neeru-Chettu Program, Andhra Pradesh etc.

(Para 4.5.1 & 4.5.2)

- ❖ Water resource availability, the figures reported for reservoirs by the States showed notable variations compared to those recorded by the Central Water Commission.

(Para 6.2.2)

- ❖ Only Andhra Pradesh, Punjab and Rajasthan has furnished data on brackish water. Notably, Lake Chilka in Odisha is the largest brackish water lagoon in Asia and the second largest coastal lagoon globally but no data made available for this Compendium.

(Para 6.2.5)

- ❖ India has achieved an impressive 89% in the Sustainable Development Goals (SDG) 6 Index by regulating the pace of groundwater extraction. Some variation in data on groundwater between those reported by the State Government and those reported to Central Ground Water Board (CGWB) was also observed.

(Para 6.2.6)

- ❖ As per 6th Census of Minor irrigation schemes report (Ministry of Jal-Shakti) there are 2,31,38,964 of schemes (2017-18) running for Minor irrigation across India. However, the data related to irrigation supplies has not been furnished by several States/UTs.

(Para 6.2.10)

- ❖ States/UTs with significant industrial water demand are encouraged to monitor their supply and wastewater disposal to prevent contamination of other water sources. They also need to adopt recycling and reuse practices for improved water management.

(Para 6.2.12)

- ❖ Some States are maintaining sector-wise data for water usage, but there remains scope for considerable improvement. Some states still do not have comprehensive sector-specific figures. Data quality issues also need to be addressed.

(Para 6.3.1)

- ❖ Monitoring groundwater extraction is essential. Although the Central Ground Water Board has established guidelines for excavation permissions, some states lack a mechanism for compliance.

(Para 6.3.2)

- ❖ Some states maintain databases on aquifers, many do not. This gap in information limits the ability to manage groundwater resources effectively.

(Para 6.3.7)

- ❖ The data on Water Resources has exposed significant gaps in data collection and reporting with respect to the availability, usage, and revenue from water resources

across States/UTs. These discrepancies hamper effective water resource management. The way forward must address these disparities through uniform data collection methods and improved reporting standards.

(Para 7.4)

- ❖ As a way forward for informed decision-making that optimizes water usage, ensures equitable access, and promotes long-term resource sustainability GASAB recommends for Knowledge Dissemination, Improvement in standardised Data Collection Methods along with Standardisation of formats.

(Para 7.5)

Conclusion

The Compendium on Water Resources for the year 2021-22 marks a significant step toward building a robust foundation for water resource accounting and management in India. By adopting international best practices and leveraging multi-stakeholder input, this report paves the way for an accountable, transparent and sustainable framework that can serve as a model for future natural resource management initiatives. As India progresses towards 2030, this Compendium will play a critical role in guiding policy decisions, better resource allocation, and ultimately achieving a secure and sustainable water future for the country.

Chapter 1

Introduction



Introduction

Water is considered to be very important and is given a high place among the five basic elements of nature. India is endowed with diverse and distinct water bodies. The major rivers such as the Brahmaputra, Ganga, Godavari, Indus, Krishna, Kauveri, Narmada, and their tributaries constitute a vast network that provides water for irrigation, drinking, and industrial purposes.



1.1. What are water resources?

Water resources are useful or potentially useful to life on earth, important for the integrity of entire ecosystem, and are needed for life to exist. Water Resources consist of freshwater and brackish water, regardless of their quality, in inland water bodies, including surface water, under river flow, groundwater and soil water.

1.1.1 Surface Water

Surface water comprises all water that flows over or is stored on the ground's surface, regardless of its salinity levels. Surface water includes water in artificial reservoirs, lakes, rivers and streams, snow, ice and glaciers. The Himalayas, dubbed “The Roof of the World,” are home to some of the world’s most vast and rugged high altitude terrain, as well as the world’s largest glaciers and permafrost outside of the poles. Ten of Asia’s greatest rivers originate there, and more than a billion people rely on them for survival.

Precipitation refills surface water, while discharge to the oceans, evapotranspiration, evaporation, and groundwater recharge deplete it. Although precipitation within a watershed is the only natural input to any surface water system, the overall amount of water in that system at any given time is influenced by a variety of other factors. Storage capacity in lakes, marshes, and artificial reservoirs, permeability of the soil underlying these storage bodies, runoff characteristics of the land in the watershed, precipitation timing, and local evaporation rates are among these aspects. All of these elements have an impact on water loss proportions.

The total number of Surface Water Bodies in India is 851093. India has 16% of the World’s population, 2.4% of the World’s land area and 4% of the World’s fresh water resources. On an average, every year India receives 4,000 Billion Cubic Meters (BCM, 1 BCM = 1 cubic km) of water by predominantly rainfall and some by snowfall. However, there are considerable spatial and temporal variations in the distribution of rainfall and hence in the availability of water in the country. It is estimated that out of the 4000 BCM of water, 1869 BCM are “available water resources”. Out of this quantity only 1123 BCM (690 BCM from surface water resources and 433 BCM from ground water) can be put to use (“usable water resources”). The water demand in the year 2000 was 634 BCM and demand is expected to be 1093 BCM by the year 2025.

1.1.2 Under river flow

The total volume of water delivered downstream by a river is typically a combination of visible free water flow and a significant contribution flowing via rocks and sediments that lay beneath the river and its floodplain¹, known as the hyporheic zone. Thus, it refers to the zone beneath and adjacent to a river or stream in which groundwater and surface water mix. This invisible component of flow may substantially exceed the visible flow for many rivers in big valleys. The hyporheic zone is a dynamic interface that exchanges flow between rivers and aquifers.²



1.1.3 Groundwater

Groundwater is a type of freshwater that is found in the pore space of soil and rocks under the surface. It also includes water that flows beneath the water table in aquifers. It is occasionally helpful to distinguish between surface water-associated groundwater and deep groundwater in an aquifer (sometimes referred to as “fossil water”).

Ground water resources are replenished through rainfall and other sources like return flow from irrigation, canal seepage, recharge from water bodies, water conservation structures etc.

Ground Water Resources of India, 2022³

1.	Total Annual Ground Water Recharge	437.60 bcm
2.	Annual Extractable Ground Water Resources	398.08 bcm
3.	Annual Ground Water Extraction	239.16 bcm
4.	Stage of Ground Water Extraction	60.08 %

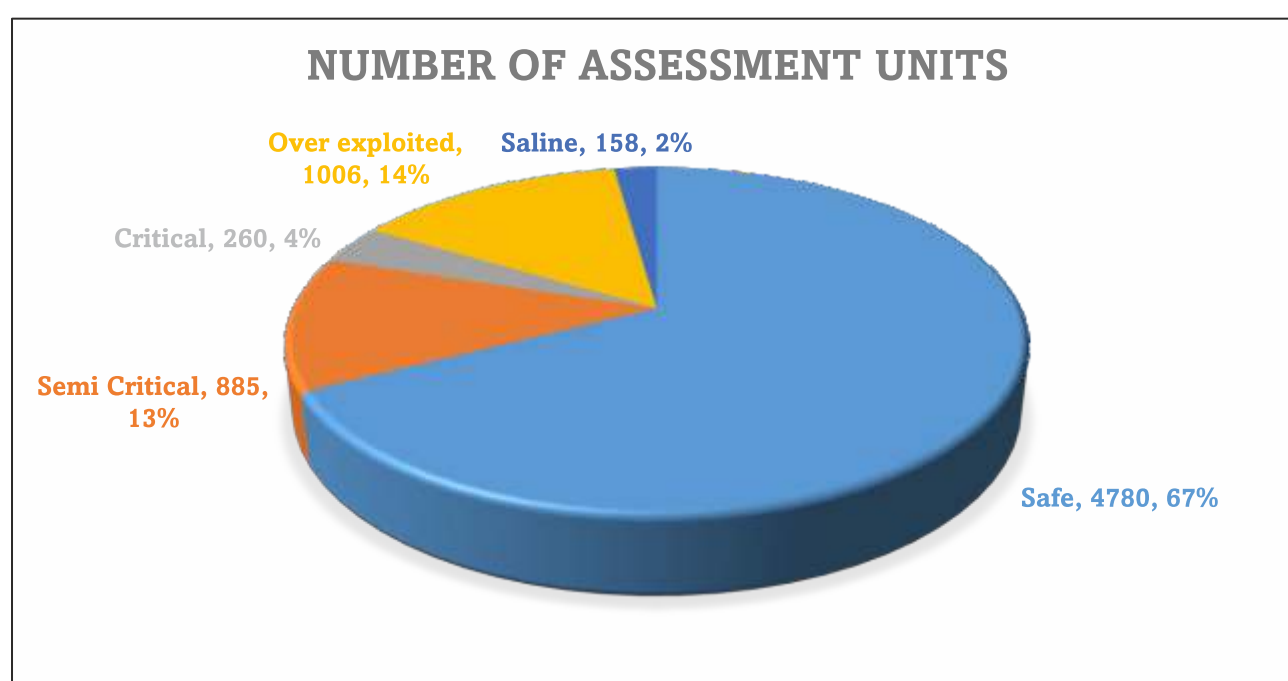
The average stage of groundwater extraction for the country as a whole works out to be about 60.08 %. Out of the total 7089 assessment units (Blocks/ Mandals/ Talukas/ Firkas) in the country, 1006 units in various States (14%) have been categorized as ‘Over-exploited’ indicating ground water extraction exceeding the annually replenishable ground water recharge. In, 260 (4%) assessment units the stage of groundwater extraction is between 90-100% and have been categorized as ‘Critical’. There are 885 (12%) “Semi-critical” units, where the stage of ground water extraction is between 70 % and 90 % and 4780 (67%) ‘Safe’ units, where the stage of Ground water extraction is

¹ Flat area adjacent to rivers that is periodically flooded.

² A geologic formation, group of formations, or part of a formation that contains sufficient saturated permeable material to yield significant quantities of water to wells and springs

³ Source: National compilation on dynamic Ground Water Resources of India, 2022 issued by CGWB

less than 70%. Apart from these, there are 158 (2%) assessment units, which have been categorised as 'Saline' as major part of the ground water in phreatic aquifers in these units is brackish or saline.



The extraction pattern of ground water is not uniform across the country, resulting in ground water stressed conditions in some parts of the country while in some other areas; ground water extraction has been sub-optimal.

1.2. Challenges in satisfying water demands

India faces several challenges in managing water resources in economic, efficient and effective manner. The challenges include:

- I. **Water Scarcity:** Rapid population growth, urbanization, and industrialization have increased water demand significantly, leading to water scarcity in many parts of the country. This is exacerbated by uneven distribution of water resources and climatic variability, which affects both availability and reliability of water supply.
- II. **Groundwater Depletion⁴:** Over and uncontrolled exploitation of groundwater for agriculture, industry, and domestic use has led to depletion of aquifers in many regions. This unsustainable extraction has long-term consequences for water availability and ecosystem health, particularly in drought-prone areas.
- III. **Water Quality Degradation:** Pollution from industrial effluents, agricultural runoff, and untreated sewage has severely degraded water quality in rivers, lakes, and groundwater sources. Contamination with heavy metals, chemicals, and pathogens poses serious health risks to millions of people who depend on these water sources for drinking and domestic use.
- IV. **Inter-State Water Disputes:** India's federal structure and dependence on shared river basins have led to conflicts over water sharing between states. Inter-State disputes underscore the

⁴ In physical terms, it is the decrease in the quantity of the stock of a natural resource over an accounting period that is due to the extraction of the natural resource by economic units occurring at a level greater than that of regeneration.

challenges in equitable allocation and management of shared water resources along with radical urbanisation/industrialisation of cities.

- V. **Climate Change Impact:** Changing weather patterns, erratic monsoons, and rising temperatures due to climate change are altering the availability and distribution of water resources in India. This poses additional challenges for water management, agriculture, and adaptation strategies.

In this context, globally, Ecosystem accounting is a coherent and integrated approach to the assessment of the environment through the measurement of ecosystems, and measurement of the flows of services from ecosystems into economic and other human activity.

To ensure water for every human being and sustainable progress the crucial requirement is to manage water resources.

1.3. Policies, Initiatives and Focus Areas of Government of India

Water is a State subject and the Central Government supplements the efforts of the States through technical and financial support. As per Government of India (Allocation of Business) Rules, 1961 the Ministry of Water Resources, River Development and Ganga Rejuvenation (Jal Sansadhan, Nadi Vikas aur Ganga Sanrakshan Mantralaya) is concerned with the matter at the Union level. Additional, brief details and the names of the organisations/bodies under this Ministry may be viewed at the Cabinet Secretariat, Government of India website⁵.

Water Security is “The capacity of a population to safeguard sustainable access to adequate quantities of acceptable quality water for sustaining livelihoods, human well-being, and socio-economic development, for ensuring protection against water-borne pollution and water-related disasters, and for preserving ecosystems in a climate of peace and political stability”.⁶ Water security has been recognized as a critical issue within Government policy circles and among various stakeholders such as civil society organizations, academics, and researchers. Water conservation is one of the foremost priorities of the Government of India. The growing recognition of water as a finite and valuable resource, coupled with the increasing risks and impacts of water-related issues, has led to water security being perceived as a threat to India's development and sustainability.

The global approach, 17 Sustainable Development Goals (SDGs) are the plans to achieve a better and more sustainable future for all. Sustainable Development Goal-6 deals with ensuring availability and sustainable management of water resources and sanitation for everyone. India's commitment to the SDGs since adopting the 2030 Agenda on Sustainable Development is reflected in the concerted efforts of GoI by rolling out multiple governmental policies/schemes in India. In adherence to the Goal various measures have been taken to address the challenges related to water security in India, including the implementation of policies, programs, and initiatives aimed at improving water management, conservation, and governance.

⁵ https://cabsec.gov.in/writereaddata/allocationbusinessrule/completeaobrules/english/1_Upload_2724.pdf

⁶ Working definition, UN-Water, 2013

The various initiatives and policies to address these challenges and improve water resources management are:

1. National Water Policy, 2012:

The National Water Policy, 2012 provides a comprehensive framework for sustainable development and management of water resources. It emphasizes integrated water resources management, demand management, and conservation measures. The Policy in Para 12 provides for the institutional arrangements and it includes data collection and collation on regular basis.

National Water Informatics Centre (NWIC) was set up by the Government of India on 28th March, 2018 to act as a central repository of updated water data and allied themes.

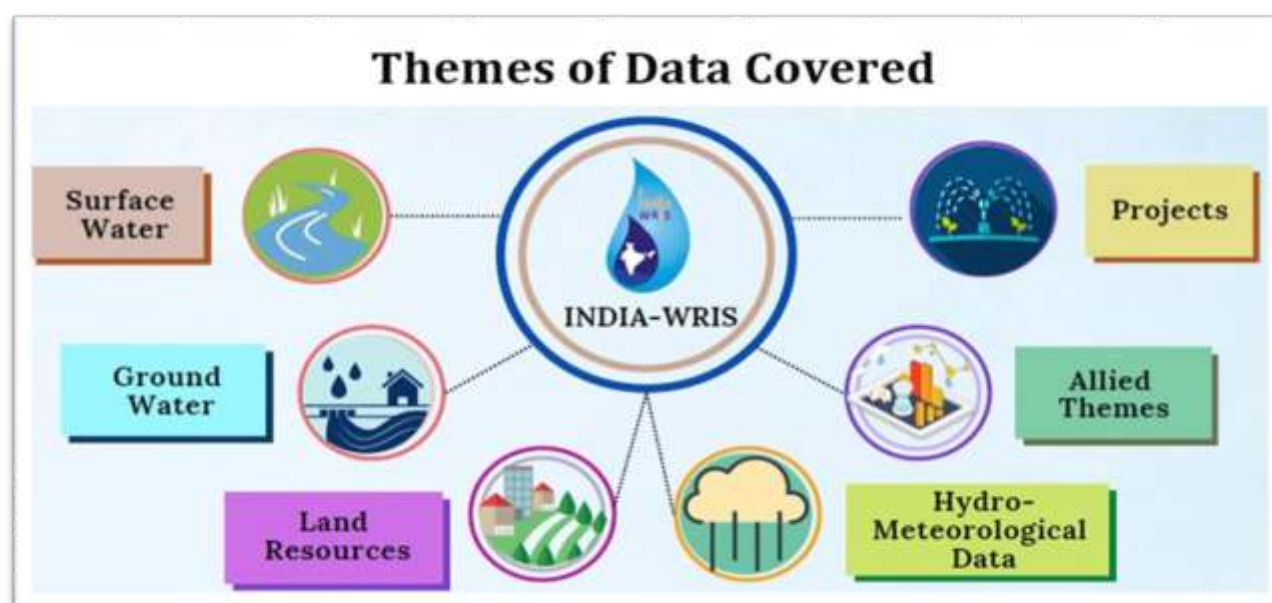
Objectives of NWIC:

- Collection of available data from varied sources, generate new database, organize in standardized GIS format and provide scalable web-enabled information system.
- Maintaining, updating, collating and disseminating water data and information.
- Sharing of hydro-meteorological data amongst central and state government organisations and other stakeholders of water & general public.
- Provide tools to create value-added maps by way of multilayer stacking of GIS database so as to provide an integrated view of the water resources scenarios, and
- Collaborate with national/ international research institutes.

NWIC's mandate also is to provide value added products and services to all stakeholders for its management and sustainable development. NWIC is managing two IT-based platforms viz:

I. India-Water Resources Information System (WRIS) - for the dissemination of data

India- Water Resource Information System (WRIS) (<https://indiawrisk.gov.in/wris/#/>). was created vide Notification dated 28th March 2018 to be a repository of nation-wide water

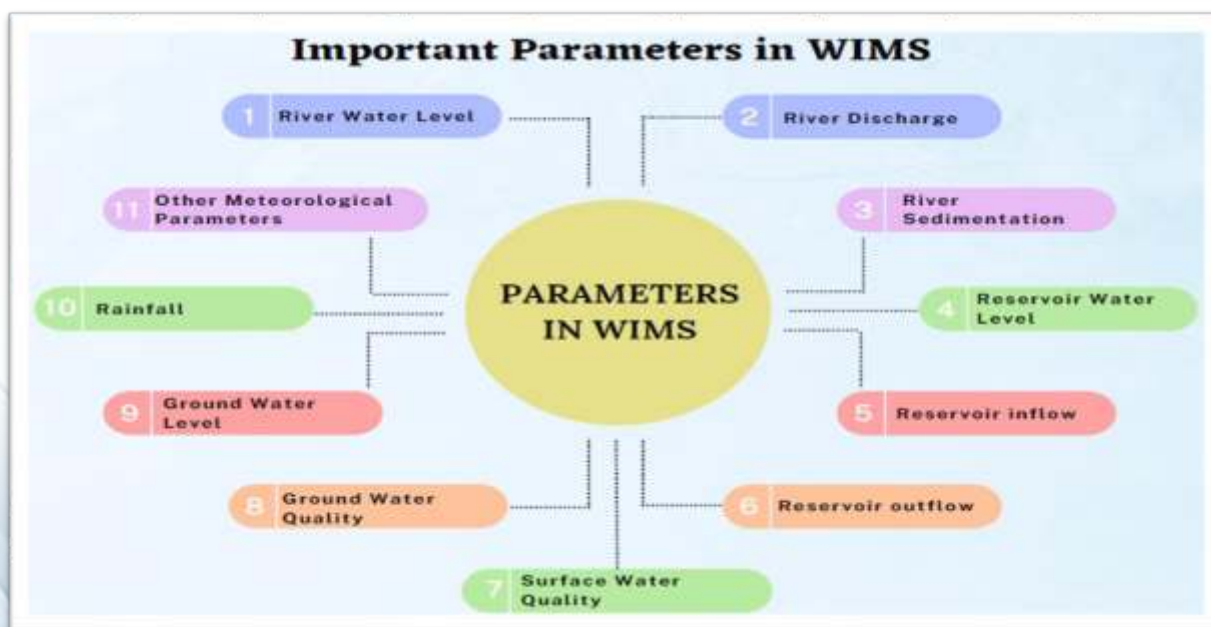


resources data, providing a 'Single Window' source of updated data on water resources & allied themes as a part of the National Hydrology Project. India- WRIS acts as a data dissemination platform for hosting static, dynamic, and semi-dynamic water resources spatial and non-spatial data under 130 Geographic Information System (GIS) layers for the entire country through various modules tailored to meet users' requirements. This platform is based on standardized National GIS framework for all water resources data and information which enables stakeholders to easily access, analyse, manage, and share relevant data. Thus, it helps in assessment, monitoring, planning, and development of water resources for Integrated Water Resources Management (IWRM).

II. Water Information Management System (WIMS) - for online collection and storage of data.

Water Information Management System (WIMS) (<https://india-water.gov.in/wims>) is an integrated web-based data collection platform through which different agencies and stakeholders update the data on Surface & Ground water. Apart from web-based manual data entry, it allows data entry in an automated method through telemetric sensors. The system has functionalities for data entry, management, analysis and reporting. The platform further offers various module-wise applications for State and Central agencies for effective database addition, updation and sharing. This application also has a provision to send Flood and Disaster Mitigation Alerts through SMS & email to Central & State Disaster Management Authorities and was primarily conceived as an internal application to be used by the technical staff of Central and State water departments.

The WIMS architecture and telemetry system were recently fine-tuned to allow more efficient data reading, decoding and processing of more than 10,000 stations. The WIMS system has been expanded for better resource management, database performance, and system architecture.



2. River Basin Management:

River basin management approach aims to coordinate water allocation, conservation, and development activities at the basin level. This approach considers ecological needs, stakeholder participation, and sustainable development goals. The River Basin Management Scheme comprises of two main components namely:-

I. Brahmaputra Board

The Brahmaputra Board, a statutory body was set up under an Act of Parliament called the Brahmaputra Board Act, 1980. The jurisdiction of the Board includes both the Brahmaputra and Barak Valley and covers all the States of the North Eastern Region, Sikkim and part of West Bengal falling under Brahmaputra basin.

Further, for other states the Interstate River Water Disputes Act, 1956 (IRWD Act) was enacted by the Parliament of India under Article 262⁷ of the Constitution of India. The IRWD Act was passed to resolve disputes over the use, distribution, and control of interstate rivers and river valleys. The Act has been amended in 2002. Ravi and Beas Water Tribunal, Vansadhara River Water Dispute Tribunal, Mahadayi Water Disputes Tribunal etc. have been constituted for such disputes.

II. Investigation of Water Resource Development Scheme (IWRDS)

- i. Central Water Commission (CWC): Central Water Commission is a premier Technical Organisation in the country in the field of water resources and is charged with the general responsibilities of initiating, coordinating and furthering in consultation with the State Governments concerned schemes for control, conservation and utilization of water resources throughout the country, for purpose of Flood Control, Irrigation, Navigation, Drinking Water Supply and Water Power Development.
- ii. National Water Development Agency (NWDA): The National Water Development Agency (NWDA) was established in 1982 to optimize water resource use through feasibility studies for Peninsular river development under the National Perspective Plan (NPP). In 1990, it was assigned the Himalayan component, and by 2006, it was tasked with exploring intra-state water links. In 2011, its role expanded to preparing Detailed Project Reports (DPRs) for these links, and in 2016, it began implementing Interlinking of Rivers (ILR) projects and managing funds for water projects under the Pradhan Mantri Krishi Sinchai Yojana (PMKSY). NWDA functions are as under:
 - a. To carry out detailed survey and investigations of possible reservoir sites and interconnecting links in order to establish feasibility of the proposal of Peninsular Rivers Development (1981) and Himalayan Rivers Development Components (1994) forming part of the National Perspective for Water Resources

⁷ Article 262 of the Indian Constitution provides a role for the Union Government in adjudicating conflicts surrounding interstate rivers that arise among the State/regional Governments.

Development prepared by the then Ministry of Irrigation (now DoWR, RD&GR, MoJS) and Central Water Commission.

- b. To carry out detailed studies about the quantum of water in various Peninsular River systems (1981) and Himalayan River systems (1994) which can be transferred to other basins/States after meeting the reasonable needs of the basin/States in the foreseeable future.
- c. To prepare feasibility report of the various components of the scheme relating to Peninsular Rivers development (1981) and Himalayan Rivers development (1994).
- d. To carry out surveys & investigations work and prepare DPRs of river link proposals under the NPP for Water Resources Development and thereafter approach concerned States for obtaining concurrence for implementation of the project (2020).
- e. To prepare Pre-Feasibility Reports (PFRs)/Feasibility Reports (FRs) (2006)/DPRs (2011) of the Intra-State links as may be proposed by the States. The concurrence of the concerned co-basin States for such proposals may be obtained before taking up their FRs / DPRs.
- f. To undertake/construct/repair/renovate/rehabilitate/implement the projects either of its own or through an appointed Agency/Organizations/PSU or Company and the projects forming part of Interlinking of Rivers, for completion of projects falling under Pradhan Mantri Krishi Sinchai Yojna (PMKSY) of which projects under Accelerated Irrigation Benefits Programme (AIBP) are also included and similar other projects (2016).
- g. National Water Development Agency (NWDA) to act as a repository of borrowed funds or money received on deposit or loan given on interest or otherwise in such manner, as directed by MoWR, RD&GR (now DoWR, RD&GR, MoJS) and to secure the repayment of any such borrowed funds/money deposits/ loan etc. by way of mortgage, pledge, charge or lien upon all or any other property, assets or revenue of the society both present and future (2016).
- h. To do all such other things the Society may consider necessary, incidental, supplementary or conducive to the attainment of above objectives (1981) component.

3. Groundwater Management:

The Central Ground Water Authority (CGWA) regulates groundwater extraction through permits and guidelines to control overexploitation. Initiatives like the National Aquifer Mapping and Management Program (NAQUIM) aim to map aquifers and promote sustainable groundwater management practices. Consolidated MoJS Guidelines to regulate and control Ground Water extraction in India was amended vide Notification dated 29.03.2023.

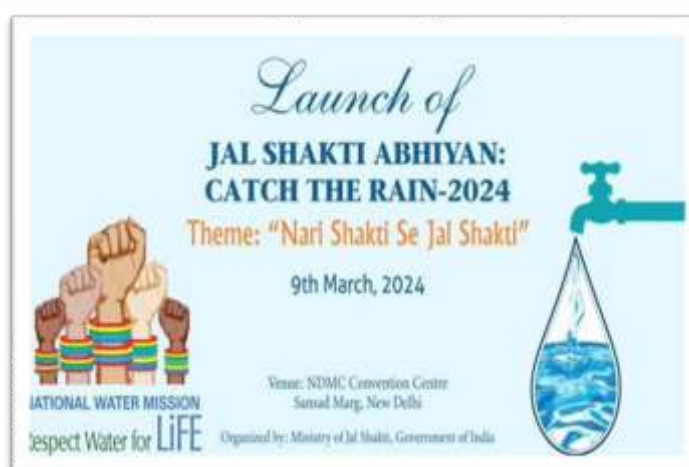
Master Plan for Artificial Recharge to Groundwater- 2020 has been prepared by Central Ground Water Board (CGWB) in consultation with States/UTs which is a macro level plan indicating various structures for the different terrain conditions of the country including estimated cost. The Master Plan envisages construction of about 1.42 crore rain water harvesting and artificial recharge structures in the country to harness 185 Billion Cubic Metre (BCM) of monsoon rainfall. The Master Plan has been circulated to all the States/UTs for implementation.

4. Water Conservation:

The Ministry of Jal Shakti has been implementing Jal Shakti Abhiyan (JSA) since 2019 on an annual basis. The salient features of the Jal Shakti Abhiyan include rainwater harvesting, revival of traditional water bodies, watershed development, irrigation efficiency, and raising awareness about water conservation. These efforts are crucial for sustainable water resource management and ensuring water security for present and future generations.

Jal Shakti Abhiyan: Catch the Rain 2023, was launched by the Hon'ble President of India on 04.03.2023 for implementation in all the districts of the country.

The fifth edition of the campaign was launched on 9th March 2024 on the theme 'Nari Shakti se Jal Shakti' to recognise and appreciate the crucial role played by women in water management, conservation and sustainability. It includes water conservation and rainwater harvesting; enumerating, geo-tagging & making inventory of all water bodies and preparation of scientific plans for water conservation; Setting up of Jal Shakti Kendras in all districts; intensive afforestation; and awareness generation among the masses.



5. Pollution Control:

The National Mission for Clean Ganga (Namami Gange) and similar programs focus on pollution abatement, sewage treatment, and river rejuvenation to improve water quality in major river systems. Its implementation has been divided into Entry-Level Activities -for immediate visible impact, Medium-Term Activities-to be implemented within 5 years of time frame and Long-Term Activities-to be implemented within 10 years.

- Entry-level activities include river surface cleaning to address the floating solid wastes; rural sanitation to arrest the pollution.
- Medium-term activities will focus on arresting the municipal and industrial pollution entering into the river.

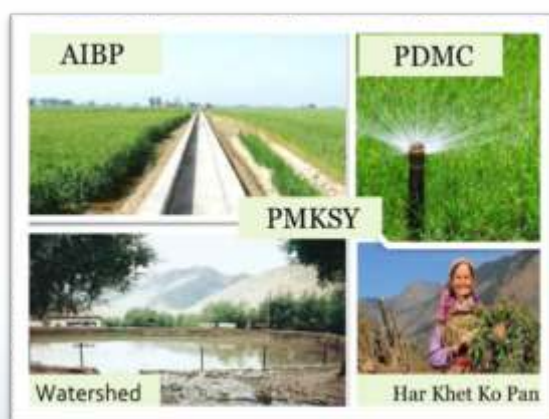
- And the long-term, providing adequate flow to the river is envisioned through determination of e-flow, increased water-use efficiency, and improved efficiency of surface irrigation.

Namami Gange : Strategic Areas of Intervention				
Nirmal Ganga	Aviral Ganga	Jan Ganga	Gyan Ganga	Arth Ganga
• Sewerage Infrastructure • Industrial Pollution • Wastewater reuse and recycle • Rural sanitation • Solid Waste management	• Maintaining ecological flow • Wetland mapping and conservation • Floodplain management • Sustainable agriculture • Afforestation and biodiversity conservation • Small river rejuvenation	• Riverfront, ghats and crematoria • Community engagement • Ganga Run • Ganga Utsav • Ganga Quest • Ganga Amartran Abhiyan	• Water quality monitoring • High resolution mapping of Ganga stretch • Microbial diversity • Aquifer mapping & spring rejuvenation • Cultural mapping & spring rejuvenation • Cultural mapping & climate scenario mapping • River Cities Alliance	• Zero Budget Natural Farming • Monetisation of Reuse of Sludge & Wastewater • Livelihood Generation • Public Participation • Culture Heritage & Tourism • Institutional Building

Government of India launched the Namami Gange Programme in June 2014, to accomplish the twin objectives of effective abatement of pollution, conservation and rejuvenation of National River Ganga and its tributaries. The actual releases by Government of India to National Mission for Clean Ganga (NMCG) from the Financial Year 2020-21 to Financial Year 2021-22 (up to 31st January, 2022), is ₹ 2,250.00 crores. Out of this, the Releases/Disbursement by NMCG (up to 31st January, 2022), is ₹ 2,355.96 crores. As in March 2022 under Namami Gange Programme, a total of 364 projects were sanctioned at an estimated cost of ₹ 30,853 crores and 183 projects were completed and made operational.

6. Pradhan Mantri Krishi Sinchayee Yojana (PMKSY)

Pradhan Mantri Krishi Sinchayee Yojana (PMKSY) was launched during the year 2015-16, with an aim to enhance physical access of water on farm and expand cultivable area under assured irrigation, improve on-farm water use efficiency, introduce sustainable water conservation practices, etc. It is an umbrella scheme, consisting of two major components being implemented by the Ministry of Jal Shakti.



- I. Accelerated Irrigation Benefit Programme (AIBP) focuses on faster completion of ongoing Major and Medium Irrigation including National Projects. Major and medium irrigation projects complying with the conditions mentioned below, are eligible for inclusion under PMKSY-AIBP:
 - (i) Having investment clearance by Department of Water Resources, River Development and Ganga Rejuvenation (DoWR, RD &GR); and
 - (ii) In advanced stage of construction having at least 50% overall physical progress can be completed within the approved completion schedule or in next 5 years, whichever is earlier; and
 - (iii) Project should not be receiving financial assistance for the work components proposed to be included under AIBP, under any other scheme of Government of India, or through external assistance.
- II. Har Khet Ko Pani (HKKP) aims for enhancement of physical access on the farm and expansion of cultivable area under assured irrigation. Under HKKP, surface minor irrigation and repair renovation-restoration of water bodies' component of PMKSY is targeted to provide additional irrigation. HKKP consists of four sub-components:
 - i. Command Area Development and Water Management (CAD&WM). It creates, strengthens and restores water sources and its distribution networks to maximize the utilization of created irrigation potential through Har Khet Ko Pani.
 - ii. Surface Minor Irrigation (SMI)
 - iii. Repair, Renovation and Restoration (RRR) of Water Bodies
 - iv. Ground Water (GW) Development

Surface Minor Irrigation (SMI) Scheme and Ground Water components are to improve water use efficiency by promoting micro irrigation and effectively manage run-offs and soil and moisture conservation, ridge and drainage area treatment.

In addition, PMKSY also consists of Watershed Development Component (WDC) which is being implemented by Department of Land Resources, Ministry of Rural Development. Further, Per Drop More Crop (PDMC) component being implemented by Department of Agriculture and Farmers Welfare (DoA&FW) was also a component of PMKSY during 2015-22, and is now being implemented separately by DoA&FW.

7. Climate Resilience:

Initiatives under the National Action Plan on Climate Change (NAPCC) promote climate-resilient water management practices, including water-efficient agriculture, watershed management, and adaptation strategies for vulnerable communities. National Water Mission (NWM) has been established as one of the eight National Missions under the National Action Plan on Climate Change. The main objective of NWM is “conservation of water, minimizing wastage and ensuring its more equitable distribution both across and within States through integrated water resources development and management”. NWM has identified five goals as under:

- Goal 1:** Comprehensive water data base in public domain.
- Goal 2:** Assessment of the impact of climate change on water resources.
- Goal 3:** Promotion of citizen and state actions for water conservation, augmentation and preservation, and Focused attention to vulnerable areas including over-exploited areas.
- Goal 4:** Increasing water use efficiency by 20%.
- Goal 5:** Promotion of basin level integrated water resources management.

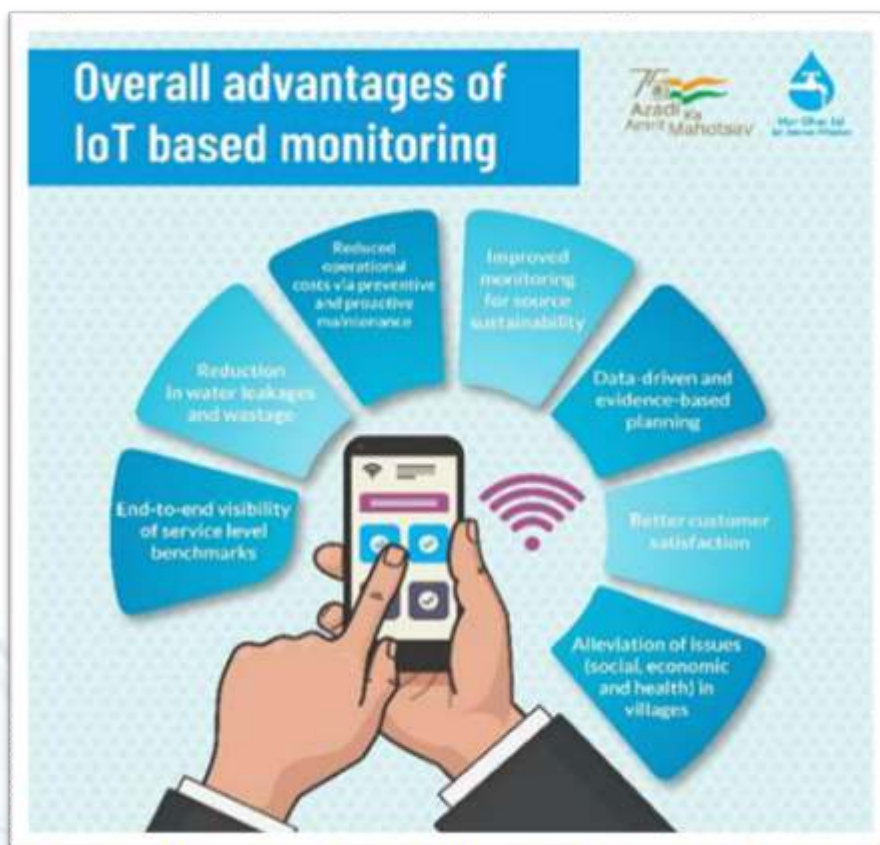
8. Atal Bhujal Yojana (ATAL JAL)

Atal Bhujal Yojana has been launched in 2019 with the objective to improve the management of ground water resources including rainwater harvesting in water stressed areas through community participation in identified priority areas in 7 states viz. Gujarat, Haryana, Karnataka, Madhya Pradesh, Maharashtra, Rajasthan and Uttar Pradesh. The scheme has been designed with the principal objective of strengthening the institutional framework for participatory groundwater management. It aims at bringing about behavioural change at the community level through awareness programs and capacity building for fostering sustainable groundwater management in the participating States.

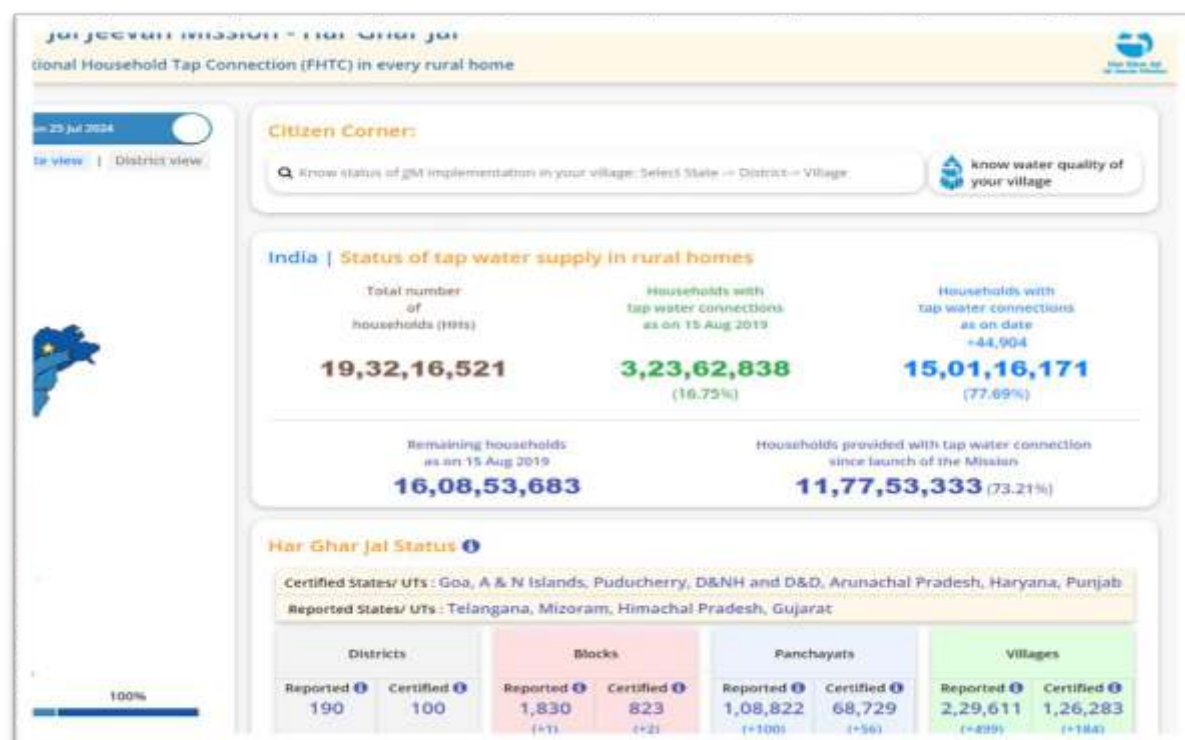
1.4. Digital initiatives/Reports for monitoring:

1. Internet of Things (IoT) based remote monitoring:

The Ministry of Jal Shakti is using IoT devices widely to provide safe drinking water. This program has set up sensor-based IoT systems in over six lakh villages to check water quality. States like Gujarat, Bihar, and Maharashtra are actively installing these IoT systems to enhance their water infrastructure.



2. Performance Dashboard on Websites



3. Census Report

The first census was launched under the centrally sponsored scheme, “Irrigation Census” in convergence with the 6th Minor Irrigation Census in order to have a comprehensive national database of all water bodies. The census provides a comprehensive inventory of India's water resources, including natural and man-made water bodies like ponds, tanks, lakes, and more, and to collect data on the encroachment of water bodies. The information on all important aspects of the water bodies including their type, condition, status of encroachments, use, storage capacity, status of filling up of storage, etc. was collected. The report reveals:

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% of water bodies are ponds, followed by tanks (15.7%), reservoirs (12.1%), Water conservation schemes/percolation tanks/check dams (9.3%), lakes (0.9%) and others (2.5%).

78% water bodies are man-made water bodies whereas 22% are natural water bodies.

55.2% of water bodies are owned by private entities whereas 44.8% of water bodies are in the domain of public ownership.

Top 05 States in terms of number of water bodies in urban areas are West Bengal, Tamil Nadu, Kerala, Uttar Pradesh and Tripura, whereas in rural areas, top 05 States are West Bengal, Uttar Pradesh, Andhra Pradesh, Odisha and Assam

Top 05 States in terms of number of water bodies are West Bengal, Uttar Pradesh, Andhra Pradesh, Odisha and Assam which constitute around 63% of the total water bodies in the country.

Top 05 States which lead in the private owned water bodies are West Bengal, Assam, Andhra Pradesh, Odisha and Jharkhand.

Chapter 2

Sustainable Development Goals
(SDGs) & Water Resources



Sustainable Development Goals (SDGs) & Water Resources

2.1. Background

A Set of 17 Goals - The Sustainable Development Goals (SDGs) are a set of 17 global goals established by the United Nations in 2015, as part of the 2030 Agenda for Sustainable Development. These goals aim to address a wide range of global challenges, including poverty, inequality, environmental degradation, climate change, and peace and justice, with the overarching aim of creating a better, more sustainable future for all.



The concept of the Sustainable Development Goals (SDGs) originated at the United Nations Conference on Sustainable Development held in Rio de Janeiro, Brazil in 2012, also known as Rio+20. The conference aimed to address global environmental and development challenges and to build on the earlier Millennium Development Goals (MDGs), which were established in 2000 with a target year of 2015.

At Rio+20, world leaders recognized that while the MDGs had made progress in areas like reducing poverty and improving health, there were still significant gaps, especially in terms of sustainability and equity. This led to the agreement to develop a new set of comprehensive goals that would apply universally to all countries, addressing not just poverty and social issues but also environmental concerns, economic growth, and governance.

The formal process of creating the SDGs was led by a working group of member states, with inputs from civil society, businesses, and other stakeholders. In 2015, the UN General Assembly formally adopted the 2030 Agenda for Sustainable Development, including the 17 SDGs, as a global framework to end poverty, protect the planet, and ensure prosperity for all by 2030.

2.2. 17 Sustainable Development Goals (SDGs)

The **2030 Agenda for Sustainable Development**, adopted by all **UN Member States** in **2015**, provides a shared blueprint for peace and prosperity for people and the planet in the present and future. At its core are the **17 Sustainable Development Goals (SDGs)**, which are a call to urgent action by all developed and developing countries in a global partnership. The list of 17 Sustainable Development Goals (Annexure-2.1)

The Sustainable Development Goals (SDGs) are a universal call to action aimed at ending poverty, protecting the planet, and ensuring peace and prosperity for all people by 2030. Among these 17 goals, **Goal 6: Clean Water and Sanitation** focuses specifically on water resources. This goal encompasses a broad spectrum of targets related to water quality, access, management, and sustainability.



2.3. Goal 6: Clean Water and Sanitation

2.3.1. Overview

Goal 6 aims to ensure availability and sustainable management of water and sanitation for all. It includes several specific targets:

- I. Improve water quality by reducing pollution
- II. Eliminate dumping and release of hazardous materials
- III. Reduce the proportion of untreated wastewater
- IV. Increase recycling and safe reuse of water

2.3.2. Introduction to SDG 6 and SEEA-Water

The Sustainable Development Goals (SDGs), established by the United Nations in 2015, represent a global blueprint for achieving a better and more sustainable future for all. Goal 6: Clean Water and Sanitation, is dedicated to ensuring the availability and sustainable

management of water and sanitation for all. This goal is vital, as water is fundamental to health, food security, and ecosystem stability.

The System of Environmental-Economic Accounting for Water (SEEA-Water) is an internationally recognized framework that provides standardized methods for collecting and analysing water-related data. SEEA-Water integrates environmental data with economic accounts, offering a holistic approach to managing water resources. This methodology is particularly important for monitoring the progress of Goal 6, as it enables the development of comprehensive indicators and supports informed decision-making.

2.4. Targets of SDG 6

In 2023, the United Nations outlined specific goals and targets under SDG 6 to accelerate progress towards sustainable water and sanitation:

i. Target 6.1: Achieve Universal Access to Safe and Affordable Drinking Water - Target 6.1 aims to achieve universal and equitable access to safe and affordable drinking water for all by 2030. Currently, around 2.2 billion people worldwide lack safely managed

drinking water services, and billions more lack access to basic sanitation facilities, which undermines health, education, and livelihood opportunities (UN, 2020).

Efforts under this target include improving infrastructure, such as water supply systems and water treatment facilities, particularly in underserved and rural areas. Strategies involve increasing investment in water infrastructure, promoting community-based water management initiatives, and ensuring water quality standards are met to eliminate waterborne diseases.

ii. Target 6.2: Achieve Access to Adequate and Equitable Sanitation and Hygiene - Target 6.2 focuses on achieving access to adequate and equitable sanitation and hygiene for all, with special attention to the needs of women, girls, and vulnerable populations by 2030. Globally, around 4.2 billion people still lack access to safely managed sanitation services, leading to significant health risks and environmental pollution (UN, 2020).

This target addresses the challenge of ending open defecation and ensuring access to proper sanitation facilities, which is crucial for public health and dignity. Strategies include promoting



hygiene education, building sanitation infrastructure, and integrating sanitation solutions into urban planning and development policies.

iii. Target 6.3: Improve Water Quality and Reduce Pollution -Improving water quality (Target 6.3) involves reducing pollution, minimizing the release of hazardous chemicals and untreated wastewater, and increasing recycling and safe reuse of water globally by 2030. Water pollution affects over 80% of the world's wastewater, with untreated discharge threatening human health and ecosystems (UN, 2020).

This target addresses the environmental impact of water pollution on ecosystems and human health. Strategies include enforcing regulations on industrial and agricultural wastewater treatment, promoting eco-friendly practices, and investing in technologies for water purification and recycling.

iv. Target 6.4: Increase Water-Use Efficiency and Address Water Scarcity -Target 6.4 aims to substantially increase water-use efficiency across all sectors and ensure sustainable withdrawals and supply of freshwater to address water scarcity by 2030. Currently, more than 2 billion people live in countries experiencing high water stress, exacerbated by climate change and population growth (UN, 2020).

This target is critical in the face of growing global water scarcity due to climate change and population growth. Strategies include implementing water-saving technologies, promoting efficient irrigation practices in agriculture, and enhancing water governance and allocation frameworks.

v. Target 6.5: Implement Integrated Water Resources Management-Implementing integrated water resources management (Target 6.5) at all levels, including transboundary cooperation, aims to ensure sustainable water use and equitable access to water resources. This target emphasizes the need for coordinated efforts among governments, communities, and stakeholders to manage water resources effectively.

Strategies include developing watershed management plans, fostering international cooperation on shared water bodies, and integrating climate change adaptation measures into water management practices.

vi. Target 6.6: Protect and Restore Water-Related Ecosystems -Protecting and restoring water-related ecosystems (Target 6.6) such as wetlands, rivers, and lakes is crucial for maintaining biodiversity and ecosystem services that support livelihoods and sustainable development. This target involves preserving natural habitats, reducing habitat degradation, and promoting sustainable use of water resources.

Strategies include establishing protected areas, implementing ecological restoration projects, and integrating ecosystem considerations into water infrastructure planning.

vii. Targets 6.A, 6.B, and 6.C: Strengthening International Cooperation and Capacity Building-Targets 6.A, 6.B, and 6.C focus on expanding international cooperation, supporting local community participation, and developing integrated water resources management plans.

These targets underscore the importance of global solidarity and collaboration in achieving water-related SDGs.

Strategies include providing financial and technical support to developing countries, enhancing local governance structures, and building capacity in water and sanitation management.

India has been actively working towards aligning its water management policies and practices with international frameworks like the **System of Environmental-Economic Accounting for Water (SEEA-Water)** and the water-related **Sustainable Development Goals (SDGs)**. Several initiatives, policies, and programs are in place to enhance water governance, improve data collection, and ensure sustainable water use in the country.

2.5. Developing Indicators

The development of comprehensive indicators is essential for monitoring progress towards the targets of Goal 6. System of Environmental Economic Accounting (SEEA)-Water of the United Nations, provides a robust framework for creating such indicators, integrating physical, quality, and economic data related to water resources.

Indicators developed within the SEEA-Water framework include measures of water quality, wastewater treatment, water use efficiency, and the economic value of water resources. These indicators are used to set benchmarks, track progress, and inform policy decisions. They are crucial for identifying areas needing improvement and for ensuring that the targets of Goal 6 are met.

2.6. Role of SEEA-Water in measuring Goal 6 Targets

SEEA-Water methodology aids in the systematic collection, recording, and analysis of water-related data, which is essential for the following:

- I. **Tracking Water Quality Improvements:** SEEA-Water helps in monitoring the reduction of pollutants and hazardous materials in water bodies. This involves measuring the levels of contaminants and assessing the effectiveness of pollution control measures.
- II. **Monitoring Wastewater Treatment:** By accounting for the sources, volumes, and treatment levels of wastewater, SEEA-Water provides data necessary for evaluating the proportion of untreated wastewater and efforts to improve wastewater management systems.
- III. **Assessing Recycling and Reuse:** SEEA-Water tracks water recycling and reuse activities, helping to gauge progress towards more sustainable water usage practices. This includes quantifying the amount of water recycled and reused across different sectors and regions.

- IV. **Developing Comprehensive Indicators:** SEEA-Water provides a framework for developing detailed and comparable indicators that align with the targets of Goal 6. These indicators are crucial for setting benchmarks, monitoring progress, and making informed decisions to enhance water sustainability.

2.7. India's Progress, SDGs:

Adoption of SEEA-Water Framework:

- I. **Ministry of Statistics and Programme Implementation (MoSPI):** MoSPI has been working on environmental-economic accounting, including water, through its **Natural Capital Accounting and Valuation of Ecosystem Services (NCAVES)** project, which aligns with the SEEA framework. This helps India integrate water resource data into its economic statistics.
- II. India is gradually moving towards producing SEEA-compliant water accounts that capture water supply, use, and quality, which can help monitor water resources more effectively.

2.8. International, National & States Initiatives

2.8.1. International Organisations:

- I. **UN Environment Programme (UNEP) and the UN Department of Economic and Social Affairs (UNDESA):** These bodies support countries in implementing SEEA-Water by providing guidelines, technical assistance, and capacity-building workshops. Their goal is to help nations produce the necessary data for SDG reporting and sustainable water governance.
- II. **UN-Water:** It coordinates efforts across various UN agencies and international organizations to track progress on water-related SDGs, ensuring data collection efforts align with SEEA-Water standards.
- III. **World Bank and International Monetary Fund (IMF):** These institutions use SEEA-Water and related frameworks to evaluate the sustainability of water resource investments, ensuring that they contribute to long-term environmental and economic stability.



- IV. **FAO:** The **Food and Agriculture Organization** incorporates SEEA-Water in its work on water use in agriculture, especially in tracking how irrigation and water management contribute to food security and rural development.

2.8.2. National Initiatives on Water Management & its link with SDG Goal 6

India's efforts to achieve SDG **Goal 6** (Clean Water and Sanitation) are reflected in multiple national-level initiatives:

- I. **Jal Jeevan Mission (JJM):** Launched in 2019, this flagship program aims to provide functional household tap connections to every rural household by 2024. It addresses **SDG Target 6.1** by ensuring access to safe and affordable drinking water.
- II. **Atal Bhujal Yojana (ABHY):** This government scheme focuses on groundwater management in over-exploited and water-stressed areas, contributing to **SDG Target 6.4** by promoting the sustainable withdrawal and efficient use of water resources.
- III. **Namami Gange Programme:** Aims at rejuvenating the Ganga River through comprehensive river basin management and pollution abatement measures. This is aligned with **SDG Target 6.6**, which emphasizes protecting and restoring water-related ecosystems.
- IV. **Jal Shakti Abhiyan:** This campaign promotes water conservation and water resource management through awareness, rainwater harvesting, and other initiatives, supporting integrated water management in line with **SDG Target 6.5**.

The schemes referred in above para depicts its connection with SDG Goal 6. However, the motive of schemes referred in chapter 4 ahead depicts its linkage with water management.

2.8.3. State level Initiatives on Water Management & its link with SDG Goal 6

Several Indian states have launched their own water management initiatives, often tailored to their specific water challenges. Here are some notable state-level initiatives on water management and how they align with Sustainable Development Goal (SDG) 6:

State	Scheme Name	Objective	Connection with SDG 6
Maharashtra	Jalyukt Shivar Abhiyan	A state-wide initiative aimed at making villages drought-free by improving water conservation, rainwater harvesting, and groundwater recharge.	Target 6.5: This initiative promotes integrated water resources management by constructing water storage structures like check dams and desilting water bodies. Target 6.4: It enhances the sustainable use of water resources, especially in drought-prone areas, and focuses on long-term water security.

State	Scheme Name	Objective	Connection with SDG 6
Gujarat	Sujalam Sufalam Yojana	A water conservation initiative aimed at deepening water bodies, rejuvenating rivers, and creating water storage structures to mitigate water scarcity.	Target 6.6: Protecting and restoring water-related ecosystems by rejuvenating rivers and lakes. Target 6.1: Increasing access to water through the creation of more reliable water sources
Rajasthan	Mukhya Mantri Jal Swavlamban Abhiyan (MJSA)	Aimed at making villages self-reliant in water by improving water conservation through community participation, constructing water harvesting structures, and planting trees for watershed management	Target 6.5: Promotes integrated water resources management by focusing on both water conservation and management through public involvement. Target 6.6: Restores and conserves local water-related ecosystems.
Telangana	Mission Kakatiya	Focuses on rejuvenating over 46,000 minor irrigation tanks to improve groundwater recharge, increase irrigation capacity, and reduce rural water stress.	Target 6.4: Ensures the efficient use of water resources by reviving traditional water storage systems. Target 6.6: Protects and restores water-related ecosystems through desilting and restoring traditional tanks.
Karnataka	Watershed Development Programme	Aimed at sustainable watershed development in drought-prone regions, focusing on soil and water conservation through check dams, contour bunding, and afforestation.	Target 6.5: Promotes integrated water resources management and the sustainable use of water resources through conservation and restoration measures. Target 6.6: Restores local ecosystems by conserving soil and improving water availability in rural areas.

State	Scheme Name	Objective	Connection with SDG 6
Tamil Nadu	Kudimaramathu Scheme	Reviving and restoring traditional water bodies (lakes, ponds, and canals) with community participation to improve irrigation and groundwater recharge.	Target 6.4: Increases sustainable water usage by restoring local water bodies. Target 6.6: Revives water ecosystems, contributing to groundwater recharge and improved water quality.
Andhra Pradesh	Neeru-Chettu Program	A flagship program focused on enhancing water conservation, recharging groundwater, and restoring water bodies across the state.	Target 6.4: Promotes sustainable use of water resources through conservation, rainwater harvesting, and water recycling initiatives. Target 6.6: Protects water ecosystems by restoring lakes and rivers and improving overall water quality.
Punjab	Pani Bachao, Paisa Kamao (Save Water, Earn Money)	An innovative initiative aimed at encouraging farmers to use water efficiently by rewarding them for saving electricity and water used for irrigation.	Target 6.4: Promotes sustainable water withdrawals by incentivizing efficient water use in agriculture.

2.9. Water Resource Monitoring and Data Collection:

Central Water Commission (CWC) and Central Ground Water Board (CGWB):

These agencies are involved in the collection and dissemination of hydrological and groundwater data. This data is crucial for policy-making and reporting on India's progress in terms of the SDGs.

National Hydrology Project (NHP):

Funded by the World Bank, this project aims to modernize India's water resource monitoring systems by integrating real-time data into decision-making processes. It contributes to **SEEA-Water** by improving water accounting and reporting mechanisms.

2.10. Water Policy and Legislative Framework:

India has adopted a **National Water Policy 2012**⁸ that emphasizes the efficient use of water, demand-side management, and participatory approaches to water governance, echoing the principles of integrated water resource management outlined in the SEEA-Water framework.

2.11. International Cooperation and Capacity Building:

UN-Water and UNEP Partnerships: India collaborates with international bodies like UN-Water and UNEP on capacity-building programs for water accounting, including training and workshops on the SEEA framework.

South Asia Water Initiative (SAWI): India, along with neighbouring countries, is part of SAWI, which promotes transboundary water cooperation and integrated river basin management, aligned with SEEA-Water principles and SDGs.

India is making concerted efforts to improve water resource management, integrate environmental-economic data, and meet SDG 6 targets through a combination of national programs, policy frameworks, and international collaboration.

While India has made significant strides, there are challenges in terms of data availability, fragmented institutional roles, and ensuring the equitable distribution of water resources.

2.12. Conclusion

SDG 6 is pivotal for achieving sustainable development globally and in India. By addressing challenges related to water scarcity, sanitation, water quality, and equitable access, countries can ensure universal access to clean water and sanitation services, contributing to improved health outcomes, environmental sustainability, and economic development. Achieving these goals requires coordinated efforts from governments, civil society, private sector stakeholders, and international organizations to overcome barriers, leverage opportunities, and build a resilient and sustainable future for generations to come.

Achieving SDG 6 requires coordinated efforts across sectors and stakeholders, robust policy frameworks, and significant investments in infrastructure and capacity building. While progress has been made, challenges such as climate change impacts, population growth, and inadequate funding remain. However, through collective action, innovation, and sustained commitment, the vision of universal access to safe water and sanitation can be realized, contributing to healthier communities, resilient ecosystems, and sustainable development globally.

⁸ https://nwm.gov.in/sites/default/files/national%20water%20policy%202012_0.pdf

2.13. Future Directions

The SEEA-Water methodology is instrumental in achieving and measuring the targets of Goal 6. By providing a comprehensive framework for water accounting, SEEA-Water supports the development of detailed indicators and informed decision-making.

Looking ahead, the continued refinement and implementation of SEEA-Water will be vital for addressing the complex challenges associated with water resources. Future directions may include the integration of new technologies for data collection and analysis, as well as increased collaboration between governments, organizations, and communities to enhance water sustainability efforts.

By leveraging the capabilities of SEEA-Water, we can make significant strides towards ensuring clean water and sanitation for all, contributing to the broader goals of the SDGs and fostering a sustainable future.

Water recycling and reuse are crucial for sustainable water management. SEEA-Water provides methodologies for quantifying the amount of water recycled and reused across different sectors, such as agriculture, industry, and municipal services. This data is captured in the Physical Supply and Use Tables and is linked with economic accounts to assess the benefits and costs of recycling initiatives.

By tracking water reuse activities, SEEA-Water enables the evaluation of policies and technologies aimed at promoting recycling and safe reuse of water. This information is key to achieving the targets of Goal 6 and ensuring the long-term sustainability of water resources.

Annexure – 2.1

Goal No.	Goal Description
1. No Poverty	End poverty in all its forms everywhere
2. Zero Hunger	End hunger, achieve food security and improved nutrition and promote sustainable agriculture
3. Good Health and Well	Being: Ensure healthy lives and promote well-being for all at all ages
4. Quality Education	Ensure inclusive and equitable quality education and promote lifelong learning opportunities for all
5. Gender Equality	Achieve gender equality and empower all women and girls
6. Clean Water and Sanitation	Ensure availability and sustainable management of water and sanitation for all
7. Affordable and Clean Energy	Ensure access to affordable, reliable, sustainable and modern energy for all
8. Decent Work and Economic Growth	Promote sustained, inclusive and sustainable economic growth, full and productive employment and decent work for all
9. Industry, Innovation and Infrastructure	Build resilient infrastructure, promote inclusive and sustainable industrialization and foster innovation
10. Reduced Inequalities	Reduce inequality within and among countries
11. Sustainable Cities and Communities	Make cities and human settlements inclusive, safe, resilient and sustainable
12. Responsible Consumption and Production	Ensure sustainable consumption and production patterns
13. Climate Action:	Take urgent action to combat climate change and its impacts
14. Life below Water	Conserve and sustainably use the oceans, seas and marine resources for sustainable development
15. Life on Land	Protect, restore and promote sustainable use of terrestrial ecosystems, sustainably manage forests, combat desertification, halt and reverse land degradation, and halt biodiversity loss
16. Peace and Justice Strong Institutions	Promote peaceful and inclusive societies for sustainable development, provide access to justice for all and build effective, accountable and inclusive institutions at all levels
17. Partnership for the Goals	Strengthen the means of implementation and revitalize the global partnership for sustainable development

Chapter 3

System of Environmental-Economic
Accounting (SEEA) -
Framework for Water Resources



System of Environmental-Economic Accounting (SEEA) -Framework for Water Resources

3.1. System of Environmental-Economic Accounting (SEEA)-Genesis

The UN has promoted the integration of environmental factors in national accounts ever since the early 1980s. In conjunction with various other organizations, the UN has launched a number of initiatives, all of which are aimed at providing a complement to conventional systems of national accounts by enabling countries to measure depletion of natural resources and the degree of environmental degradation.

The first environmental accounts were constructed by Norway in 1970s. After that World Commission on Environment and Development, also known as the Brundtland Commission set up in 1987. The report of this Commission popularized the concept of sustainable development as an alternative to unfettered economic growth and defined “sustainable development” as “development that meets the needs of the present without compromising the ability of future generations to meet their own needs.”



This was followed by the UN Earth Summit held in Rio de Janeiro in 1992. In this Summit - Agenda 21 recommended, among other steps, that - a first step towards the integration of sustainability into economic management is the establishment of better measurement of the crucial role of the environment as a source of natural capital and as a sink for by-products generated during the production of man-made capital and other human

activities. As sustainable development encompassing social, economic and environmental dimensions and therefore, a program to develop national systems of integrated environmental and economic accounting in all countries is proposed.

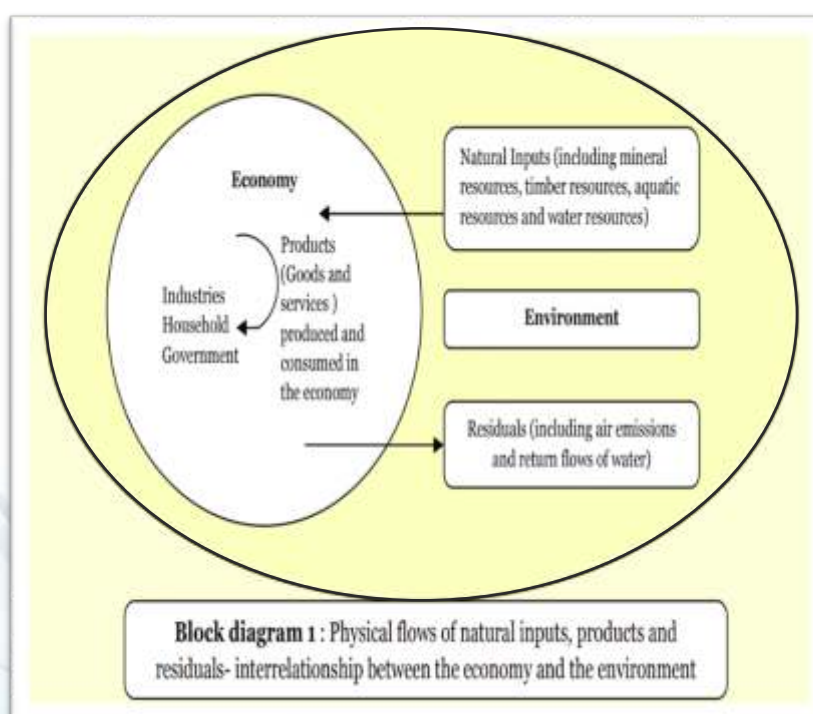
The outcome document of the UN Conference on Sustainable Development held also in Rio in 2012 reconfirmed that need for environmental accounting in decision making processes. Successive follow up meetings as shown below:

3.2. System of Environmental-Economic Accounting (SEEA)-Central Framework

The United Nations Security Council (UNSC) adopted the System of Environmental-Economic Accounting (SEEA)-Central Framework as the initial international statistical standard for environmental economic accounting, to be implemented in a flexible and modular approach in 2012.

The SEEA Central Framework is the international standard for environmental-economic accounting consisting of a comprehensive set of tables and accounts, which guides the compilation of consistent and comparable statistics and indicators for policy making, analysis and research. It is a multipurpose conceptual framework for understanding the interactions between the economy and the environment, and for describing stocks and changes in stocks of environmental assets. It puts statistics on the environment and its relationship to the economy at the core of official statistics.

This version of the SEEA is an outcome of much path-breaking work on extending and refining concepts for the measurement of the interaction between the economy and the environment. As an accounting system, it enables the organization of information into tables and accounts in an integrated and conceptually coherent manner. Regular compilation of environmental economic accounts in countries as part of a programme of official statistics will foster international statistical comparability, provide policy-relevant information at national, regional and international levels, improve the quality of the resulting statistics and ensure a better understanding of the measurement concepts.



The following block diagram discusses the inter-relation between the economy and the environment:

The SEEA-CF provides information related to a broad spectrum of environmental and economic issues including, in particular, the assessment of trends in the use and availability of natural resources, the extent of emissions and discharges to the environment resulting from economic activity, and the amount of economic activity undertaken for environmental purposes.

3.3. Accounting principles as defined in System of Environmental-Economic Accounting (SEEA)-- Water

System of Environmental-Economic Accounting (SEEA)-Water is a satellite system of the 2008 SNA and an elaboration of the SEEA framework. It comprises the five categories of accounts described below.

Category 1: Physical supply and use tables and emission accounts.

This category of accounts brings together, in a common framework using definitions and classifications of the standard economic accounts of the 2008 SNA, hydrological data on the volume of water used and discharged back into the environment by the economy, as well as the quantity of pollutants added to the water.

Bringing the physical information on water into the accounting framework introduces checks and balances into the hydrological data and produces a consistent data system from individual sets of water statistics often collected independently by different line ministries responsible for designing targeted policies.

Physical supply and usage tables provide information on the volumes of water exchanged between the environment and the economy (abstractions and returns) and within the economy (supply and use). Emission accounts provide information by economic activity and households on the quantity of pollutants which have been added to or removed from the water (by treatment processes) during its use.

Category 2: Hybrid and economic accounts.

This category of accounts aligns physical information recorded in the physical supply and use tables with the monetary supply and use tables of the 2008 SNA. These accounts are referred to as “hybrid” flow accounts in order to reflect the combination of different types of measurement units in the same accounts. In these accounts, physical quantities can be compared with matching economic flows, for example, linking the volumes of water used with monetary information on the production process, such as value added, and deriving indicators of water efficiency.

This category of accounts also explicitly identifies those elements of the existing 2008 SNA which are relevant to water. These include, for example, information on the costs associated with water use and supply, such as water abstraction, purification, distribution and

wastewater treatment. Those elements of the 2008 SNA also furnish information on financing, that is, the amount that users pay for the services of wastewater treatment, for example, and the extent to which those services are subsidized by the Government and other units.

These accounts are particularly useful for cost-recovery policies and water-allocation policies; they can also be compiled for activities aimed at the protection and management of water resources to obtain information on national expenditure and financing by industries, households and the Government.

Category 3: Asset accounts.

This category of accounts comprises accounts for water resource assets measured mostly in physical terms. Asset accounts measure stocks at the beginning and the end of the accounting period and record the changes in the stocks that occur during the period.

They describe all increases and decreases of the stock due to natural causes, such as precipitation, evapotranspiration, inflows and outflows, and human activities, such as abstraction and returns.

These accounts are particularly useful because they link water abstraction and return to the availability of water in the environment, thus enabling the measurement of the pressure on physical water induced by the economy.

Category 4: Quality accounts.

This category of accounts describes the stock of water in terms of its quality. It should be noted that the quality accounts are still experimental. Quality accounts describe the stocks of water resources in terms of quality: they show the stocks of certain qualities at the beginning and the end of an accounting period.

Because it is generally difficult to link changes in quality to the causes that affect it, quality accounts describe only the total change in an accounting period, without further specifying the causes.

Category 5: Valuation of water resources.

The final category of the SEEA-Water accounts comprises the valuation of water and water resources. With regard to the quality accounts, this category of accounts is still experimental; there is still no agreement on a standard method for compiling them.

When natural resources are used in the production process, they are embodied in the final good or service produced. The price charged for the product contains an element of rent, which implicitly reflects the value of the natural resource. Establishing this implicit element is at the heart of valuing the stock of the resource.

In the case of water, however, which is often an open access resource, this implicit element is often zero. Increasingly, water is being treated as an economic good. Therefore, it is expected that in the future the resource rent for water would be positive and thus the value of the water stocks would be included in the balance sheets of a country.

The valuation of water resources is included in SEEA-Water because of its policy relevance. However, since no agreement has yet been reached on how to value water (consistent with 2008 SNA valuation concepts), SEEA-Water presents only the valuation techniques commonly used in economic analyses, which may go beyond the value of the market transactions recorded in the 2008 SNA, and their relationship to the concepts of the 2008 SNA, while discussing the advantages and disadvantages of different techniques.

3.4. Implementation of System of Environmental-Economic Accounting (SEEA)-Water in India

The System of Environmental Economic Accounting (SEEA) provides policy makers and decision-makers with information that accounts for the value nature contributes to our economies. India is one of 90 countries that have successfully adopted the system including the new framework for SEEA - Ecosystem Accounting.

India's efforts, led by the Indian Ministry of Statistics and Programme Implementation were supported by the European Union funded project "Natural Capital Accounting and Valuation of Ecosystem Services" (NCAVES), which is implemented by the United Nations Environment Programme (UNEP), United Nations Statistics Division and the Secretariat of the Convention of Biological Diversity (CBD).

With regard to the development of natural capital accounts in India, the Expert Group, constituted under the Chairmanship of Prof. Sir Partha Dasgupta, released its report, "Green National Accounts in India-A Framework" in 2013 and recommended compilation of the accounts envisaged in the SEEA-CF in phased manner. Further, with the adoption of the common SEEA framework by the United Nations Statistical Commission (UNSC), which provides an internationally agreed set of 2 recommendations for the development of environmental-economic accounts and related statistics, the Ministry of Statistics and Programme Implementation (MoSPI) has been proactive in developing such accounts under the SEEA Framework.

The Ministry of Statistics & Programme Implementation has adopted the SEEA framework in 2018 and has been regularly compiling accounts on various ecosystems. In order to showcase the work done by India in the domain of Environment Accounting and to pave the way for future endeavours toward expanding the coverage of the Environment Accounts in India.

3.5. Additional other Key Organisations in India working as per System of Environmental-Economic Accounting (SEEA) - Water alignment

The various Institutes in India along with their role and SEEA Water alignment are enumerated in the following table:

Sl. No.	Key Organization	Role	SEEA-Water Alignment
1.	Central Water Commission (CWC)	Responsible for initiating, coordinating, and promoting measures for the control, conservation, and utilization of water resources across India.	CWC works on water resource assessments, water use efficiency, and basin-level water planning, which align with SEEA-Water principles.
2.	National Institute of Hydrology (NIH)	Engages in research and development related to surface and groundwater hydrology, water quality, and water resources management.	The institute conducts water accounting and assessments that are important for water resource sustainability, which is in line with SEEA-Water.
3.	National Water Academy (NWA)	A premier institute that focuses on capacity building for water resources management through training programs.	NWA provides training on water auditing, management, and integrated water resources planning, which aligns with the SEEA framework.
4.	Indian Institute of Water Management (IIWM)	Conducts research on water management strategies, particularly in agriculture.	Their research on sustainable agricultural practices and efficient water use in agriculture complements SEEA-Water by integrating water management with economic and environmental sustainability.
5.	National Remote Sensing Centre (NRSC)	Works on satellite data and remote sensing applications, including water resource monitoring.	NRSC contributes to water accounting by providing data for water resource assessment and management through remote sensing

Sl. No.	Key Organization	Role	SEEA-Water Alignment
			technology, aligning with the SEEA-Water framework.
6.	Central Ground Water Board (CGWB)	Focuses on the monitoring, development, and management of groundwater resources in India.	CGWB's work on groundwater assessments and policies ties into water accounting and sustainable management, as prescribed by SEEA-Water.
7.	Ministry of Jal Shakti	The main governmental body for water resources management and planning.	Under various programs such as the National Water Mission and Jal Jeevan Mission, this ministry is actively working towards sustainable water management practices that are consistent with SEEA-Water.

3.6. Conclusion

The SEEA Framework for Water Resources is vital for India to manage its water resources more effectively. By integrating water data with economic accounting, the framework supports sustainable water policies that address India's diverse needs—agriculture, urbanization, industry, and environmental conservation. Implementing SEEA in India could significantly contribute to better resource management, mitigate the effects of climate change, and ensure sustainable growth.



Chapter 4

Water Resources Management in India
(WRM)

Water Resources Management in India (WRM)

4.1. Evolution of International Milestones with respect to Water Resources Management

Water Resource Management is the strategic planning and regulation of water usage and distribution to meet the needs of various users while ensuring sustainability and environmental protection. It involves balancing the needs of various stakeholders—including agriculture, industry, and communities—while ensuring sustainable practices that protect ecosystems.

Monitoring water quality is crucial for preventing pollution and protecting ecosystems. Regulatory frameworks guide water allocation and usage rights, often involving collaboration between governments, businesses, and communities. Effective Water Resource Management aims to maximize water availability, improve water quality, and mitigate the impacts of droughts and floods, ensuring equitable access and long-term sustainability for current and future generations.

By the 20th century, with growing industrialization and urbanization, Water Resource Management became a critical global issue. This period saw the construction of large dams, aimed at providing water storage, flood control, and hydropower. However, by the late 20th century, environmental concerns about the sustainability of such projects emerged. The **Integrated Water Resource Management (IWRM)** approach was developed to balance the water demands of agriculture, industry, and domestic users, while protecting ecosystems. International frameworks, like the Dublin Principles (1992) and the United Nations' Sustainable Development Goals (SDG 6), emphasize equitable access to clean water and sustainable management.

Water Resources Management have evolved significantly over the decades, reflecting growing awareness of the importance of sustainable water use all around the globe. Here are some key milestones:

- a. The 1977 United Nations Water Conference (Mar del Plata): This was the first major international conference dedicated solely to water, where the concept of "water as a finite resource" was recognized. It also stressed the need for access to clean drinking water and sanitation.
- b. Agenda 21 and the Rio Earth Summit (1992): Water resources management was highlighted as a critical part of sustainable development in this landmark agreement. It promoted integrated approaches to water, land, and ecosystem management.
- c. World Water Forums (since 1997): Held every three years, these forums bring together Governments, organizations, and experts to discuss global water challenges and develop strategies for sustainable water management.

- d. United Nations Sustainable Development Goals (SDGs) (2015): SDG 6 focuses specifically on ensuring availability and sustainable management of water and sanitation for all, targeting access, quality, and efficiency of water use by 2030.
- e. Paris Agreement (2015): Though focused on climate change, the Paris Agreement recognized water as central to adaptation strategies, with water scarcity and floods being major concerns in the context of a changing climate.
- f. UN High-Level Panel on Water (2016): Co-convened by the United Nations and World Bank, this initiative aimed to mobilize global action on sustainable water management, focusing on water governance, financing, and innovation.
- g. The 2023 UN Water Conference: Held 46 years after the last dedicated water conference, this event focused on accelerating action to achieve global water goals, emphasizing cross-border cooperation and innovative approaches to water crisis.

4.2. What is Water Resource Management?

Water Resources Management (WRM) is the process of planning, developing, and managing water resources, in terms of both water quantity and quality, across all water uses. It includes the institutions, infrastructure, incentives, and information systems that support and guide water management.



Water Resource Management seeks to

- a. harness the benefits of water by ensuring there is sufficient water of adequate quality for drinking water and sanitation services, food production, energy generation, inland water transport, and water-based recreational;
- b. sustaining healthy water-dependent ecosystems and protecting the aesthetic and spiritual values of lakes, rivers, and estuaries;
- c. Managing water-related risks, including floods, drought, and contamination.

Globally, WRM is approached from a coordinated development and management of water, land and other related resources as is prescribed by the Global Water Partnership. The intended approach is to maximize the resultant economic and social welfare in an equitable manner without compromising the sustainability of vital ecosystems.

4.3. Necessity for Water Resource Management

4.3.1. Water Scarcity

Water scarcity refers to a situation where the demand for freshwater exceeds its available supply, resulting in insufficient water for drinking, agriculture, and sanitation. It can arise from factors like population growth, climate change, pollution, and poor

water management. Water scarcity can be classified as physical scarcity, where there is not enough water, or economic scarcity, where water is available but inaccessible due to financial or infrastructural barriers. This condition poses serious challenges to human health, food security, and economic development.

4.3.2. Pollution

The contamination of water bodies, such as rivers, lakes, oceans, and groundwater, due to harmful substances causes pollution of water. These substances include chemicals, waste materials, plastics, and pathogens, which can originate from industrial discharges, agricultural runoff, sewage, and littering. The presence of these pollutants adversely affects aquatic ecosystems, harming wildlife and disrupting food chains. Additionally, polluted water poses significant health risks to humans, leading to diseases and compromised drinking water sources. Addressing water pollution is essential for preserving biodiversity and ensuring safe water for all.

4.3.3. Climate Change

Climate change refers to long-term shifts in temperature and weather patterns, primarily due to human activities. With respect to water, it leads to significant impacts such as altered precipitation patterns, increased evaporation, and more extreme weather events. These changes can cause droughts in some areas, reducing freshwater availability, while others may experience heavier rainfall and flooding. Additionally, rising temperatures contribute to the melting of glaciers and polar ice, resulting in rising sea levels and affecting coastal ecosystems. Overall, climate change disrupts the water cycle, impacting water quality, supply, and ecosystem health.

4.4. Major methods for Water Resource Management :

Effective water resource management is crucial for ensuring sustainable access to clean water, and it involves a variety of methods that address both conservation and efficient usage-

- a. **Policy and Regulation Development:** Establishing and enforcing regulations on water usage, pollution control, and sustainable practices across different sectors.
- b. **Water Supply Infrastructure Improvement:** Upgrading and expanding water supply systems, including pipelines and treatment facilities, to enhance efficiency and reduce losses from leaks.
- c. **Rainwater Harvesting Initiatives:** Promoting the installation of rainwater harvesting systems in homes, schools, and businesses to supplement water supply during dry periods.
- d. **Wastewater Management and Treatment:** Implementing effective wastewater treatment systems to recycle and reuse water, reducing demand on freshwater sources.
- e. **Climate Resilient Water Management:** Climate-resilient water management refers to strategies and practices designed to ensure that water systems can withstand

and adapt to the impacts of climate change, such as altered precipitation patterns, increased temperatures, and more frequent extreme weather events

4.5. Water Resources Management initiatives in India.

India, home to 16% of the world's population but only 4% of global freshwater resources, faces a unique set of challenges in water management. Traditionally, India's water management revolved around local practices, such as tanks, stepwells, and small-scale irrigation systems. Post-independence, India's focus shifted towards large dam projects, with iconic structures like the Bhakra-Nangal Dam built to address water supply, irrigation, and hydropower needs. By the 1980s, concerns about the environmental and social impacts of such large infrastructure projects emerged. This led to a greater emphasis on decentralized and participatory water management approaches. Groundwater, a critical resource for Indian agriculture, became increasingly exploited, leading to serious concerns about over-extraction and contamination.

Water resources management encompasses a range of strategies and practices aimed at optimizing the use of water across various sectors, including agriculture, industry, and domestic consumption. These initiatives seek to balance human needs with ecological sustainability by employing integrated approaches that account for the interconnected relationships between water systems, land use, and environmental health.

4.5.1. National Initiatives:

The Government of India has launched several national initiatives to manage and conserve its water resources, addressing challenges like water scarcity, pollution, and overuse. Some of the key national initiatives include:

Sl. No	Name of Scheme	Scheme Objective	Scheme Focuses on Water Resource Management
1.	Jal Jeevan Mission (JJM)	Launched in 2019, Jal Jeevan Mission aims to provide safe and adequate drinking water to every rural household in India through functional household tap connections by 2024.	Ensuring water quality and promoting rainwater harvesting and groundwater recharge.
2.	Namami Gange Programme (NGP)	This flagship initiative, launched in 2014, focuses on cleaning and rejuvenating the Ganga River and its tributaries.	River surface cleaning, treatment of industrial effluents, rural sanitation, and afforestation along the river banks.
3.	Pradhan Mantri Krishi Sinchayee Yojana (PMKSY)	Started in 2015, PMKSY aims to improve irrigation efficiency by providing water to every farm ("Har Khet Ko Pani") and ensuring	Watershed development, rainwater harvesting, micro-irrigation (drip and sprinkler systems), and efficient water use in agriculture.

Sl. No	Name of Scheme	Scheme Objective	Scheme Focuses on Water Resource Management
		more crop per drop through effective water conservation.	
4.	Atal Bhujal Yojana (ABY)	This groundwater management initiative was launched in 2020 to improve groundwater levels in areas facing critical water shortages.	Community-led sustainable groundwater management, groundwater conservation, and recharge efforts in water-stressed regions.
5.	National Water Mission (NWM)	Part of India's National Action Plan on Climate Change (NAPCC), the NWM aims to ensure integrated Water Resource Management, conservation of water, and equitable distribution of resources.	Increasing water use efficiency by 20%, promoting basin-level Water Resource Management, and developing better water data systems.
6.	National Mission for Clean Ganga (NMCG)	As a subset of the broader Namami Gange program, the NMCG focuses on long-term strategies for cleaning and rejuvenating the Ganga River.	Reducing pollution, improving sewage treatment infrastructure, and promoting afforestation along riverbanks.
7.	Jal Shakti Abhiyan (JSA)	Launched in 2019, this initiative promotes water conservation and rainwater harvesting across India, with a focus on water-stressed districts.	Encourages a community-driven, district-based approach to rainwater harvesting, watershed management, and groundwater recharge.
8.	National Hydrology Project (NHP)	This initiative focuses on improving the monitoring and data collection of water resources across the country.	Establishing a nationwide water database for better decision-making, forecasting, and managing water resources more effectively.
9.	Mission Amrit Sarovar	An initiative to rejuvenate and develop 75 water bodies in every district across India to improve local water availability and promote water conservation.	These initiatives reflect India's holistic approach to manage water resources by focusing on sustainable use, conservation, pollution control, and infrastructure development to secure water for future generations.

4.5.2. State Initiatives:

In addition to national initiatives, various state governments in India have launched their own initiatives to manage and conserve water resources, often tailored to the specific geographical and climatic challenges they face. Here are some notable state government initiatives on water resources management:

Sl. No.	Name of Scheme/ Place of implementation	Objective w.r.t Water Management
1.	Jal Samvardhan Yojna Tumakuru District, Karnataka	• Providing enabling environment for sustainable and decentralized tank management systems. • Reduce poverty by developing and strengthening community-based institutions to take up development and management activities. • Rehabilitate tanks within the district.
2.	Neeru-Chettu Program Andhra Pradesh	• Increase overall green cover in state and ensure 33% forest cover against the current 25% . • Maintain groundwater levels at a safe zone (between 3-8 metres). • Reduce the gap ayacut under Major, Medium, and Minor irrigation projects by providing assured water up to tail-end areas.
3.	Sujalam Sufalam Jal Abhiyan (Gujarat) Gujarat	• Deepen 13,000 reservoirs to increase their capacity and store rainwater before monsoon. • Strengthen irrigation facilities and enhance agricultural productivity. • Revitalise about 32 rivers having length of about 340 kilometres across 30 districts. • Conduct cleaning drive for canals of 5,400 kilometres.
4.	Mukhyamantri Jal Swavlamban Abhiyan Rajasthan	• Making the village self-sufficient in terms of drinking water. • Increase the level of groundwater table and strengthen watershed. • Increase the area under irrigation and cultivation through water harvesting & conservation. • Enhance crop production and productivity. • People's participation in designing and implementing projects.

Sl. No.	Name of Scheme/ Place of implementation	Objective w.r.t Water Management
5.	Drink From Tap Mission (24x7 Water Supply) Odisha	• Drink pure water straight from the tap conversion of intermittent water supply systems to continuous (24x7) water supply systems. • Equitable, sustainable and people-centric service provision with focus on the urban poor. • Water Supply Management through Community Partnership (Self Help Groups) – “Jalsaathi”. • 100% coverage of households with piped drinking water of good quality as per recommended standards. • 100% metering of house connections to eliminate Non-Revenue Water (NRW) due to leakages and wastage for full cost recovery.
6.	Kapildhara Yojana Madhya Pradesh	• The program focuses on providing financial support to landholders without access to irrigation facilities and prioritizes marginalized communities to maximize impact. • The program has contributed to improved productivity, intensity, and diversity of crop production in the region and generated livelihood sources.
7.	Automation of Irrigation System: Narayanpur Left Bank Canal System Karnataka	• To automate the Narayanpur left canal system and increase water use efficiency. Source https://kbjnl.karnataka.gov.in/storage/pdf-files/KBJNL-ERM-NLBC-Presentation.pdf
8.	Jalyukt Shivar Abhiyan Maharashtra	• Focus areas under the program include deepening and widening of streams, construction of cement and earthen stop dams, work on nullahs, and digging of farm ponds. • Increase ground water level in drought areas, and to create, new structure of water conservations.

4.6. Extract of Compendium of Best Practices in Water Management 3.0, (July-2023), published by NITI AAYOG

Sl. No.	Name of Scheme/Place of implementation	Objective
CLIMATE RESILIENT WATER MANAGEMENT		
1.	Temporary flood water storage in agricultural areas in the Middle Tisza river basin - Govt. of Hungary	• Cost effective measures for flood protection strategy for the middle Tisza river basin. • To cope with the changing condition of river basin and strengthen weak points of existing dike system.
2.	Sihlanzimvelo Stream Cleaning Project - eThekweni municipality, South Africa	• To remove solid waste, alien and invasive vegetation along 295 km of streams. • To control flood and clean stormwater blockages. • To create employment.
3.	Metropolitan Area Outer Underground Discharge Channel (MAOUDC)- Tokyo City Administration	• To build flood defence system using advanced infrastructure. • To mitigate risk of flooding and associated impacts.
4.	Making Namakkal District of Tamil Nadu Water secure - District Administration of Tamil Nadu	• Underground tunnels works as a function to divert and manage flood water. • Five contaminant silos which are connected to 6.3 km long central tunnel located 50 meters beneath the surface collects excess water from rivers in and around the city.
5.	Flood Forecasting and Early Warning System - Govt. of Kolkata and Asian Development Bank	• To improve flood resilience of the city. • Monitor and disseminate flood risk data.
Watershed Development		
6.	REVERSING SALINITY IN SAURASHTRA Kodinar, Saurashtra	• To prevent salinity ingress and ensure sustainable water supply for drinking and irrigation purposes through effective Water Resource Management interventions.
7.	Rejuvenation Of Khadakwasla Dam For Augmentation Of Water Use	• To rejuvenate the dam and increase its water holding capacity

Sl. No.	Name of Scheme/Place of implementation	Objective
	Khadakwasla Dam, Pune	
8.	Clean And Safe Drinking Water In Odhisa Nuapada district in Odhisa	• Provide access to clean and safe drinking water in Odhisa.
9.	Neknampur Lake Restoration - Dhruvansh Organization Neknampur Lake, Hyderabad (Telangana)	• Restoration of lake and biodiversity • Increase in water retention capacity • Create a recreational place Biological STP model installation at lake Intervention
Waste Water Treatment & Reuse.		
10.	Growing tomatoes without soil using vertical farming in hydroponics-Sundrop Farms Port Augusta, South Australia	• To produce crop with the help of sea water, without soil in arid regions • To increase water usage efficiency in farms and conserve more water. • Use of vertical farming to achieve food security
11.	Waterless dyeing technology in textile processing - DELFT University, DyeCoo, Tong Siang Co. Taiwan	• To reduce withdrawal of waste water and reduce consumption of freshwater in textile industry. • To improve water quality and increase net basin benefit.
12.	Reuse of treated water in Arequipa, Peru - Cerro Verde Arequipa, Peru	• To treat waste water and to improve Chili water river quality. • To reduce waterborne disease and advance sustainable solutions to region's water supply and sanitation sector.
13.	Making Namakkal District of Tamil Nadu Water secure - District Administration of Tamil Nadu Namakkal District of Tamil Nadu	• Address water scarcity in Namakkal district and make it water secure.
14.	Reuse of treated wastewater in thermal power plant in Nagpur -	• Address water scarcity in Nagpur. • To increase water demand for power plant. • To diversify water supply sources by incorporating alternative sources (treated

Sl. No.	Name of Scheme/Place of implementation	Objective
	Nagpur Municipal Corporation Nagpur	wastewater) and invest in sanitation and wastewater infrastructure for the city.
15.	Watershed development in Hyderabad to address water scarcity Five villages near Hyderabad, Telangana.	• Improving drinking water availability and quality, and sanitation facilities to maximize economic and social welfare without compromising vital ecosystems. • Install drinking water and sanitation facilities at local schools, provide livelihood support (e.g., backyard poultry, livestock for milk) to landless families through women self-help groups, and plant 3,000 trees.

4.7. Conclusion:

As we move forward, a collective commitment to sustainable **Water Resource Management** is essential. This requires collaboration across sectors and borders, innovative thinking, and active participation from all stakeholders. While challenges are significant, they are not insurmountable. By leveraging technology, fostering equitable policies, and engaging communities, we can create resilient water management systems that safeguard this vital resource for generations to come.

In summary, the future of **Water Resource Management** lies in a balanced approach that harmonizes ecological integrity, social equity, and economic viability. It is imperative that we act decisively and collectively to ensure that water remains a source of life, prosperity, and well-being for all.

Chapter 5

GASAB role in compilation of
Water Accounts



GASAB role in compilation of Water Accounts

5.1. GASAB and Natural Resource Accounting

The Government Accounting Standards Advisory Board (GASAB) has been established in August 2002 by the Comptroller & Auditor General of India with the support of the Government of India. GASAB is a representative body of the Central and State Governments with the responsibility of formulating, proposing and improving standards of government accounting and financial reporting.

GASAB had come out with a Concept Paper on NRA in India in July 2020 which, inter-alia, envisaged a goal plan for implementation of NRA in India in consonance with the strategy enshrined in the SEEA – CF of the UN.

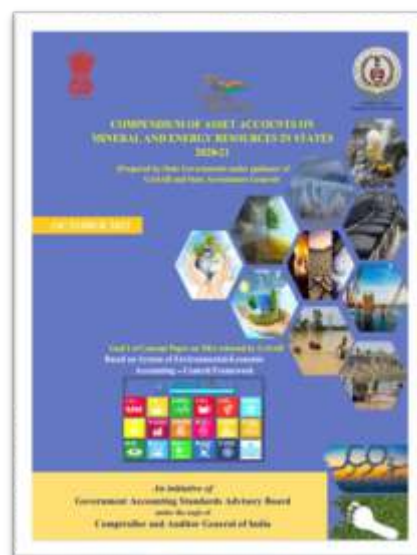
The Paper discussed the concept of NRA, related issues like the Sustainable Development Goals (SDGs) and Climate Change, endeavour of UN in bringing out the latest framework, progresses made around the world including those in India. It also envisaged Short, Mid and Long term goals in consonance with the four stage strategy suggested by the SEEA-CF of the United Nations as mentioned below.

Short term goals	Mid-term goals	Long term goals
• Preparation of Asset Accounts on Mineral and Non-Renewable Energy Resources in States • Initiation and preparation of disclosure statement • Revenues and expenditure related to natural resources (2019-20 to 2021-22)	1. Preparation of National Asset Accounts on Mineral and Non-Renewable Energy Resources 2. Preparation of Asset Accounts in respect of other four resources namely water, land Resources in the States and forestry & wildlife resources in the States. 3. Preparation of supply and use tables in physical and monetary terms showing flow of natural resource inputs, products and residuals (2022-23 to 2024-25)	• Preparation of the economic accounts highlighting depletion adjusted economic aggregates; and • Preparation of functional accounts recording transactions and other information about economic activities undertaken for environmental purposes. (2025 - 26 onwards)

The five resources namely mineral and energy, water, forestry, wildlife and land have been prioritised based on the international trends and good practices.

The Compendium also discusses areas of focus and possible remedies to improve the overall management of natural resources further and realise revenues due.

After completion of Short-term goals in preparation of Asset Accounts on Mineral and Energy Resources in States, GASAB moved ahead and focussed on Mid-term goals relating to (i) Second Compendium on Asset Accounts on Mineral and Energy Resources 2021-22 and (ii) First Compendium of Asset Accounts on Water Resources for the year 2021-22.



5.2. Role of GASAB in Water Accounts

5.2.1. Formulating Principles:

The Asset Accounts on Water Resources have been considered as an important goal as it consists of renewable resources that gets re-charged naturally. Depletion⁹ of water level has started in every part of the country which has set off a warning bell for our policy makers. Hence, GASAB is attempting to formulate a systematic principle which is required for recording and reporting of our resources.

5.2.2. Promoting Uniformity:

By promoting templates on Water Accounts, GASAB seeks to ensure uniformity in how different Government bodies report on Water Resources. By compiling water accounts, GASAB supports policymakers in making informed decisions regarding water resource management, allocation and investment. Reliable data would enable Union Territory/State Governments to assess the efficiency and sustainability of water use. This would facilitate better comparison and analysis of Water Accounts across all States/UTs, contributing to informed policymaking.

5.2.3. Encouraging Stakeholder Participation

GASAB encourages the involvement of States/UTs, including Governmental bodies in the compilation of Water Accounts. This participatory approach aims to bringing in the diverse perspectives on the subject.

5.2.4. Evaluation of data

GASAB also plays a role in evaluation of data as received from the State Government Departments. This would endeavour to its effective analysis while compilation of Asset Accounts on Water Resources. Feedback from these evaluations would help in refining the templates and practices over time.

⁹ In physical terms, it is the decrease in the quantity of the stock of a natural resource over an accounting period that is due to the extraction of the natural resource by economic units occurring at a level greater than that of regeneration.

5.2.5. Promoting Sustainability:

GASAB promotes sustainable Water Resource Management practices, emphasizing the importance of conserving and efficiently utilizing water resources in the face of growing demands and environmental challenges.

5.3. Stakeholders on-board and Consultation Process

The formation of a Consultative Committee for the implementation of the National Resource Accounting (NRA) represents a critical step in ensuring the inputs from domain experts, stakeholder organisation in Government of India like Ministry of Jal Shakti, Ministry of Statistics and Programme Implementation (MoSPI), Central Water Commission (CWC), the Central Ground Water Board (CGWB), NITI Aayog and the specialist agencies like The Energy and Resources Institute (TERI), National Remote Sensing Centre (NRSC), iCED(Jaipur) and State Governments. The selected six States were Delhi, Karnataka, Maharashtra, Punjab, Rajasthan, West Bengal and were coordinated through Principal Accountant Generals /Accountant Generals in these States/Union Territory.



The Consultative Committee meeting was held on 19th September 2024 and was attended by eminent environmentalist's Shri Mukul Sanwal, IAS 1971 and Shri Nitin Desai, Member of the Audit Advisory Board, Office of the CAG of India and Officers from TERI, CGWB, NITI Aayog, NRSC, iCED along with nominated Nodal Officers from State Governments, PAG/AGs of six states. The meeting was chaired by Shri Jayant Sinha, DAI (GA) and Chairperson GASAB. The members provided expert views from multiple perspectives to guide us on technical and policy-related aspects for achieving the envisioned action plan.

GASAB was benefitted greatly from the insights of Shri Mukul Sanwal, IAS (Retd. 1971), who emphasized the importance of water resource management for India. He advocated for water conservation strategies, particularly for storage of monsoon rain for groundwater recharge, and recommended mapping and restoring traditional water bodies.

Shri Nitin Desai, praised the NRA's focus on water resources, highlighting India's growing water demand amid constant



freshwater scarcity. He emphasized the need for groundwater regulation beyond consumption of river water its role in terms of ecological balance towards maintaining of symbiotic relationship among living things.

With expert guidance and collective insight, the GASAB initiated and finalised the compilation of a Compendium on the basis of data received from the 31 States/Union Territories

5.4. Compilation of Water Accounts 2021-22

Water is a natural resource and a great asset to a country. Water Accounting is a systematic study of the status and trends in water supply, demand, accessibility and use in specified domains.

- I. The work on preparation of the Asset Accounts in the States commenced with joint efforts of the Accountants General Offices and the State Governments with formation of State NRA Cells. Presently, State NRA Cells are functional in all States Field Offices and UTs like Delhi and J&K. GASAB continued to handhold the States with periodical meetings and correspondences to ensure that all States complete the project within the stipulated timeline.
- II. The Asset Accounts on Water Resources was started by the GASAB in the month of March 2023 by forwarding templates in the form of three tables and certain Questionnaires and endeavour was made to capture data against these tables from the State Government stakeholders.
- III. The role of GASAB in compiling Water Accounts is pivotal in ensuring transparency, accountability and sustainability in Water Resource Management. The GASAB has been involved in the preparation of Water Accounts in India by developing a framework for implementation of Natural Resource Accounting (NRA). GASAB's role in this process includes:-
 - i. **Developing a template:** GASAB developed a template on Water Accounts in the form of three tables under NRA in India, including a concept paper and a goal oriented implementation plan. State Governments/UTs were requested to nominate a Nodal Officer for preparation of Water Accounts. GASAB Wing forwarded the tabular datasets and relevant questionnaire on Water Accounts to respective State Accountants General for collection of data against these tables from State Governments.
 - ii. **Collecting information:** Correspondence are made to Nodal Officers for furnishing relevant information against the fields of the tabular datasets. Relevant information in turn are obtained from the concerned State Government authorities.
 - iii. **Analysis of data:** The collected data were analysed before compilation of Accounts. Analysis of information collected from various stakeholders helps in gaining a valuable insight and make informed decisions.

- iv. **Compilation of Tables:** The analysed data received from the field offices was captured in the Tables (i.e. Table 1 Availability of The Water Resources in the states, Table 2 Usage of Water Resources and Table 3 Details of Cost of revenue on water supply/ extraction of water) by GASAB Secretariat. The information compiled in the tabular form was then sent to State field offices for Confirmation/verification/correction of the figures.
- v. **Preparation of National Compendium:** The Validated/ Compiled data has been taken for the study in the first compendium of Water Resources Account compiled by GASAB Secretariat.

IV. The information sought in the form of three tables is depicted below:-

Tables	Contents
Table 1 – Availability of Water Resources	• Information on total availability of water resources in rivers and canals including inflows from other territories • Total water available in reservoirs • Total water available in tanks/ponds • Total water available in flood plain/lakes/derelict water bodies • Brackish water • Annual extractable ground water • Water availability in the state • Volume of water resources tapped out of the total water availability
Table 2 – Usage of Water Resources	• Natural discharge • Natural disasters • Man-made disasters • Irrigation supplies • Power generation • Industrial usages • Domestic usage including urban and rural • Outflow to other province/sea • Total volume of water usage during the period • Gap with the availability of water resources
Table 3 - Details of cost revenue on water supply/extraction of water	• Agricultural Users (Cost of supply & Water charges/rates) • Industrial users (Cost of supply & Water charges) • Domestic Users (Urban & Rural)

The analysis and key findings of the study and the way forward are depicted in chapter 6 & 7 respectively.



Chapter 6

Water Accounts



Water Accounts

6.1. Introduction

Water accounting is a tool to assist policymakers in making informed decisions on linking water availability and use, allocating water resources, investing in water infrastructure, improving water use efficiency, understanding the impacts of water management on users, and, making available a standardised information system (UN, 2012).

In general terms, water accounts present a snapshot on total inflows in the basin, consumptive water use across sectors and quantum (and quality) of water returned to the systems, covering both surface water and groundwater (Molden, 1997).

Water accounts present information relating to the physical volumes of water – these are sometimes referred to as ‘water balances’¹ (e.g., European Commission, 2015), although some approaches also consider water quality (pollutants added or removed from the water) and the economic aspects of water supply and use (Lange et al., 2007; Vardon et al., 2007; UN, 2012).

6.2. Water Accounting

Succeeding the release of the first National Compendium of Asset Accounts on Mineral and Energy Resources(2020-21) GASAB took initiative to establish water-Asset Accounts as a mid-term goal of Natural Resources Accounting.

As State Governments administer Water Resources within their territories, State Principal Accountant Generals’/ Accountant Generals’ were tasked with collecting information on these resources from the concerned for the year 2021-22. This being the first study of its kind in the country, State Accountants General Offices faced significant challenges in gathering and collating data on various water resources, which were often scattered among multiple Organisations/Departments/Corporations etc. depending on the organogram of the state concerned.

The efforts of the State Accountants General Offices in collecting and providing this information are noteworthy. As outlined by the System of Environmental-Economic Accounting (SEEA) framework, countries initiating such studies typically require a few years to stabilize their processes. The maiden water accounts for the states has been prepared using available data from the respective State Governments.

(Paras 6.2.1 to 6.2.6)

Table 1 - Availability of Water (In BCM)

Sl. No.	State/ Union Territory	Total availability of water resources in rivers and Canals including inflows from other territories, precipitation, returns	Total Water available in reservoirs	Total water available in tanks and ponds	Total water available in flood plain lakes and derelict water bodies	Brackish water	Total annual extractable ground water	Total water availability in State/ UT*	Total volume of water resources tapped for usage out of the total water availability
1.	Andhra Pradesh	229.51	13.32	5.84	NASG	1.12	25.86	275.65	264.68
2.	Arunachal Pradesh	218.65	NASG	NASG	NASG	NA	4.07	222.72	NASG
3.	Assam	NASG	NASG	NASG	NASG	NASG	NASG	-	NASG
4.	Bihar	374.91	0.66	0.09	NASG	NA	30.04	405.70	13.50
5.	Chhattisgarh	48.296			DNF	DNF	11.630	59.926	17.72
6.	Delhi	0.00392	NASG	NASG	NASG	NASG	0.00057	0.0049	0.0045
7.	Goa	2.82	0.779	0.0036	NASG	NASG	0.331	3.9336	0.88
8.	Gujarat	DNF	18.51	DNF	DNF	DNF	24.58	43.09	13.09
9.	Haryana	20.00	DNF	DNF	1.04	DNF	9.53	30.57	30.57
10.	Himachal Pradesh	DNF	DNF	DNF	DNF	DNF	0.94	0.94	DNF
11.	J & K	9.95	48.61	NASG	NASG	NASG	2.13	60.69	2.68
12.	Ladakh	119.22	0.28	0.02	NASG	NASG	0.50	120.02	28.33
13.	Jharkhand	23.39	DNF	DNF	NASG	NASG	1.61	25.00	DNF
14.	Karnataka#	60.26	30.70	4.82	DNF	DNF	10.383	110.59#	70.93
15.	Kerala	70.32	1.73	NASG	NASG	NASG	5.19	77.24	NASG

Sl. No.	State/ Union Territory	Total availability of water resources in rivers and Canals including inflows from other territories, precipitation, returns	Total Water available in reservoirs	Total water available in tanks and ponds	Total water available in flood plain lakes and derelict water bodies	Brackish water	Total annual extractable ground water	Total water availability in State/ UT*	Total volume of water resources tapped for usage out of the total water availability
16.	Madhya Pradesh	107.66	47.53	DNF	DNF	DNF	19.25	174.44	7.23
17.	Maharashtra	131.56	34.44	0.12	NASG	DNF	30.45	196.57	34.44
18.	Manipur	NASG	0.192	NASG	NASG	NA	0.47	0.662	NASG
19.	Meghalaya	NASG	12.19	NASG	NASG	NASG	0.10	12.29	12.28
20.	Mizoram	40.98	NASG	NASG	NASG	NASG	0.20	41.18	NASG
21.	Nagaland	19.483	NA	0.00012192	NA	NA	1.98	21.46312192	19.483
22.	Odisha	NASG	NASG	NASG	NASG	NASG	16.34	16.34	7.23
23.	Punjab	33.74	28.42	0.146	NASG	1.23	17.07	80.606	50.81
24.	Rajasthan	13.29	10.54	DNF	DNF	2.98	10.95	37.76	39.28
25.	Sikkim	DNF	DNF	DNF	DNF	DNF	DNF	-	DNF
26.	Tamil Nadu	7.36	5.26	9.27	NASG	NASG	19.09	40.98	14.43
27.	Telangana	DNF	20.68	DNF	DNF	DNF	19.25	39.93	21.43
28.	Tripura	7.643	1.30931	0.032	0.431	NA	1.063	10.47831	1.87
29.	Uttar Pradesh	210.92	8.30		3.19	DNF	69.92	292.33	95.14
30.	Uttarakhand	89.50	4.87	0.00048	NASG	NA	3.04	97.41048	18.89
31.	West Bengal	136.90	1.69	DNF	DNF	DNF	21.30	159.89	11.51

* To maintain the uniformity in the data, the figure in this column is a cumulative sum of the numeric values in the preceding six columns as provided by the State Governments / UTs & hence, this figure may vary with figure as provided by some of the States / UTs.

Wide variation in sets of data provided by State Government. Needs reconciliation.

NASG- Data not available with the State Government/ UT

DNF- Data not furnished by the State Government/ UT

NA- Not applicable in the State/ UT

Sl No.	Total Water available in Reservoirs			
	States/Union Territory	Figures reported to Central Water Commission	Figures provided by State Government/UT	Difference
14.	Maharashtra	7.07	34.44	27.37
15.	Meghalaya	^	12.19	DNF
16.	Nagaland	0.19	NA	DNF
17.	Odisha	3.48	NASG	DNF
18.	Punjab	0.94	28.42	27.48
19.	Rajasthan	1.50	10.54	9.04
20.	Tamil Nadu	3.02	5.26	2.24
21.	Telangana	1.65	20.68	19.03
22.	Tripura	0.11	1.31	1.20
23.	Uttar Pradesh	1.70	8.30	6.60
24.	Uttarakhand	1.33	4.87	3.54
25.	West Bengal	0.57	1.69	1.12

(^) Figure for the States/UTs were not mentioned in this particular report of CWC

(!) The figure was provided separately by the State

NASG- Data not available with the State Government/UT

DNF- Data not furnished by the State Government/UT

NA- Not applicable in the State/UT

The data regarding reservoirs shows significant discrepancies compared to the figures reported to the Central Water Commission. As significant discrepancies exist in States, which report substantial differences as shown in the table above, suggesting inconsistencies in reporting or data validation. Notably, multiple States have not furnished data, indicating potential issues in data collection or reporting practices.

States/UT reported lower figures to the Central Water Commission than those reported to the Accountant General. Notably, Madhya Pradesh and Punjab exhibits a significant difference of 35.44 BCM and 27.48 BCM respectively. Also both the States depict the availability, which is more than its live storage capacity at Full Reservoir Level (FRL), 30.34 BCM for Madhya Pradesh and 2.34 BCM for Punjab, highlighting, the need for analysis into water reporting practices.

These findings emphasize the necessity for improved data quality and transparency among the States, as well as potential regulatory authority to ensure adherence to reporting standards. Accuracy of data is essential for effective resource allocation and planning to enhance water management strategies.

6.2.3. Total Water Available in Tanks and Ponds

For information collection on tanks and ponds local governance is responsible for data administration in both urban and rural areas. The eighteen States/UT like Assam, Delhi, Gujarat, Haryana, Himachal Pradesh, Manipur, Odisha etc. have reported the "data not furnished" & "data not available" for this study. Hence, no conclusive inferences can be made.

6.2.6. Annual Extractable Ground Water

The Ministry of Jal Shakti and the Central Ground Water Board emphasize the sustainable development and efficient management of groundwater extraction. India has achieved an impressive 89% in the Sustainable Development Goals (SDG) 6 Index by regulating the pace of groundwater extraction. The National Compilation on Dynamic Groundwater Resources-2022, has detailed annual extractable groundwater figures across States/Union Territories. The data in the compilation and those furnished by the States is identical with respect to annual extractable Ground Water in 16 states viz. Andhra Pradesh, Arunachal Pradesh, Bihar, Goa, Gujarat, Himachal Pradesh, Kerala, Maharashtra, Manipur, Mizoram, Odisha, Punjab, Rajasthan, Tamil Nadu, Tripura, Telangana. However, discrepancies in data have been observed with respect to annual extractable Ground Water, in 15 States/UTs as mentioned below:

Table-Difference in the figure of annual extractable ground water provided by the State Government and CGWB

Total annual extractable Ground Water (In BCM)				
Sl. No.	State/Union Territory	Figures reported to CGWB	Figures provided by State Government/UT	Difference = (CGWB-State) figure
1.	Assam	21.40	NASG	NASG
2.	Chhattisgarh	11.01	5.76	5.75
3.	Delhi	0.37	0.00057	0.37
4.	Haryana	8.61	9.53	DNF
5.	Jammu and Kashmir	4.44	2.13	2.31
6.	Ladakh	0.07	0.50	0.43
7.	Jharkhand	5.69	1.61	4.08
8.	Karnataka	16.04	10.383	5.657
9.	Madhya Pradesh	32.58	19.25	13.33
10.	Meghalaya	1.51	0.10	1.41
11.	Nagaland	0.71	1.98	DNF
12.	Sikkim	0.24	DNF	DNF
13.	Uttar Pradesh	65.30	69.92	4.62
14.	Uttarakhand	1.86	3.04	1.18
15.	West Bengal	21.42	21.30	0.12

NASG- Data not available with the State Government/UT

DNF- Data not furnished by the State Government/UT

The differences in figures reported to the Accountant Generals' office and those to the CGWB points to the need for strengthening reporting of data on Ground Water particularly with respect to 15 States/UTs.

Table 2 - Usage of Water (In BCM)

(Paras 6.2.7 to 6.2.15)

Sl. No.	States/ Union Territory	Natural discharge	Natural disasters	Man- made disasters	Irrigation supplies	Power generation	Industrial usage	Domestic usage						Outflow to other province / sea etc	Total volume of water usage during the period	Gap with the availabilit y of water resources (+/-)
								Urban users			Rural users					
								Surface water	Water supplies	Underground water	Surface water	Water supplies	Underground water			
1.	Andhra Pradesh	134.99	NASG	NASG	31.58	4.69	0.16	0.74	NASG	0.09	0.20	NASG	0.35	91.89	264.68	10.97
2.	Arunachal Pradesh	NASG	NASG	NASG	NASG	NASG	NASG	NASG	NASG	NASG	NASG	NASG	NASG	218.65	218.65	16.40
3.	Assam	NASG	NASG	NASG	NASG	NASG	NASG	NASG	NASG	NASG	NASG	NASG	NASG	NASG	NASG	NASG
4.	Bihar	3.10	NASG	NASG	22.23	0.08	0.02	3.14*						352.68	381.24	(-)15.8
5.	Chhattisgarh	DNF	DNF	DNF	6.790	0.56	0.340	0.119			0.401			DNF	8.21	DNF
6.	Delhi	NASG	NASG	NASG	NASG	NASG	NASG	0.00000000027*#						0.001211	0.0045	0.00136
7.	Goa	NASG	NASG	NASG	0.371	NASG	0.017	0.458*						6.560	0.880	5.680
8.	Gujarat	DNF	5.50	DNF	28.00	0.45	1.04	3.66*(2.84- Surface Water & 0.82-Ground Water)						DNF	37.61	(-) 0.29
9.	Haryana	DNF	DNF	DNF	40.44	1.91			1.21*						DNF	44.60
10.	Himachal Pradesh	DNF	DNF	DNF	1.11	DNF	0.03	DNF	0.06	0.000035	DNF	0.17	DNF	DNF	1.36	DNF
11.	J & K	NASG	NASG	NASG	2.68	48.48	NASG	0.000917066*						7.27	58.43	2.26
12.	Ladakh	NASG	NASG	NASG	8.09	20.07	NA	0.16	0.00012	0.00002	0.0017	0.0007	0.0006	91.63	28.33	91.63
13.	Jharkhand	6.87	NASG	NASG	9.20	DNF	1.28	DNF	DNF	DNF	DNF	DNF	DNF	DNF	17.35	DNF
14.	Karnataka®	DNF	DNF	DNF	42.23	DNF	1.48	DNF	DNF	DNF	0.96®	DNF	NASG	39.52	84.19®	DNF
15.	Kerala	42.77	NASG	NASG	28.87	10.40	0.10	1.55*						NASG	83.693	NASG
16.	Madhya Pradesh	DNF	DNF	DNF	33.82	1.31	1.94	3.07*						9.80	49.94	DNF
17.	Maharashtra	36.28	DNF	DNF	35.15	DNF	0.95	6.31*						DNF	78.69	13.80

Sl. No.	States/ Union Territory	Natural discharge	Natural disasters	Man- made disasters	Irrigation supplies	Power generation	Industrial usage	Domestic usage						Outflow to other province / sea etc	Total volume of water usage during the period	Gap with the availabilit y of water resources (+/-)
18.	Manipur	NASG	NASG	NASG	0.11	NASG	NASG	NASG	0.967 x 10 ⁻⁴ per day	NASG	NASG	0.1219 x 10 ⁻³ per day	0.231 x 10 ⁻⁵ per day	NASG	NASG	NASG
19.	Meghalaya	NASG	NASG	NASG	NASG	NASG	NASG	NASG	DNF	7.82	0.003	DNF	0.003	NASG	12.29	DNF
20.	Mizoram	21.83	NASG	NASG	0.81	19.61(Power generation figures not included by the State Water Dept.)	0.19	0.07*						NASG	22.89	18.29
21.	Nagaland	NASG	NASG	NASG	2.862	NASG	79.728	0.000005 33885	NASG	NASG	NASG	NASG	0.000009	NASG	NASG	NASG
22.	Odisha	1.44	DNF	DNF	DNF	DNF	1.14	0.34	0.46	0.95	0.12	DNF	9.71	DNF	14.16	NASG
23.	Punjab	5.32	NA	NA	40.5	0.807	0.174	1.42*						15.95	64.167	(-)13.211
24.	Rajasthan	1.17	NASG	NASG	31.26	2.23	0.18	0.94	DNF	0.25	0.66	DNF	2.60	DNF	39.28	(-) 1.52
25.	Sikkim	DNF	DNF	DNF	DNF	DNF	DNF	DNF	DNF	DNF	DNF	DNF	DNF	DNF	DNF	DNF
26.	Tamil Nadu	0.48	DNF	DNF	25.70	0.39	1.01	0.32	0.37	DNF	DNF	1.74	DNF	0.92	30.91	10.06
27.	Telangana	2.02	DNF	DNF	20.68	DNF	0.16	DNF	1.08	0.66	0.21	0.70	7.94	DNF	33.44	6.48
28.	Tripura	2.03	NASG	NASG	1.20	0.40	0.03	0.004	0.13	0.02	0.004	0.06	0.03	2.29	6.19	No gap
29.	Uttar Pradesh	4.61	DNF	DNF	87.00	1.02	0.32	0.54	DNF	2.32	0.39	DNF	3.56	173.46	273.22	19.11
30.	Uttarakhand	0.026	NA	NA	5.004	48.99	4.62	0.54	NASG	NASG	0.18	NASG	NASG	35.78	95.14	NASG
31.	West Bengal	139.08	DNF	DNF	21.68	0.11	0.46	3.08	DNF	0.95	0.34	DNF	2.66	DNF	168.35	(-8.46)

* Combined figure for urban and rural domestic water usage.

@ Wide variation in sets of data provided by State Government. Needs reconciliation.

Includes Irrigation supplies, Power Generation and Industrial usage.

NASG- Data not available with the State Government/UT

DNF- Data not furnished by the State Government/UT

NA- Not applicable in the State/UT

6.2.7. Natural Discharge

Natural discharge refers to the flow of water from various environmental sources, such as rivers, lakes, reservoirs, and groundwater, influenced by factors like precipitation, soil permeability, and topography. This discharge is crucial for maintaining ecosystems, regulating water cycles, and supporting human activities.

6.2.8. Natural Disasters

Natural disasters significantly impact water resources, affecting both their quantity and quality. Flooding can inundate water sources, temporarily increasing availability but often contaminating them with pollutants and debris while damaging water treatment infrastructure, leading to potential health crises.

Prolonged droughts reduce surface water levels in rivers, lakes, and reservoirs, causing severe water shortages and prompting over-extraction of groundwater, which depletes water tables.

Tsunamis can inundate coastal freshwater sources with saltwater, degrading quality and posing health risks due to contamination.

Landslides disrupt water flow and increase sedimentation, negatively impacting aquatic habitats. Hurricanes and typhoons cause storm surges that lead to flooding and contamination of freshwater resources, while damaging supply systems.

Glacial Lake Outburst Floods (GLOFs) release massive water volumes that can destroy downstream infrastructure and degrade water quality.

Overall, these disasters threaten sustainable water resources, highlighting the need for effective disaster preparedness and management strategies to mitigate their impacts. None of the States/UTs reported figures for natural disasters except for the Gujarat in the year 2021-22.

6.2.9. Man-made Disasters

Man-made disasters related to water encompass a range of events resulting from human activities that have significant environmental, social, and economic impacts. Key examples include water pollution from industrial discharge and agricultural runoff, which contaminate water supplies and harm ecosystems.

Dam failures, often due to poor design or maintenance can lead to catastrophic flooding, while over extraction of groundwater for various uses results in depletion and contamination of aquifers.

Urban flooding can be exacerbated by inadequate drainage systems and unregulated construction, particularly in the face of climate change, which increases extreme weather events. Inefficient water management contributes to water scarcity, while competition for resources can lead to conflicts and displacement of local communities.

Additionally, climate change impacts, such as rising sea levels, threaten freshwater aquifers through saltwater intrusion.

Addressing these issues requires sustainable water management, pollution control, infrastructure investment, and community engagement to mitigate risks and protect vital water resources. No States/UTs provided figures for man-made disasters in 2021-22.

6.2.10. Irrigation Supplies

India is an agriculture-rich country; irrigation is essential for crop production. Various methods—such as surface irrigation, drip irrigation, sprinkler irrigation, and sub-surface irrigation—are vital for sustainable agriculture.

States have reported data on irrigation supplies sourced from rivers, dams, reservoirs, and canals. However, the States/UT namely Arunachal Pradesh, Assam, Delhi, Meghalaya, Odisha and Sikkim have not furnished the related figures. As per 6th Census of Minor irrigation schemes report (Ministry of Jal-Shakti) there are 2,31,38,964 schemes (2017-18) running for Minor irrigation across India. The States are requested to hand-hold for this study in future.

6.2.11. Power Generation

Water supply is integral to power generation, particularly for thermal and hydroelectric plants, as well as cooling systems. States/UT have provided input on water use in the power generation sector. However, the States/UT namely Arunachal, Assam, Delhi, Jharkhand, Karnataka, Maharashtra, Manipur, Meghalaya, Nagaland, Odisha, Sikkim and Telangana have not furnished the related figures.

Uttarakhand and Jammu and Kashmir have reported highest amount of Water Supply in Power Generation. The state of Gujarat has furnished combined figure with industrial purpose.

Notably, State of Mizoram did not include the figures in usage of Water in Power Generation, as the water in Mizoram the water is recycled and reused. The uniformity of the same across all the States/UTs, may be ensured in future.

6.2.12. Industrial Usage

Water is essential across various industrial processes, including manufacturing, food and beverage production, chemical processing, pharmaceuticals, mining, textiles, and construction.

States have furnished the data on industrial water usage except Arunachal Pradesh, Assam, Delhi, Jammu and Kashmir, Ladakh, Manipur, Meghalaya, and Sikkim. The Study of data reveals that Nagaland and Uttarakhand has the highest consumptions in industrial sector.

States/UTs with significant industrial water demand are encouraged to monitor their supply and wastewater disposal to prevent contamination of other water sources. They should also adopt recycling and reuse practices for improved water management.

6.2.13. Domestic Usage

Domestic water usage encompasses a range of household activities. Every person, in both urban and rural areas, relies on water for daily needs. Enhanced monitoring of domestic water resources is necessary, as households are the primary consumers of water and play a significant role in overall consumption patterns. Effective monitoring can help identify usage trends, detect leaks, and ensure equitable distribution of water. Furthermore, it enables policymakers to assess the sustainability of water supplies and develop strategies for conservation and management. By understanding domestic water usage better, communities can implement more efficient practices, promote water-saving technologies, and ultimately safeguard this vital resource for future generations.

However, Arunachal Pradesh, Assam, Jharkhand and Sikkim have not furnished the figures. Also, some of the states have furnished the combined figures for urban and domestic users. The States/UTs are suggested to maintain the bifurcated figures for the same in future for assessing the impact of urbanisation.

6.2.14. Outflow to Other Provinces/Sea

Outflow of water to other provinces or seas typically occurs through rivers, lakes, and other bodies of water. This process is vital for maintaining ecological balance and supporting biodiversity.

Bihar and Uttar Pradesh report higher water outflow compared to other states. As this is an initial initiative for water resource accounting, states are advised to monitor inflows to their provinces and include this data in future reports.

6.2.15. Gap with the Availability of Water Usage

The gap in water availability refers to the difference between water availability and water usage in different sectors like Power Generation, Industrial Usage, Irrigation Supply and Domestic Usage etc. Gaps have been observed in some of the States/UTs, 'Total water availability' being less than the 'Total volume of Water usage' and thus needs to be monitored and reconciled by authorities concerned. All these sectors are influenced by factors such as population growth, agricultural practices, urbanization, pollution, and infrastructure.

The states experiencing water stress, highlighting the need for integrated water resource management, infrastructure investment, conservation efforts, and sustainable practices to ensure equitable water access.

Table 3: Details of cost of revenue on water supply/extraction of water (2021-22)

(Para 6.2.16)

Sl. No	States/UTs	Agriculture users		Industrial users		Domestic users		
		Cost of supply/cost of water in INR per unit (if available)	Water charges/rates recovered in INR per unit	Cost of supply/cost of water in INR per unit (if available)	Water charges/rates recovered in INR per unit	Urban	Rural	Water charges/rates recovered in INR per unit
1.	Andhra Pradesh	DNF	DNF	DNF	DNF	₹ 7115 per ML	₹ 5161 per ML	₹ 30 per Kilo litre
2.	Arunachal Pradesh	NASG	NASG	DNF	₹ 50 per month/tap	DNF	₹ 50 per month/tap	₹ 50 per month/tap
3.	Assam	NASG	NASG	NASG	NASG	NASG	NASG	NASG
4.	Bihar	(a) Perennial Paddy - ₹ 88/acre Wheat - ₹ 75/acre Ganna - ₹ 150/acre (b) Non Perennial Paddy - ₹ 44/acre Wheat - ₹ 56/acre	(a) Perennial Paddy - ₹ 88 Wheat - ₹ 75/acre Ganna - ₹ 150/acre (b) Non Perennial Paddy - ₹ 44/acre Wheat - ₹ 56/acre	₹ 18/thousand gallon	₹ 18/thousand gallon	NASG	Levied as per property tax slabs	₹ 30 Per month (rural)
5.	Chhattisgarh	Kharif - ₹ 81.00/Acre Rabi - ₹ 200.00/Acre	₹ 254.03 lakh ^{\$}	A. Govt. Sources 1. Dam/Barrage/Anicut ₹ 10.50/Cum 2. Canal System ₹ 12.25/Cum B. Natural Source 1. River/Naila - ₹ 5.00/Cum 2. Ground Water - ₹ 10.00/Cum	Water charges:- ₹ 63544.28 lakhs Rates recovered in INR per unit:- NASG	Drinking Water ₹ 0.60/Cum	For domestic users, total water charges = ₹ 335.96 lakh* ^{*/\$} .	

Sl. No	States/UTs	Agriculture users		Industrial users		Domestic users		
		Cost of supply/cost of water in INR per unit (if available)	Water charges/rates recovered in INR per unit	Cost of supply/cost of water in INR per unit (if available)	Water charges/rates recovered in INR per unit	Urban	Rural	Water charges/rates recovered in INR per unit
				C. Self-constructed Source - ₹ 3.50/Cum				
6.	Delhi	NASG	NASG	₹ 146.41 to ₹ 1317.69 (Service Charge) ₹ 17.57 to ₹ 175.69/KL (Volumetric Charge)	₹ 499.37 crore	₹ 146.41 to ₹ 292.82 (Service Charge) ₹ 5.27 to ₹ 43.93/KL* (Volumetric Charge)		₹ 411.35 crore ^s
7.	Goa	NASG	NASG	NASG	₹ 35 per M ³ per PWS	NASG		
8.	Gujarat	NASG	₹ 905.57/1000 ltr	NASG	₹ 34.52 (per 1000 litre)	NASG	NASG	DNF
9.	Haryana	Metered : ₹ 125/Month Unmetered : ₹ 15000/Month	DNF	Metered : ₹ 125/Month Unmetered : ₹ 15000/Month	DNF	Metered* : ₹ 60/Month Unmetered : ₹ 120/Month	₹ 2.5 per KL for first 10 KL* ₹ 5.00 per KL upto 20 KL ₹ 8.00 per KL upto 30 KL ₹ 10 per KL above 10(ULB)	
10.	Himachal Pradesh	DNF	Lift irrigation – ₹ 53.79 per crop per acre Flow irrigation – ₹ 26.90 per crop per acre	DNF	₹ 27.71 per KL	DNF	₹ 27.71 per KL (for cities of Shimla and Solan) ₹ 13.86 per KL (for Other Cities & towns)	₹ 34.54 per connection per month
11.	J & K	₹ 596.76 per acre	₹ 225.32 per acre	NASG	1" = ₹ 43200 per annum 1.5" = ₹ 117600 per annum 2" and beyond = 169500 per annum	NASG	1/2" = ₹ 3000 per annum 3/4" = ₹ 5700 per annum	1/2" = ₹ 1000 per annum 3/4" = ₹ 1600 per annum
12.	Ladakh	₹ 92/acre	₹ 114.09 lakh per year	NA	NA	₹ 0.0125 lakh per year	₹ 0.01610 lakh per year	₹ 0.00920 lakh per year

Sl. No	States/UTs	Agriculture users		Industrial users		Domestic users		
		Cost of supply/cost of water in INR per unit (if available)	Water charges/rates recovered in INR per unit	Cost of supply/cost of water in INR per unit (if available)	Water charges/rates recovered in INR per unit	Urban	Rural	Water charges/rates recovered in INR per unit
13.	Jharkhand	NASG	Free of cost	₹ 4.5-32/1000 ltr	DNF	₹ 3.8-6.5/1000 ltr	₹ 0-4.30/1000 ltr	DNF
14.	Karnataka	₹ 15 to ₹ 400/ acre rates different for different crops.	DNF	₹ 100000/mcft to ₹ 200000/mcft	DNF	₹ 375/mcft bulk water rates	₹ 375/mcft bulk water rates	DNF
15.	Kerala	NA	NA	NASG	(A) Piped Water Supply - ₹ 157.50 (fixed charge) + ₹ 42/KL with minimum of ₹ 262.50 (B) River water abstraction - ₹ 10/KL (as per Irrigation and Water Conservation Act, 2003)	NASG	NASG	₹ 10.92/KL
16.	Madhya Pradesh	DNF	(1) Kharif crops: Paddy Kharif ₹ 380 per hectare Cotton - ₹ 335 per hectare Green fodder crops, groundnut (Kharif), Jowar, Maize, Moong(Kharif),	DNF	(1) From Govt. sources: ₹ 8/cum (2) From Natural Resources ₹ 3/cum	DNF	DNF	Supply from Government Source (Dam) at ₹ 0.62 per Cubic meter Supply from Natural Resources (River) at ₹ 0.31 per Cubic meter Supply from Government Source (Dam) at ₹ 0.62 per Cubic meter Supply from Natural Resources

Sl. No	States/UTs	Agriculture users		Industrial users		Domestic users		
		Cost of supply/cost of water in INR per unit (if available)	Water charges/rates recovered in INR per unit	Cost of supply/cost of water in INR per unit (if available)	Water charges/rates recovered in INR per unit	Urban	Rural	Water charges/rates recovered in INR per unit
			Soyabean (kharif), Till, Tuar (Kharif): ₹ 275/hectare (2) Rabi crops: Wheat: ₹ 350/hectare Gram: ₹ 200/hectare Paddy Rabi: ₹ 590/hectare (3) Pulses and oilseeds crops: ₹ 350/hectare (4) Vegetable Crops: ₹ 630/hectare (5) Fruit crops: ₹ 960/hectare (6) Fodder crops: ₹ 480/hectare					(River) at ₹ 0.31 per Cubic meter
17.	Maharashtra	(1) Registered water user association Kharif – ₹ 3.38 / 1000L Rabi – ₹ 6.75/1000L	Irrigation recovery out arrears at the end of March 2022 is ₹ 52.10 Cr & out of irrigation charges is ₹ 49.66 Cr.	Non-irrigation charges at the end of Mar 2022 is ₹ 1417.29 Cr. ^④	Non irrigation recovery out arrears at the end of Mar 2022 is ₹ 161.42 Cr. and out of non-irrigation charges is ₹ 896.95 Cr. ^④	DNF ^③	DNF ^③	Non irrigation recovery out arrears at the end of Mar 2022 is ₹ 161.42 Cr. and out of non-irrigation charges is ₹ 896.95 Cr. ^④

Sl. No	States/UTs	Agriculture users		Industrial users		Domestic users		
		Cost of supply/cost of water in INR per unit (if available)	Water charges/rates recovered in INR per unit	Cost of supply/cost of water in INR per unit (if available)	Water charges/rates recovered in INR per unit	Urban	Rural	Water charges/rates recovered in INR per unit
		Summer – ₹ 10.13/1000L 2) Individual users/farmers Kharif – ₹ 4.50 paise/1000L Rabi – ₹ 9.00/1000L Summer – 13.50/1000L						
18.	Manipur	Rabi Crop Paddy – 1 ₹ 602/Ha Wheat ₹ 305/Ha Mung peas, Mustard, etc. ₹ 84/Ha Kharif Crop Paddy – 1 ₹ 305/Ha Others ₹ 184/Ha	NASG	NASG	NASG	NASG	₹ 250/month per household	₹ 50-250/month per household as decided by Gram Panchayat
19.	Meghalaya	NASG	NASG	NASG	NASG	₹ 8.00/KL	Pumping Schemes ₹ 20500.00 per capita Gravity Schemes	₹ 5.25/KL

Sl. No	States/UTs	Agriculture users		Industrial users		Domestic users		
		Cost of supply/cost of water in INR per unit (if available)	Water charges/rates recovered in INR per unit	Cost of supply/cost of water in INR per unit (if available)	Water charges/rates recovered in INR per unit	Urban	Rural	Water charges/rates recovered in INR per unit
						Cost of supply/cost of water in INR per unit (if available)	Cost of supply/cost of water in INR per unit (if available)	
						₹ 16100.00 per capita	₹ 16100.00 per capita	
20.	Mizoram	NASG	NASG	NASG	NASG	₹ 67.59 per KL	1. ₹ 200 for ≤ 5,000L/month 2. ₹ 45/KL for > 5,001 L but ≤ 10,000L/month 3. ₹ 75/KL for > 10,001L ≤ 20,000/month 4. ₹ 90/KL for 20,001L ≤ 30,000L/month 5. ₹ 105/KL for ≥ 30,001L	NASG
21.	Nagaland	NA	NA	NA	NA	NA	₹ 50/1000 litres for Metered ₹ 100/Month for Non Metered	Since communitised the WATSAN committees fixes their own water tariffs
22.	Odisha	DNF	₹ 60.00 to ₹ 840 per hectare/year for different crops (Kharif/Rabi)	DNF	Rates vary from ₹ 0.015 to ₹ 45.00 for industrial and commercial uses of water	DNF	₹ 5.29/KL	NA (Department has not fixed any water charges for rural users)
23.	Punjab	NASG	₹ 50/- per acre per crop	NASG	Surface water = ₹ 5/Cum for industries & ₹ 10/Cum for Power Plants Groundwater: As per Slab PWRDA	Variable Cost (For Urban due to differences of supply weather ground water)	Variable (For Rural due to differences of supply weather ground water)	₹ 50/-per Month per House

Sl. No	States/UTs	Agriculture users		Industrial users		Domestic users		
		Cost of supply/cost of water in INR per unit (if available)	Water charges/rates recovered in INR per unit	Cost of supply/cost of water in INR per unit (if available)	Water charges/rates recovered in INR per unit	Urban	Rural	Water charges/rates recovered in INR per unit
						Cost of supply/cost of water in INR per unit (if available)	Water charges/rates recovered in INR per unit	Cost of supply/cost of water in INR per unit (if available)
						canal water etc.)	canal water etc.)	canal water etc.)
24.	Rajasthan	NASG	₹ 12 to ₹ 146 per acre	NASG	₹ 275/1000 cft & ₹ 33/1000 cft	₹ 6136.20 (per connection per annum)	₹ 1583.12 (per connection per annum)	₹ 13650.94 (per connection per annum)
25.	Sikkim	NA	NA	PHE Deptt.	PHE Department	PHE Department	PHE Department	PHE Department
26.	Tamil Nadu	DNF	DNF	DNF	₹ 372.58 crore	₹ 10.42/ kilo Litre	₹ 16.00/kilo Litre	₹ 8.10/kilo Litre
27.	Telangana	DNF	DNF	₹ 15.00 per Ltr	₹ 150.00/ kilo Litre	DNF	Slab wise water rates as per water use	DNF
28.	Tripura	NASG	NASG	DNF	DNF	DNF	In urban sector, the water taxes for domestic and commercial purposes are ₹ 40.00 per month & ₹ 1000.00 per month respectively.	DNF
29.	Uttar Pradesh	Free of Cost (As per Ground)	Free of Cost (As per Ground Water Department)	DNF#	₹ 0.70 to ₹ 1.3/Cum (m)/day based on quantity of	Free of Cost (As per Ground Water)	Free of Cost (As per Ground Water Department)#	Free of Cost (As per Ground)

Sl. No	States/UTs	Agriculture users		Industrial users		Domestic users		
		Cost of supply/cost of water in INR per unit (if available)	Water charges/rates recovered in INR per unit	Cost of supply/cost of water in INR per unit (if available)	Water charges/rates recovered in INR per unit	Urban	Rural	Water charges/rates recovered in INR per unit
		Water Department) ₹ 50 to 3155/Ha per crop (As per Irrigation and Water Resources Department)			extraction (As per Ground Water Department) #	Cost of supply/cost of water in INR per unit (if available) Department) #	Water Department) ₹ 50/month per household (As per U.P. Jal Nigam, Gramin)	Water Department) #
30.	Uttarakhand	NASG	NASG	NASG	NASG	NASG	NASG	Total collection in FY 2021-22 ₹ 23304.37 lakh\$ Average ₹ 388 per month per household
31.	West Bengal	₹ 15/Acre to ₹ 50/Acre	DNF	₹ 0.50 KL to ₹ 15 KL	DNF	₹ 6/ KL	DNF	DNF

* The bifurcation of figures for domestic users into urban and rural is not available with the state government.

\$ Water Charges/Rates recovered in INR per unit is not available with State Government/UT.

@ Rate per unit for Industrial users and Domestic users are not received from the concerned Department of Government of Maharashtra.

As per Irrigation and Water Resources Department, Uttar Pradesh, vide GO No. (2953/11-27-15) dated 15.7.2011 for Non-Agriculture Use Royalty/Water Charges of ₹ 600000 per cusec per year and

Water Tax of ₹ 12.48 per thousand cubic feet is applicable.

NASG- Data not available with the State Government/UT

DNF- Data not furnished by the State Government/UT

NA- Not applicable in the State/UT

6.2.16. Gaps in cost of revenue on water supply/extraction of water

This table presents the costs of supply and the water charges collected from agricultural, industrial, and domestic users. It is appreciable that various states have participated in this study. As noticed, there is an enormous variation of water pricing in all the sectors across the States. As observed, the structure of water pricing mechanism seems different in all States of India. Each of the State following its own policies based on geographical and climatic conditions.

6.3. Key findings of the study of basic information collected from Stakeholders through questionnaire-Annexure-6.1

6.3.1. Sector-wise Water Usage Data (Points 1 to 3 of Annexure-6.1)

The study indicates that states are maintaining sector-wise data for water usage, but there remains scope for improvement. Some states still do not have comprehensive sector-specific figures. States are requested to compile and submit this data systematically. Data quality issues also need to be addressed.

6.3.2. Groundwater Excavation (Points 4 to 8 of Annexure-6.1)

Groundwater extraction involves accessing and extracting water from underground aquifers, a critical resource in regions with limited surface water. Monitoring groundwater extraction is essential. Although the Central Ground Water Board has established guidelines for extraction permissions, some states lack a mechanism for compliance.

A. States and their Approving Authorities:

States and Approving Authority of Borewells		
Sl. No.	State	Authority
1.	Andhra Pradesh	State Authority
2.	Bihar	State Authority
3.	Delhi	UT Authority
4.	Goa	CGWA
5.	Gujarat	CGWA
6.	Karnataka	State Authority
7.	Kerala	State Authority
8.	Madhya Pradesh	State Authority
9.	Maharashtra	CGWA
10.	Meghalaya	State Authority
11.	Odisha	CGWA
12.	Punjab	State Authority
13.	Rajasthan	State Authority
14.	Tamil Nadu	State Authority
15.	Telangana	State Authority
16.	Uttar Pradesh	State Authority
17.	Uttarakhand	CGWA
18.	West Bengal	State Authority

CGWA – Central Ground Water Authority

B. States with functional Water Meters:

States with affixing water meters in each of the bore wells	
Sl. No.	State
1.	Chhattisgarh
2.	Goa
3.	Haryana
4.	Himachal Pradesh
5.	Jammu & Kashmir
6.	Kerala
7.	Odisha
8.	Punjab
9.	Rajasthan
10.	Sikkim
11.	Tamil Nadu
12.	Tripura
13.	Telangana
14.	Uttar Pradesh
15.	West Bengal

States without functional water meters in borewells are encouraged to implement them for better monitoring and sustainable groundwater management. The volumetric water pricing as recommended in the National Water Policy (Ministry of Water Resources, 2012), if adopted, hitherto, this has not been practiced due to a lack of development of water metering infrastructure in the field.

C. States with Fixed Water Norms per Head per Day:

States with fixed Water Norm	
Sl No.	State
1.	Andhra Pradesh
2.	Bihar
3.	Chhattisgarh
4.	Delhi
5.	Gujarat
6.	Himachal Pradesh
7.	Jammu & Kashmir
8.	Ladakh
9.	Karnataka
10.	Kerala
11.	Madhya Pradesh
12.	Maharashtra
13.	Meghalaya
14.	Odisha
15.	Punjab
16.	Rajasthan
17.	Tamil Nadu
18.	Telangana
19.	Tripura
20.	Uttarakhand

States that have not yet established water norms are urged to implement them to monitor usage and for assessment as per availability.

6.3.3. Jal Jeevan Mission (Points 9 & 10 of Annexure-6.1)

Reference to previous Chapter 2 & 4 Jal Jeevan mission has already been covered for different objectives. Study of data for rural household connections provided under Jal-Jeevan Mission in the State during 2021-22, revealed that although almost every State/UT had implemented the scheme and submitted data related to it. Some States/UT, including Delhi, Haryana, and Jharkhand, have not provided the necessary information for this study. Despite the operational status of the scheme in these states, the gaps in reporting should be monitored, and data may be updated in subsequent years.

6.3.4. Sector-wise Water Rates/Taxes (Point 11 of Annexure-6.1)

During this study, details of sector-wise (agriculture, industries, domestic usage) water rates and taxes were collected from the states. Each state follows its own formats for water rate prescriptions based on its water management policies, geographical features, and climate conditions

As revealed in Table 3 –“Details of cost of revenue on water supply/extraction of water (2021-22, it was noted that there is a lack of uniformity in the units for water rates charged by the Water Resources Department.

- i. Agriculture users-the basis for rates is perennial/non-perennial, Kharif/ Rabi, Metered/unmetered, different rates per acre/hectare, Registered water user Association/Individual user etc.
- ii. Industrial users-the basis of rates is per month/tap; thousand gallon, based on source of water; service charge/volumetric charge; thousand litre/mcft/Cum per day etc.
- iii. Domestic users-per month/tap; levied as per property tax slabs; rates as per consumption; based on the diameter of supply pipes, as per supply of source.

6.3.5. Water Stressed/Surplus States (Point 12 of Annexure-6.1)

The average annual water availability of any region or country is largely dependent upon hydro-meteorological and geological factors, however, water availability per person is dependent on population of a country. The per capita water availability in the country is reducing due to increase in population.

Annual per-capita water availability of less than 1700 cubic meter is considered as water stressed condition whereas annual per-capita water availability below 1000 cubic meters is considered as a water scarcity condition. States/UT have reported their water conditions. The following states have declared themselves as water-stressed:

Water Stressed States/UTs	
Sl. No.	State
1.	Andhra Pradesh
2.	Arunachal Pradesh
3.	Delhi
4.	Goa
5.	Gujarat

States with Database on Aquifer	
Sl. No.	State/UTs
1.	Andhra Pradesh
2.	Chhattisgarh
3.	Delhi
4.	Gujarat
5.	Himachal Pradesh
6.	Haryana
7.	Kerala
8.	Maharashtra
9.	Meghalaya
10.	Punjab
11.	Rajasthan

While some states maintain databases on aquifers, many do not. This gap in information limits the ability to manage groundwater resources effectively.

6.3.8. Water Policies (Point 17 of Annexure-6.1)

Water policies encompass the laws, regulations, and strategies governing water resource management. They aim to ensure sustainable water use, protect water quality, and promote equitable access. The following states as per the data provided have formulated their own water policies for the balanced use of water:

States/UTs with prescribed Water Policies	
Sl. No.	State
1.	Andhra Pradesh
2.	Chhattisgarh
3.	Gujarat
4.	Himachal Pradesh
5.	Jammu and Kashmir
6.	Karnataka
7.	Kerala
8.	Madhya Pradesh
9.	Maharashtra
10.	Meghalaya
11.	Odisha
12.	Punjab
13.	Rajasthan
14.	Uttar Pradesh

6.3.9. Monitoring Mechanism between Local Bodies and State Government (Point 18 of Annexure-6.1)

A monitoring mechanism for water resources between local bodies and state governments is essential, especially for rural areas where local resources such as tanks and ponds are crucial for domestic use. Currently, as reported, only 8 States have established such monitoring mechanisms:

States/UTs with Monitoring Mechanism of Water Resources	
Sl. No.	State
1.	Andhra Pradesh
2.	Chhattisgarh
3.	Haryana
4.	Kerala
5.	Madhya Pradesh~
6.	Odisha
7.	Punjab
8.	Rajasthan

~Monitoring Mechanism of Water Resources is available pertaining to Narmada Valley Development Authority (NVDA), which is one of the seven stakeholders of the Water Resources in Madhya Pradesh.

Only a few states have established effective monitoring systems between local bodies and state governments, crucial for managing rural water resources. Enhanced collaboration and communication are needed.

The observations from this study highlight concerns regarding water sustainability and the need for improved monitoring mechanisms. Inconsistent or lacking data can hinder accurate assessments, particularly in remote or under-resourced areas. The complexity of systems requires sophisticated models and approaches to capture all interactions. Ensuring collaboration among various water users and sectors is essential for comprehensive accounting.

6.4. Conclusion

The analysis of water resource management across States highlights both progress and significant challenges in ensuring sustainable water use. While various initiatives, such as the Jal Jeevan Mission, aim to improve access to clean water, disparities in data reporting and monitoring mechanisms raise concerns about the effectiveness of these efforts.

Addressing these issues through improved data reporting, standardized practices, and enhanced collaboration among stakeholders is essential for achieving sustainable water management and ensuring access to safe water for all.

Annexure-6.1

1. Whether the State Government Authorities possess detailed database of **water users** segregating into domestic (urban/rural), industries, irrigation, power generation etc. If so, please provide the details.
2. Whether the State Government authorities possess detailed database of **water usage** segregating into domestic (urban/ rural), industries, irrigation, and power generation etc. vis-à-vis surface as well as underground water resources. If so, please provide the detail.
3. Whether the State has the detailed breakup showing domestic/ industrial, irrigation users of water from **surface water** including water supply schemes and those dependent on **underground water**. If so, please provide details.
4. Whether there is a system of seeking approvals from the authorities before excavation of bore wells.
5. Total numbers of bore-wells allowed to be excavated and those functional within the State and types of users like agriculture, industry, domestic (urban/ rural) users.
6. Whether the State Government authorities collect data on abstraction of water through the bore wells from the above users.
7. Is there a system of affixing water meters in each of the bore wells functional in the State?
8. Has the State Government Authorities fixed or plans to fix a water norm per head per day in State.
9. Total number of rural household connections provided under Jal-Jeevan Mission in the State during 2021-22.
10. Whether all these connections were functional for water supply during 2021-22 and as status as on date vis-à-vis connections provided during 2021-22.
11. Whether water rates/taxes are leviable on different sectors like agriculture, industries, domestic usage.
12. If the State/UT is water-surplus or water-stressed during 2021-22. Please provide detailed area-wise assessments.
13. Any other input/ information, the State/UT authorities would like to share.
14. Whether the State Government/UT authorities possess detailed database of Water Quality Labs in State/UTs. If so, please provide the details.
15. Whether the State Government/UT authorities possess detailed database of total no. of aquifers & quantity of water available in aquifers present in State/UTs. If so, please provide the details.
16. Whether the State Government/UT authorities possess inventory of total no. of glaciers/glacial lakes (with area) present in State/UTs.
17. Whether the State Government/UT authorities have prescribed Water Polices?
18. Monitoring Mechanism of Water Resources between local bodies and the State Government, if any.

Chapter 7

Way Forward – Challenges and
Better Management of Resources

Way Forward – Challenges and Better Management of Resources

Water is a renewable resource as it is constantly renewed and recharged through the water cycle still it is critical to sustainable development. It is renewable resource till it is used dutifully, appropriately managed for present consumption by humans/living beings and **planned so that it is sustainable** for the future generations.

As accepted by the Ministry of Jal Shakti, GoI “*Water is essential for sustenance of life. **It is a limited resource.** Water resources of the country are required to be harnessed judiciously to meet the growing requirement of our developing economy. Therefore, development, conservation and management of water resources are crucial*”.

"The earth, the air, the land and the water are not an inheritance from our forefathers but on loan from our children. So we have to handover to them at least as it was handed over to us"

– Mahatma Gandhi

7.1 Action Plan

SEEA-Water was developed with the objective of standardizing concepts and methods in water accounting. SEEA-Water includes, as part of its standard presentation, information on the following:

- (a) Stocks and flows of water resources within the environment;
- (b) Pressures imposed on the environment by the economy in terms of water abstraction and emissions added to wastewater and released into the environment or removed from wastewater;
- (c) The supply of water and its use as an input in the production process and by households;
- (d) The reuse of water within the economy;
- (e) The costs of collection, purification, distribution and treatment of water, as well as the service charges paid by its users;
- (f) The financing of these costs, that is, who is to pay for the water supply and sanitation services;
- (g) The payment of permits for access to abstract water or to use it as a sink for the discharge of wastewater;
- (h) The hydraulic stock in place, as well as investments in hydraulic infrastructure made during the accounting period.

However, some of the key factors in the above information which have not been covered in the present tables, needs to be reviewed and incorporated in future compilations.

7.2 Challenges for Improvement of Existing Systems and Processes

With respect to the observations included in Chapter 6 based on the data received from the State Governments/Union Territories, the following are the suggested ways forward:

7.2.1 Availability of Water¹⁴

I. Enhance Data Collection:

- a. A systematic approach to tracking water/water quality loss due to both natural and man-made disasters is necessary. This includes establishing mechanisms for real-time data collection following events like floods, enabling authorities to identify recovery needs and inform future disaster preparedness strategies. Monitoring such data can significantly reduce water loss/wastage and enhance response efforts.
- b. Since rivers play a vital role in maintaining the water cycle, acting as natural channels for the transportation of water from the land to the oceans. They serve as a lifeline for countless species, providing them with essential resources for survival. States/UTs should establish robust mechanisms to ensure reliable and comprehensive data collection on water availability from various sources such as rivers, canals, reservoirs, tanks, and ponds. This data should be cross-verified with central sources of data like the Central Water Commission to reduce discrepancies. A standardized format for reporting will ensure reliability and accuracy across States/UTs

II. Floodplain Lakes and derelict water bodies:

- a. Data regarding this has been received only from three States. Floodplain of the rivers in urban areas have witnessed the excessive construction activities due to urbanisation or industrialisation, a phenomenon which has severely dishonoured the overall natural environment and river ecology. As mentioned in the National Water Policy, 2012 in Para 8.2 encroachments and diversion of water bodies must not be allowed and restored to the extent feasible and maintained properly. After the maintenance these water bodies could be used for conservation of water.
- b. In the context, to the above fact that results in shrinking/disappearing of water bodies, the “Indicative Guidelines for Restoration of Water Bodies (Polluted Lakes, Ponds and Rivers)” were issued by Central Pollution Control Board (CPCB) in June 2019 illustrating Recognition Phase, Restoration Phase, Protection Phase, Improvement Phase and Sustenance Phase be monitored in entire nation. The data as received from States/UTs for water availability in tanks/ponds/floodplain lakes/derelict water bodies indicates non-compliance to such environmental guidelines.
- c. Water Bodies lose their storage capacity due to sedimentation. Sedimentation reduces the storage volume and affects the productive management of water resources. Periodic assessment of sedimentation is crucial to ascertain and maintain

¹⁴ Table 1-As available in Chapter 6

the live storage capacity. The Ministry of Jal Shakti has formulated a “National Framework for Sediment Management” for holistically managing sediments. The compliance by the State Governments to this framework which emphasis sediment management through integrated river basin management plan would have increased the storage capacity and thus the water availability. The timely sediment management in watershed areas, rivers, reservoirs, lakes/water bodies etc would have lessen the existence of derelict bodies.

III. Brackish Water Monitoring:

There has been limited data from only a few states on brackish water resources. As per the “Mission Brackish Water/Saline Aquaculture-2022 action plan Report States/UTs” the data should have been received atleast from eleven States/UTs. The concerned Departments in this States/ UTs must intensify efforts to map and monitor these resources, especially in coastal and delta regions. This data is crucial for managing brackish water effectively and optimizing its use for industries, fisheries, and agriculture.

7.2.2 Usage of Water¹⁵

I. Sector-Specific Usage tracking/monitoring:

Some of the States/UTs have given combined figures for Urban users and Rural users not to mention the sources from where the water is supplied for domestic usage. In absence of data relevant to sources of water, it would be difficult to assess whether it is from surface water/underground water/water supplies. The distinction whether the supply is from surface water and underground water would give the analytical view which is being consumed in strategic way or which is being over exploited.

The over exploitation has negative effects and continued over exploitation can lead to the destruction of the resource, as it will be unable to replenish it. Increasing urbanisation has caused stress on ground water. The unceasing groundwater consumption rate imbalances with its natural replishment. For ground water the over exploitation can result in Water Table depletion, increased costs, land subsidence, Water Quality concerns. Land subsidence occurs when large amounts of groundwater have been withdrawn from certain types of rocks, such as fine-grained sediments. The rock compacts because the water is partly responsible for holding the ground up. When the water is withdrawn, the rocks falls in on itself. The over exploitation of Surface Water too can cause decrease in flow of water in rivers, drying of ponds and lakes especially during summers, droughts, disputes on water.

II. Wastewater Recycling:

- a. Encouraging industries to implement wastewater recycling and reuse systems is critical for reducing overall water consumption. Policies that incentivize recycling can lead to more sustainable water use in industrial sectors.

¹⁵ Table 2-As available in Chapter 6

- b. In this regard, “Benchmarking Industrial Water Use Efficiency in India” - a Policy Brief issued by TERI (October 2022) after reviewing the current water use practices in water intensive industries viz. Thermal Power Plants, Pulp & Paper, Textile and Iron & Steel have attempted to facilitate the setting up of the potential benchmarks for water use in water intensive industries in India through identified water saving interventions as well as technical and policy recommendations. These policies can be examined and thereafter considered for dissemination. This could serve as a guiding roadmap for industries in attaining the goal of improving water use efficiency in the country as an effective step in Water Resource Management.

III. State Governments/UT Authorities have with respect to some data stated “Data Not available with the State Government/UT”. This indicates that the demand of the the State in all the three sectors cannot be correctly assessed and the perceptions on this data would not be dependable. The weaknesses in the data collection need to addressed by all the line Departments in the State/UT dealing with Water Resources. The dedicated data collection can ensure data accuracy which is crucial for decision making in management of Water Resources. The tracking of water usage sector wise would enhance accountability and manage water resources more effectively.

7.2.3 Details of cost of revenue on water supply/extraction of water (2021-22)¹⁶

I. Standard water tariff mechanism:

Water Resources are an important resource and cannot be replaced. The development of the economy, the increase in population and urbanisation have increased the water demand continuously. Supply-demand imbalances, occurs when the quantity of a good supplied does not match the quantity demanded. The imbalance has two primary causes regarding water: physical is when there is inadequate water in a region to meet demand and economic is where water exists but poor management and lack of infrastructure limits the availability of clean water to the user.

Both causes can be covered to the extent by creating the infrastructures for conservation or supply that requires a financial proposition. The focus on constructing supply systems, need a radical transformation to be able to address such challenges. This creates essentiality for rationalised rate polices through designed tariff structure.

As observed in Table 3 there is no standardised format in the tariff related data for all the three sectors e.g it is volumetric based, source of water/supply based, per connection.etc. States/UTs need to adopt a standardized water tariff policy with the technical guidance from the Central Government that ensures standardisation, equitable pricing across sectors, particularly for high-demand users like industries and agriculture. Regular reviews of water tariffs will ensure that pricing remains fair and reflects the true cost of water provision. States/UTs need to streamline water tariff collection processes to improve the financial sustainability of water resource management.

¹⁶ Table 3-As available in Chapter 6

II. Standardize Water Charge Collection Criteria from the users:

The study highlights significant variations in water charge collection for the users across States/UTs. The users need to be classified and the measurement unit needs to be uniform. A uniform framework for collecting water charges should be developed, accounting for differences in domestic, agricultural, and industrial usage. The standardised framework will reduce discrepancies and ensure transparency. States/UTs should adopt tariff policies that focus on sustainable consumption and efficient water use. If the users are charged suitably for water supply, consumption may become more economical and the wastage of water may tend to diminish and the sustenance of this resource would be possible.

A detailed and real-time tracking/monitoring system for water usage by different sectors (domestic, industrial, agricultural) would serve as a base for standardised water tariff structure. It is essential in analysis of water demand and supply management in all sectors. The well-designed database can ensure that each relevant data for water exists in one location at a time and that would be foundation for integrated strategic planning and decision making for Water Resource Management and its sustenance for the future.

Efforts at the Central Government Level:

- The Department of Water Resources, River Development and Ganga Rejuvenation, Ministry of Jal Shakti is responsible for laying down policy guidelines and programmes for the development and regulation of country's water resources. It aims to ensure optimal sustainable development, maintenance of quality and efficient use of water resources to match with the continuously growing demands on this precious natural resource of the country. In the year end Review of 2022 it is mentioned that several key policies and schemes have been implemented by the Department and guidelines issued from time to time to ensure optimal implementation of these schemes and policies at the grassroot level.
- Outcomes are the results or changes that occur due to implementation/ accomplishment of any program/scheme for water with the focus on sustaining water resources. Lack of data or data gaps with the State Government/UT does not serve the objective of Water Resources Management to achieve sustainable development and therefore this aspect needs to be addressed.

7.3 Way forward as per data collected in questionnaire from States/UTs in Chapter 6

- States/UTs sharing water bodies must engage in **effective inter-state/UT monitoring** to ensure that water flow data is coordinated and reconciled. Effective collaboration between concerned territories is crucial for preventing disputes and managing shared resources efficiently. Such cooperation is essential for maintaining equitable access and sustainable management of water resources. (Para 6.2.14)
- To enhance water resource management, it is important to implement **sector-specific reporting**. Each sector that utilizes water—such as agriculture, industry, domestic use, and environmental needs—should maintain distinct records. For example, in

agriculture, data on different irrigation methods should be collected to promote more efficient practices. Similarly, industrial sectors should report on water reuse and recycling rates, allowing for targeted interventions to maximize efficiency. (Para 6.3.1)

- A clear **framework for bore-well excavation** should be established to enhance regulatory oversight. Permits for bore-well excavation should only be issued following review by a designated authority to ensure compliance with groundwater conservation guidelines and protect critical water resources. (Para 6.3.2)
- Comprehensive records of **borewells**, including their functionality and user type, should be maintained. Categorizing borewells based on agricultural, industrial, or domestic use is vital for assessing overall water demand and usage patterns. (Para 6.3.2)
- With declining **groundwater levels** in many regions, installing **water meters** in key sectors is essential for monitoring and regulating groundwater abstraction. Mandatory installation of meters for sectors like industry will help track usage and ensure adherence to sustainable extraction practices, addressing the need to balance supply and demand. (Para 6.3.2)
- Monitoring the total number of rural household connections under initiatives like the **Jal-Jeevan Mission** is vital for evaluating access to water resources. Publishing statistics on new household water connections can highlight progress and identify areas requiring further improvement, ensuring safe and reliable access to water for all communities. (Para 6.3.3)
- In **water-stressed regions**, it is crucial to develop policies that regulate water extraction based on available resources. Implementing seasonal restrictions on groundwater extraction can allow for natural recharge and promote long-term sustainability. Such proactive policies can help address challenges related to diminishing water supplies and environmental health. (Para 6.3.5)
- Maintaining comprehensive **water quality data** is critical for safeguarding public health and the environment. States/UTs can create public platforms to share water quality test results, ensuring transparency and promoting responsible water use. (Para 6.3.6)
- Establishing a **robust database on aquifer levels and quality** is vital. Centralized systems that detail water table levels and recharge rates across aquifers will help inform policy decisions and enable more effective groundwater management. (Para 6.3.7)
- **Uniformity in water policies** across States/UTs is crucial to ensure consistent monitoring and regulation. Adopting similar definitions for water scarcity and establishing common quality thresholds will streamline national efforts to address water issues. This coherence is particularly important for coordinated responses to shared challenges. (Para 6.3.8)
- **Effective communication and coordination** between local bodies and state authorities are essential for managing rural water supplies. Local entities should share data on the availability of water from traditional sources with state/UT agencies to inform broader water management strategies and ensure that local needs are addressed in state-level planning. (Para 6.3.9)

7.4. Impact of Data Disparity on Decision-Making

Compendium on Water Resources has revealed significant gaps in data collection and reporting concerning the availability, usage, and revenue from water resources across States/UTs. These discrepancies hamper effective water resource management. The way forward must address these disparities through uniform data collection methods and improved reporting standards.

The data disparity identified in Chapter 6 impacts decision-making in several crucial areas:

- **Inaccurate Resource Allocation:** Discrepancies in reported water availability can lead to misallocation of resources. States/UTs that over report water availability may not receive the necessary support, while those with genuine water shortages might be overlooked, exacerbating regional water crises. Discrepancies between reported and actual water availability or usage can lead to public distress.
- **Policy Formulation and Implementation:** Inaccurate data makes it difficult for policymakers to craft effective water management policies. This could lead to misaligned interventions, such as inefficient water conservation programs or improper irrigation practices that fail to address real-world needs.
- **Financial Planning and Revenue Generation:** Data discrepancies in water usage and revenue collection affect financial planning. States/UTs may undercharge or overcharge users, leading to either revenue shortfalls or inefficiencies in water service delivery.
- **Water Sharing and Disputes:** For States/UTs that share water resources, data inconsistencies can lead to disputes. Accurate and coordinated data reporting is essential to prevent conflicts and ensure equitable sharing of water between States/UTs.
- **Long-Term Sustainability:** Discrepancies in data, particularly regarding groundwater extraction, can mislead authorities about the sustainability of resources. This may lead to over extraction or insufficient conservation efforts, compromising the long-term availability of water.

7.5 Way Forward for NRA Cell in GASAB and State Offices

- **Implementation Variation:** While GASAB has initiated the study, implementation across States/UTs remains inconsistent. A unified approach is necessary to ensure all States/UTs adhere to the same standards of data collection and reporting.
- **Knowledge Dissemination:** Field officers require enhanced technical expertise in water resource management. Capacity building including regular workshops and training sessions can help improve the quality of data collected and the effectiveness of water management strategies.
- **Improvement in Data Collection Methods:** States/UTs need to have centralised real-time information at one point from all the line Departments dealing with this resource within their own focus areas. A more comprehensive approach to data collection is necessary, particularly in rural and under-resourced areas. Enhanced methodologies for accurate and systematic data collection will address the current gaps in water availability and usage reporting.

- **Standardization of Methods:** Establishing standardized methods for data collection and reporting across States/UTs will facilitate national-level aggregation and comparison of data, leading to more effective policy formulation and resource allocation.

7.6 Conclusion

Accurate water accounting is a foundational tool for sustainable water management. It allows for informed decision-making that optimizes water usage, ensures equitable access, and promotes long-term resource sustainability. As water scarcity becomes an increasingly urgent global issue, investing in reliable and consistent water accounting systems will be crucial for securing water resources for future generations.

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