

# How Can We Measure Water Security Accurately?

Introduction to the Water Index for Sustainability, Equity, and Resilience (WISER)

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About this Publication

This learning note is the first in a two-part series capturing the findings from Phase 1 (July 2024–March 2025) of the Water Index for Sustainability, Equity, and Resilience (WISER) initiative. It includes key learnings from stakeholder interviews, listening circles, feedback sessions, and a roundtable discussion.

We also conducted a literature review to develop a framework of indicators to assess water security and tested them through a pilot survey across five different aquifer typologies. Part 2 of this series summarises the literature review and the pilot study results.

# About Water Index for Sustainability, Equity, and Resilience (WISER)

The Water Index for Sustainability, Equity, and Resilience (WISER) initiative bridges gaps in water security monitoring by providing a structured framework for tracking meaningful, outcomebased indicators.

By systematically tracking key water security indicators, WISER enables data-driven decisionmaking, improves resource allocation, and fosters more effective interventions to achieve water security in India.

# About WELL Labs

Water, Environment, Land and Livelihoods (WELL) Labs is a research and innovation centre driving social impact in the field of water sustainability. Based in Bengaluru, it is part of the Institute for Financial Management and Research (IFMR) Society. WELL Labs co-creates science-backed solutions that improve people's lives and livelihoods and sustain nature. It works closely with multiple stakeholders such as governments, businesses, multilateral institutions, and civil society groups.

# About Technical Consulting Programme

The Technical Consulting programme at WELL Labs enables better decision-making in the natural resources management sector through the use of data, models, and evidence-based approaches. It focuses on systematising monitoring, evaluation, and learning (MEL) for the water sector while developing simple, accurate indicators to assess water security. It is also building tools and frameworks to improve problem diagnosis in the sector.



# 1. Why a Water Index for Sustainability, Equity, and Resilience?

India has been experiencing severe and escalating water crises, driven by multiple factors: groundwater over-extraction, pollution, and climate change. Water security is a multidimensional challenge, encompassing aspects like sustainability, equity, resilience, and productivity. These dimensions, while critical, do not always align. Sometimes, achieving one might be at the expense of another. For example, enforcing groundwater extraction bans may improve sustainability, but could disproportionately impact marginalised users who lack access to alternative water sources.

#### India's water crisis manifests in several ways:

#### ① Too little

Seasonal and chronic water shortages are prevalent across urban and rural areas, exacerbating competition for limited resources.

#### ္နွို့ Too much

Climate change is intensifying extreme weather events like floods, which disrupt lives.

#### Too polluted

Water quality has degraded due to untreated sewage, industrial discharge, and agricultural runoff, compromising public health and ecosystems.

The government and philanthropic initiatives have made significant investments in water management to address these challenges. However, there is limited evidence regarding whether these efforts are yielding measurable improvements in water security. This situation raises critical questions like:

- · Are worsening forces prevailing over improving ones?
- · What indicators should guide interventions?
- How do we measure progress effectively?

Assessing these is a challenging task because water management is a dynamic, multifaceted issue. Unlike education or health, where indicators such as literacy rates or immunisation coverage help clearly assess outcomes, water security is influenced by spatial, temporal, and socioeconomic factors. For instance, the same intervention may yield different results in Punjab (where groundwater depletion is severe) compared to a remote settlement in Rayalaseema (where the primary concern is access).

Further, different stakeholders—water users, government agencies, donors, and civil society organisations—have varied perspectives on what constitutes water security. Farmers may prioritise irrigation reliability, while policymakers may focus on sustainable groundwater

levels. A robust indicator framework must integrate these diverse perspectives while ensuring scientific rigour and practical applicability. The principle of 'what gets measured gets managed' underscores the need for a robust framework to track water security outcomes beyond traditional input-output metrics.

#### The water sector would benefit from building a consensus on the most important outcomes and getting regular data to assess them.

Current water security assessments primarily focus on inputs (for example, funds allocated) and outputs (for example, the number of check dams constructed) rather than long-term outcomes. This results in gaps. For instance, reporting on the volume of water infrastructure created does not necessarily indicate whether communities have achieved reliable access to water. A shift toward outcome-oriented tracking is essential to address this gap.

Within the water sector, there are various strands of thought, often opposed to each other. Stakeholders differ on:

- If outcomes or outputs should be tracked when assessing water security.
- If data collection exercises should be community-led or largely steered by the government or civil society organisations.
- If the unit of analysis to assess water security should be the watershed level or the village/ block level.
- The frequency of tracking indicators.

Lessons from other sectors highlight the transformative potential of systematic monitoring. The health sector in India, through the National Family Health Survey (NFHS), and the education sector, through the Annual Status of Education Report (ASER), have successfully shifted their focus to meaningful outcomes.

ASER, launched in 2005, demonstrated that despite high school enrolment rates, learning outcomes were alarmingly poor, prompting a policy shift towards improving education quality rather than just increasing access. A similar approach in the water sector could provide datadriven insights into whether interventions are making a tangible difference and how we can make them more effective.

## 2. Conceptualising the Water Index

Imagine the water security of a region as analogous to the health of a human being. There are a set of vitals that indicate the person's overall health. We ideally track them repeatedly over time—think annual physicals—to learn about the person's health. In this context, asking "Did this drug lower the person's cholesterol?" is different from asking "How healthy is this patient?". The latter depends on multiple variables. The set of vitals that give a comprehensive picture of this person's health is analogous to the dimensions of water security we should track: balance, access, productivity, resilience, etc. We should ideally track these dimensions year-on-year to understand the directionality of the region's water security: is the region more or less water secure than the previous year?

A stakeholder may only be interested in the success of one output, such as "Were check dams effective in raising groundwater levels?". However, when tracking water security at the landscape level, the question we should be asking is "How healthy is the watershed?". Thus, water security assessment in India requires:

- a. An outcomes-focused framework that thoroughly investigates the problems with a watershed before implementing water management interventions. Not doing so would be akin to treating a patient without performing a health check-up.
- b. A mutually collective and collectively exhaustive framework that provides a holistic picture of the landscape. For this, it is critical to find an affordable yet comprehensive way of measuring biophysical complexities such as rainfall variability, runoff, surface water availability, and groundwater dynamics.

# 3. Objectives of the Water Index

The Water Index for Sustainability, Equity, and Resilience (WISER) initiative seeks to bridge gaps in water security monitoring by establishing a structured framework to track meaningful, outcome-based indicators. Its overarching objectives are:

#### Developing a coherent indicator framework

Creating a scientifically sound, stakeholder-informed set of indicators to measure water security across multiple dimensions.

#### Leveraging existing data and remote sensing

Combining secondary data sources with advanced remote sensing techniques to enhance the accuracy, scalability, and real-time tracking of water security trends. This includes filling gaps with systematic data collection in collaboration with civil society organisations to help the water sector move beyond anecdotal evidence.

Visualising and communicating the gathered data Effectively communicating the data stories that emerge from this exercise are key to fostering community engagement.

The initiative is a crucial step towards transitioning from fragmented, anecdotal assessments to a comprehensive, evidence-based approach that can drive policy and investment decisions for the long-term resilience of India's water resources.

# 4. What We Did in WISER Phase 1

a. Stakeholder consultations

Engaging practitioners, policymakers, donors, and technical experts to ensure the proposed indicators reflect ground realities and diverse needs.

#### b. Literature review

Drawing lessons from national and global water security measurement frameworks to ensure alignment with the best practices in the sector.

#### c. Pilot testing

Validating the indicators in diverse hydrogeological contexts to ensure their applicability and adaptability across different water-stressed regions in India.  Building the foundations of a multistakeholder consortium
 Establishing partnerships with civil society organisations, research institutions, and government agencies to

drive long-term institutionalisation and policy adoption.



# 5. What We Learnt from WISER Phase 1

#### 5.1 Stakeholder Engagement

August–September 2024

We interviewed the following stakeholders from grassroots organisations, donors, academia, and policy think tanks to get a pulse of the water sector.

SI no	Stakeholder	Туре	
1	Foundation for Ecological Security (FES)		
2	Transform Rural India Foundation (TRIF)		
3	BAIF Development Research Foundation	NGO/Grassroots	
4	World Wildlife Fund India		
5	CTARA, Indian Institute of Technology Bombay	Academia	
6	Indian Institute for Human Settlements (IIHS)		
7	CoRE Stack, Indian Institute of Technology Delhi		
8	World Bank		
9	Sattva Knowledge Institute	Policy	
10	Tata Trusts		
11	IndusInd Bank	Donors/CSR	
12	Arghyam		

The main takeaways from the exercise are:

### There is a need for landscape-level indicators, which are currently missing in impact assessments.

The sector lacks a landscape-level view of water security, which is reflected in the collected data. Commonly used indicators track water storage, access, and productivity. While stakeholders acknowledged the utility of outcome indicators, they also mentioned that certain indicators like groundwater levels are difficult to change.

# 2. Data collection requires a lot of time and money, and the collected data might not even be useful.

Differing assessment frameworks and data collection capabilities result in a lack of comparable insights. For example, donor requirements often determine what data is collected at the grassroots, resulting in datasets that cannot be easily compared. Further, data granularity differs based on scale and reporting requirements. Geographies differ, so a particular impact assessment model might not be applicable everywhere.

Moreover, robust data is cost-intensive to collect year-on-year, even for outputlevel indicators, pointing towards the need for more cost-effective data collection.

Besides, results from monitoring and evaluation assessments are not translated and communicated to the last mile, resulting in a lack of incentives to use them for landscape-level insights and course correction.  Water security is linked to different aspects of society and the environment, and cannot be worked on in isolation.

All stakeholders concurred that efforts to improve water security in India cannot be conceptualised and assessed in silos. The water sector struggles to understand what interventionspecific outputs actually mean for the overall water security of a region. This strengthens the need for a sectoral shift to landscape-level impact assessments.

The water sector needs a comprehensive indicator framework to track landscape-level, longterm impacts on water security and time-saving, cost-efficient ways to measure indicators.

We combined the stakeholder inputs with a literature review to create the WISER indicator framework.

#### 5.2 Literature Review

July–October 2024

There is considerable literature on assessing water security. We reviewed the existing scholarship to integrate scientific rigour with practical applicability and create a water security framework that is comprehensive yet contextually adaptable. We proposed a structured framework adapted from the Driver-Pressure-State-Impact-Response (DPSIR) approach<sup>1,2</sup>. Inspired by the socio-ecological systems framework (SESF)<sup>3</sup>, it is context-sensitive and ensures relevance to regional conditions.

<sup>1</sup> Babel, M. S., Shinde, V. R., Sharma, D., & Dang, N. M. (2020). Measuring water security: A vital step for climate change adaptation. Environmental Research, 185, 109400. DOI: 10.1016/j.envres.2020.109400.

<sup>2</sup> Rafaai, N. H., & Lee, K. E. (2024). Reconciling and contextualising multi-dimensional aspects for consolidated water security index: A synthesis. Journal of Environmental Management, 359, 121067. DOI: 10.1016/j.jenvman.2024.121067.

<sup>3</sup>Ostrom, E. (2007). A diagnostic approach for going beyond panaceas. Proceedings of the National Academy of Sciences, 104(39), 15181–15187. DOI: 10.1073/pnas.0702288104. We selected six dimensions to build a comprehensive picture of water security:

- Water balance
- Water access
- Water productivity
- Water resilience
- Water governance
- Water and ecosystem health

These dimensions consist of 12 indicators, which we selected based on four criteria: outcome-orientedness, sensitivity to ground realities, relevance to stakeholders and geographies, and ease of capturing. The dimensions capture the diverse and interconnected aspects of water security, thereby providing a holistic perspective. All stakeholders concurred on the utility and comprehensiveness of these dimensions.

#### 5.3 Pilot Testing

#### November 2024–January 2025

We conducted a data collection pilot to test the indicator framework before presenting it to sector experts for consensus-building. We worked with four Hindustan Unilever Foundation partners and one WELL Labs partner across five aquifer typologies to conduct primary surveys in two villages in each typology. A total of 30 households were surveyed in each of the 10 villages (total sample n=300) in the states of Punjab, Uttar Pradesh, Chhattisgarh, Maharashtra, and Karnataka. We also collected village-level data for indicators such as groundwater levels and surface water extent to validate the values obtained from remote sensing.

The pilot was useful in understanding how our proposed indicators perform on the ground and adding nuance to our understanding of landscapes.<sup>4</sup> For example, adjacent villages in Karnataka scored differently on the same indicators as one was in a canal command area and the other in a dryland area.

It also gave us insights into which indicators can be improved upon. For example, we learned that we need to ask sharper questions to improve the local water governance indicator.

Once our draft indicator framework and pilot results were ready, we conducted feedback sessions with technical experts and listening circles with select stakeholders. The key learnings from these interactions are summarised below.

<sup>&</sup>lt;sup>4</sup>The key findings from the literature review and the pilot study are captured in this report.

#### 5.4 Listening Circles

We conducted listening circles with select stakeholders to gather user perspectives.

- Akvo and Arghyam emphasised simplifying the communication of findings while maintaining scientific rigour, gamification for better data capture, and a phased survey design for sustainable 'design for scale'.
- b. Hindustan Unilever Foundation recommended clarifying data sources, accounting for seasonal trends, and contextualised explanations of indicators.
- c. WWF India suggested improving ecosystem health indicators through cost-effective biological proxies like fish species and eutrophication markers, complemented by simple water quality testing kits.

### 5.5 Technical Consultations

#### February 2025

We also presented the pilot findings to academic experts. These technical consultations focused on improving the methodology and scientific rigour for specific dimensions and indicators.

- Partik Kumar, a water governance expert, advised incorporating governance frameworks and proxy questions to capture institutional dynamics across different contexts.
- b. Dr. Aaditeshwar Seth, a professor at IIT Delhi, suggested integrating CoRE Stack indicators to enhance data validation and reduce duplication.
- c. Dr. Sunderrajan Krishnan of INREM
  Foundation suggested incorporating user
  perceptions and social equity in water
  access and quality indicators.

- Dr. Tushar Apurv, a professor at IIT Kanpur, provided methods to refine drought and groundwater indicators using statistical trend analyses and remote sensing data.
- e. Dr. Tom Gleeson, a hydrogeologist and professor at the University of Victoria, proposed a balance of static and dynamic indicators, with a focus on usability, equity, and environmental flows.

### 5.6 WISER Roundtable

We held a roundtable in Bengaluru with 30 stakeholders from academia, donor organisations, and grassroots groups to review Phase 1 pilot results and discuss how they would like to engage with WISER. Participants formed working groups to refine the framework and explore data management best practices for Phase 2.

The roundtable shaped the direction of Phase 2 (discussed in Section 7 below) and elicited interest from participants in collaborating on fundraising, data collection, and research.

# 6. Reflections on WISER Phase 1

 The WISER framework must not just be a measurement tool, but a driver of change.

Unlike older water indices, it must balance scientific rigour with simplicity, public engagement, and policy relevance. In this respect, it takes inspiration from ASER's media traction and actionable data model. **2** We must distinguish between output and outcome indicators.

The former enable immediate, localised action (for example, competitions like the Water Cup), while the latter offer strategic guidance.

**3** We must build a broad coalition and design data collection as a 'for the community, by the community' process.

This participatory model would promote public ownership and acceptability, provided the framework ensures transparency and accuracy.

There were debates about integrating satellite or government data as they could dilute the citizen-led nature of WISER. Some participants suggested that such data might be more appropriately housed in platforms like CoRE Stack. 4 It is important to choose the right unit of analysis, use adaptable sampling designs, and build robust, communitydriven data infrastructure.

The latter includes direct water quality testing and surveyor capacity-building, and can promote both credibility and scalability.

# 7. What's Next for WISER

The extensive feedback we received during Phase 1 highlighted the diverse expectations stakeholders in the water sector have from the framework.

In Phase 2, our primary goal is to establish WISER's adaptability across different contexts and its value in enabling decision-making for various stakeholders. This entails designing for scale, while keeping the framework simple to capture public interest and relevant to drive policy change.

To achieve this goal, we shall explore how the framework performs on the following pathways to change:

# 1. A local, community-driven exercise for better local water governance

This pathway focuses on positioning WISER as a digital public good with a do-it-yourself toolkit that communities can use to assess their water security. Such a model empowers local actors to assess and act on water issues, though the density of the data they collect might be limited.

For this pathway to be effective, we would need both landscape and householdlevel water security indicators. Welldesigned community engagement efforts would be required to translate the data into on-ground efforts. The identification of meaningful indicators and communication around them would also be critical.

# 2. Government partnerships for secondary data-driven indicators

This pathway involves partnering with state governments to use secondary data and remote sensing for large-scale assessments. It would help address the most urgent water-related outcomes by integrating WISER into state policy planning. We shall focus only on remote sensing and/or indicators based on secondary data for this pathway. For this approach to be effective, we would need a statistically representative sample size for the whole state. Strong government partnerships would also be required to funnel our findings into state-level water resources management initiatives.



The priorities for Phase 2 are:

#### **1** Creating a modular framework

The framework should be adaptable to different geographies and stakeholders. This can be facilitated using a core set of indicators and a secondary/optional one. This approach ensures flexibility, allowing various users to select relevant indicators based on their needs and contexts.

# 2 Testing the framework along the two pathways to change

Building and testing hypotheses for the two pathways will help us narrow down the most effective strategies. It will also help us learn how to design for scale beyond Phase 2.

# **3** Balancing data collection and assimilation

Primary data serves as a sharp tool for targeted insights, while secondary data provides a broader foundation for analysis. A strategic blend of both ensures a comprehensive understanding without overcomplicating the data collection process.

#### **4** Ensuring data ethics and ownership

Clear guidelines on data ownership, privacy, and access rights are essential to maintaining transparency and trust among stakeholders.

WISER is an ambitious initiative and we are only at the beginning of this journey. The enthusiastic engagement from key players during Phase 1 has reinforced our belief that the water sector is ready for a robust indicator framework. Their valuable feedback has strengthened our commitment to refining WISER into a tool that effectively addresses the most pressing questions and provides accurate, actionable insights.

As we move forward, we shall make WISER more practical and impactful. In Phase 1, we worked to create the needle—with Phase 2, we seek to move the needle on water security in India.



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