Authored by

Supported By

TATA TRUSTS

SUSTAINABILITY OF DRINKING WATER SOURCES IN THE DISTRICTS OF PALI (RAJASTHAN) AND BANDA (UTTAR PRADESH)

UNDERSTANDING THE GROUND REALITIES

Authored by

Supported By

TATA TRUSTS

SUSTAINABILITY OF DRINKING WATER SOURCES IN THE DISTRICTS OF PALI (RAJASTHAN) AND BANDA (UTTAR PRADESH)

UNDERSTANDING THE GROUND REALITIES

Research direction: Subrata Chakraborty

Research guidance: Sushmita Sengupta

Authors: Pradeep Kumar Mishra, Swati Bhatia and Vivek Kumar Sah

Research support: Hari Prakash Haihyvanshi and Manish Mishra

Editor: Archana Shankar

Cover and design: Ajit Bajaj

Production: Rakesh Shrivastava and Gundhar Das

Supported by TATA TRUSTS

Maps in this report are indicative and not to scale.

Citation: Pradeep Kumar Mishra, Swati Bhatia and Vivek Kumar Sah 2026, *Sustainability of Drinking Water Sources in the Districts of Pali (Rajasthan) and Banda (Uttar Pradesh): Understanding the Ground Realities,* Centre for Science and Environment, New Delhi

Published by
Centre for Science and Environment
41, Tughlakabad Institutional Area
New Delhi 110 062
Phones: 91-11-40616000
Fax: 91-11-29955879
E-mail: cse@cseindia.org
Website: www.cseindia.org

Contents

Executive summary

India's rural drinking water sector has made substantial progress under the Jal Jeevan Mission (JJM), particularly in expanding household tap connectivity. As the programme matures, the focus is increasingly shifting towards ensuring reliability, sustainability and quality of service delivery.

This study, based on field assessments across 30 villages (15 each in Pali [Rajasthan] and Banda [Uttar Pradesh]) covering 589 households, provides insights into the functioning of rural water supply systems across two distinct hydrogeological settings.

The findings indicate that while infrastructure coverage has expanded significantly, service delivery varies across locations, with notable differences between Pali and Banda.

In Pali district, of the surveyed households, 70 per cent had access to tap connections, while 58 per cent reported receiving water through these. In Banda district, the corresponding figures are higher, with 83 per cent of households having tap connections and 67 per cent reporting water supply. These trends suggest that while coverage has improved in both districts, there is scope to further strengthen the functionality and reliability of service delivery, particularly in regions facing hydrogeological constraints.

Water supply patterns also differ in their intensity and regularity. In Pali, water supply is often constrained by limited sources, with many households receiving water intermittently. In Banda, although supply coverage is higher, households still report variability in regularity. Across both districts, only about 19 per cent of households receive a daily water supply, while 47 per cent depend on an alternate-day supply, typically for one to two hours per day, indicating opportunities to enhance distribution efficiency and service consistency.

A key distinction between the two districts lies in their dependence on sources and sustainability. In Pali, which is characterized by arid conditions, households continue to rely significantly on groundwater sources despite the expansion of surface water supply systems. The study found that approximately 40 per cent of groundwater-based sources in Pali are defunct or degraded, primarily due to salinity and over-extraction. Surface water supply through systems such as

the Jawai Dam is helping bridge gaps, but groundwater remains an essential supplementary source.

Banda district shows around 37 per cent of groundwater sources to be defunct. Located in the alluvial plains, it shows relatively better groundwater availability than Pali, and households continue to use hand pumps, borewells, and shallow tube wells alongside piped supply systems. While this provides a degree of resilience, it also indicates that multi-source dependence remains integral to rural water use patterns in both districts.

With respect to water usage, households in both districts reported consumption levels of approximately 40–50 litres per capita per day (LPCD) for essential domestic needs. However, in both Pali and Banda, these estimates are based on user responses due to the absence of metering systems, suggesting the need for improved measurement and monitoring mechanisms.

Water quality perceptions also vary across districts. In Pali, around 40 per cent of surveyed households reported concerns, with smaller proportions citing turbidity and fluoride issues, particularly in groundwater-dependent villages. In Banda, water quality concerns were less pronounced, though around 12 per cent of surveyed households still reported issues related to salinity and iron. These findings indicate the importance of strengthening water quality testing, monitoring, and communication systems in both contexts.

Institutional arrangements, particularly the role of Village Water and Sanitation Committees (VWSCs), show similar patterns across both districts. While VWSCs have been formed in villages under JJM, their level of awareness and engagement varies. In both Pali and Banda, there is an opportunity to further strengthen capacity building, community participation, and institutional ownership to support long-term sustainability.

Operation and maintenance (O&M) systems are currently supported by government and contractor-led mechanisms in both districts. In Pali, some villages previously collected community contributions, though their use remains limited. In Banda, reliance on government-supported systems is more pronounced. These trends indicate scope to develop context-specific and sustainable O&M models, aligned with policy frameworks and local capacities.

The study also highlights the importance of institutional convergence in both districts. Strengthening coordination between departments responsible for

water supply, groundwater recharge, and watershed development can enhance the effectiveness of investments. This is particularly relevant in Pali, where hydrogeological challenges require more targeted and integrated planning, and in Banda, where improving system efficiency and maintenance can further strengthen outcomes.

The experience of these two districts highlights that sustainable water security requires a context-specific and integrated approach—one that responds to local hydrogeological conditions while combining infrastructure, source management, community participation and institutional coordination.

A. Introduction

Rural drinking water programmes have been a focus of different governments since Independence. Various programmes have been launched by the Central and state governments to meet the drinking water needs of the rural community. Various Central-level schemes have been started since 1949, and many have failed to meet their objectives. As the number of villages increased under newly launched schemes, older covered villages saw a decline in water supply coverage (see *Table 1: Centrally sponsored programmes launched in India*).

Table 1: Centrally sponsored programmes launched in India.

1949	The Environment Hygiene Committee (1949) recommended provision of safe water supply to cover 90 per cent of India's population in a timeframe of 40 years.
1950	The Constitution of India conferred ownership of all water resources on the government, thereby making water a state subject and granting citizens the right to safe drinking water.
1954	The National Water Supply and Sanitation Programme was launched in India as a part of first Five-Year Plan, and as recommended by the Environment Hygiene Committee (1949)
1969	The National Rural Drinking Water Supply Programme was launched, with technical support from UNICEF. 1.2 million borewells were dug, and 17,000 piped water supply schemes were provided.
1972–73	The Central government introduced the Accelerated Rural Water Supply Programme (ARWSP) to expedite rural water supply.
1986	ARWSP was put into mission mode with the formation of the National Drinking Water Mission (NDWM).
1991	NDWM was renamed Rajiv Gandhi National Drinking Water Mission (RGNDWM).
1994	The 73rd Constitutional Amendment assigned Panchayati Raj Institutions (PRIs) the responsibility of providing drinking water.
2002	Sector reforms were scaled up nationwide. India committed to the Millennium Development Goals, i.e. to halve by 2015 the proportion of people without sustainable access to safe drinking water and basic sanitation from 1990 levels. Swajal Dhara was launched to empower panchayats to formulate, implement, operate and maintain drinking water projects.
2004	All drinking water programmes were brought under the RGNDWM umbrella.
2005	The Government of India launched the Bharat Nirman Programme for overall development of rural areas by strengthening housing, roads, electricity, telephone, irrigation and drinking water infrastructure. The target was to provide within five years drinking water to 55,069 uncovered habitations, those affected by poor water quality and slipped-back habitations (based on the 2003 survey).
2007	Pattern of funding under the Swajaldhara Scheme changed from the previous 90:10 Central–community share to 50:50 Centre–state share. Community contribution was now optional.
2019	Jal Jeevan Mission was introduced. For the first time grey-water management became a part of the water supply system. The funding pattern was 100 per cent for Union Territories without legislature, 90:10 for the Northeastern and Himalayan states and Union Territories with legislature, and 50:50 for rest of the states.

Source: Compiled by CSE

The latest flagship programme launched in the year 2019, Jal Jeevan Mission (JJM) promised to cover all the backlogs and provide every rural household with a Functional Household Tap Connection (FHTC). These FHTCs would provide drinking water to rural households through groundwater sources, surface-water sources or a combination of both. Apart from providing drinking water, JJM also mandated the sustainability of water sources to ensure the regularity and longevity of water supply. Wherever there was a regular decline of groundwater or the groundwater was polluted, the mission moved towards surface water sources. Another important aspect of JJM is the grey-water management, for which the mission emphasizes on household and community-level interventions. And to make this entire mission sustainable, the community institutions in the villages were made central to the implementation of the programme. For this, the JJM guidelines mandate the formation of VWSC in every village, and they should be part of every process, starting from planning, implementation and installation of infrastructure, collection of water tax, community contribution and operation and maintenance.

To understand the ground reality, the CSE team conducted an evidence-based study in selected villages of two ecologically different districts—desert district Pali district, in Rajasthan, and Banda district, in the Indo-Gangetic Plain of Uttar Pradesh . The study involved visiting selected villages and understanding the state of household supply. The team met the household owners, gram panchayats, Village Water and Sanitation Committees, school teachers, and anganwadi and ASHA health workers. Meetings were also held with JJM (under the Public Health Engineering Department/water utility) officials, the Rural Development Department, the Panchayati Raj Department, the Watershed Department, and other relevant departments responsible for household supply, greywater management, and building water conservation structures in the villages.

Several rounds of field visits in Pali and Banda districts have revealed that providing a safe and secure household supply to villages in these districts is an uphill task. The reasons vary from slow progress of pipe connections, poor maintenance of laid down pipes, wrong pipe layouts plans and drying of sources.

State water policies in Rajasthan and Uttar Pradesh in connection with rural water supply schemes

Both Rajasthan and Uttar Pradesh have framed state water policies that prioritize drinking water supply, especially for rural areas, in line with sustainable water management principles.

Rajasthan adopted its State Water Policies in 1999 and 2010. The 2010 policy, which is currently in force, declares drinking water for humans and livestock as the highest priority and treats it as the 'first charge' on all water resources. It emphasizes decentralized and community-based management, empowering Panchayati Raj Institutions and local water user groups. The policy promotes the conjunctive use of surface and groundwater, integration of traditional water sources, rainwater harvesting, and strict monitoring of water quality, particularly for fluoride contamination. It also ensures a minimum quantity of drinking water for those unable to pay water charges.[1]

Uttar Pradesh introduced its first State Water Policy in 1999, followed by a revised policy in 2020. The 2020 policy gives first priority to drinking water, followed by environmental flows, irrigation, power and industry. It focuses on universal access to safe drinking water and sanitation, groundwater regulation, aquifer mapping, rainwater harvesting, and recharge of overexploited blocks. The policy adopts an integrated water resources management approach through river basin planning and incorporates environmental protection and climate resilience.[2]

Overall, both states emphasize drinking water security, sustainable use of water resources, community participation, and alignment with rural water supply initiatives such as the Jal Jeevan Mission

Rural drinking water schemes in the two districts

Since Independence, various Centrally sponsored programmes were launched to provide drinking water to the rural communities, prior to Jal Jeevan Mission (JJM). There were different mandates in different programmes, but the implementation faced roadblocks, making these programmes suffer. Every successive programme would add new villages under drinking water supply, but the villages covered in respective previous programmes faced slippage due to operational reasons. Additionally, sustainability of drinking water sources was a bigger challenge in these programmes. As per the Jal Jeevan Mission dashboard, only 16.72 per cent of rural households had Functional Household Tap Connections (FHTCs) as of 15 August 2019. While access to basic drinking water sources existed through earlier programmes, this highlights the limited penetration of household-level piped water supply prior to JJM.

On 15 August 2019, Government of India launched the flagship programme Jal Jeevan Mission aiming to provide safe and adequate water to rural households. Not only the water supply was guaranteed in this mission, sustainability of drinking water sources and management of greywater was also envisaged in this

programme. As per the dashboard, since start of the mission, more than 77 per cent of rural households have received Functional Household Tap Connections (FHTC) under the mission. The total fraction of rural households in the country covered under JJM stands at 81.45 per cent. The mission has been implemented in all the states and Union Territories of the country with the help of state governments (see *Table 2: Household coverage at national, state and district levels under JJM*).[3]

Table 2: Household coverage at national, state and district levels under JJM

Household coverage under JJM at national level—81.45%				
Coverage at state level	Rajasthan	58.45%	Uttar Pradesh	91.22%
Coverage at district level	Pali	85.22%	Banda	99.82%

Source: JJM dashboard (https://ejalshakti.gov.in/jjmreport/JJMState.aspx) as viewed on 10 September 2025.

Apart from rural drinking water programmes launched by the Central government, states also had their own initiatives to provide drinking water to rural communities. Some states had implemented only Centrally sponsored schemes, while other had initiated state-sponsored schemes, sourcing state funds. The villages are getting water supply from different sources, implemented under various schemes. The previously existing state-sponsored schemes, programmes and projects in Pali and Banda districts are as follows.

1. Pali (Rajasthan)

a. **Janta Jal Yojana (JJY):** Prior to 1990, Rajasthan state was implementing Centrally sponsored schemes in the state through Public Health Engineering Department (PHED). In the state of Rajasthan, PHED is the key department responsible for implementation of all the rural water supply programmes in the state. It was the main authority in the state which controlled the planning, implementation, monitoring, operation and maintenance of rural water supply initiatives. The state water policy 1999 also defines the role of PHED in providing drinking water to the rural communities.[4]

In 1990s, the Rajasthan government launched a rural drinking water supply programme famously known as Jal Jal Yojana (JJY). This was a major shift in the history of rural drinking water supply schemes in the state, as it intended to shift ownership of the scheme from government to community. It also proposed that the gram panchayat, NGOs and other community-based organizations should take the ownership of the drinking water supply under Janta Jal Yojana by active participation, collecting water user charges and facilitating operation and maintenance of the scheme. The draft state water policy of 2005 and 2008 and the finalized state water policy 2010, brought a shift in the responsibilities of

PHED, where now the department would play a role of a planner, implementer and facilitator instead of a central authority. In almost all villages in the state, the gram panchayat used local water sources to provide drinking water to rural households. Most of the sources were groundwater based. In some villages, the gram panchayats provided household tap connections, while in other villages, ground-level reservoirs (GLRs) and public standposts were provided. Since the groundwater-based sources were overly extracted, a huge problem of high TDS and fluoride contamination started to emerge. In Pali district, most of the groundwater-based sources used for providing drinking water in villages under JJY have high TDS. This became a need for the gram panchayats to shift from groundwater-based sources to surface-water sources.

b. Jawai Dam Project: One of western Rajasthan's biggest dams, Jawai Dam was built in the 1950s aimed to provide flood control to Pali and Jalore districts, provide irrigation, drinking water supply and generate hydro-electric power. Due to non-availability of required pressure round the year for producing electricity, the primary goal was for the dam to provide drinking water and irrigation to villages and towns of Pali district. Built on the Jawai River, a tributary of Luni River, this dam proved a milestone in ensuring water security in the Pali district. Many villages were facilitated with pipe and tap connections under the Jawai Project where drinking water was supplied. This project was mainly useful for the villages where groundwater-based sources were being contaminated with high TDS and fluoride.

After the start of the Jal Jeevan Mission (JJM), these schemes were merged under this flagship mission. In 2021, JJM started to source water from Jawai Dam to provide drinking water to around 333 villages, in phase-wise manner. More villages are being added to provide drinking water from Jawai Dam Project, under Jal Jeevan Mission.

2. Banda (Uttar Pradesh)

a. Centrally sponsored schemes (National Rural Drinking Water Programme): In Uttar Pradesh state, initially the Centrally sponsored schemes were implemented by the Uttar Pradesh Jal Nigam Department, where the gram panchayats were supplied drinking water through hand pumps and tube wells. The Public Health Engineering Department in the state of Uttar Pradesh was established in 1927, and changed to the Local Self Government Engineering Department (LSGED) in 1946.[5] With the launch of Uttar Pradesh Water Supply and Sewerage Act, 1975, LSGED was renamed as Uttar

Pradesh Jal Nigam (UPJN), which aimed at providing water supply to rural and urban areas of Uttar Pradesh state. This department was responsible for implementation of all centrally sponsored schemes in the state of UP through gram panchayats. Most of the villages in Banda district were supplied drinking water from the groundwater-based sources, prior to Jal Jeevan Mission, where the villages were provided with an overhead tank and household tap connections.[6]

In 2021, Uttar Pradesh Water Supply and Sewerage (amendment) Act, 2021 brought new changes and separated rural and urban supply. Hence, Uttar Pradesh Jal Nigam (Rural) was formed, focusing on rural areas to provide drinking water supply. The department now implements the JJM programme in rural areas of Uttar Pradesh by creating infrastructure for rural water supply. The surface-water source has also been now taken for rural water supply under JJM. In Banda district, apart from the groundwater-based sources used for supplying drinking water, Yamuna River is also being used as a surface water source under JJM.[7]

b. **Jal Sansthan Chitrakoot Dham Mandal Scheme:** In Banda district, Jal Sansthan of Chitrakoot district initiated a drinking water supply programme to provide drinking water to some towns and villages. Under the scheme, 21 villages in the Banda district were supplied with drinking water. Due to infrastructural and operational issues, the schemes were paused in rural areas. After the launch of Jal Jeevan Mission, the village water supply was taken care of under the mission.[8]

Aim, objective and scope of the study

Aim of the study

The aim of the study is to undertake an evidence-based assessment of the sustainability of drinking water sources in selected villages of Pali district (Rajasthan) and Banda district (Uttar Pradesh). The study seeks to examine the on-the-ground realities of rural drinking water supply by analysing source sustainability, institutional arrangements, community participation, their roles in operation and maintenance practices, and greywater management. The study also aims to understand the community's views on the current state of rural drinking water supply systems in contrasting hydrogeological contexts.

Objective of the study

The specific objectives of the study are to:

1. Study the current status of rural drinking water supply systems in selected villages of Pali and Banda districts;
2. Understand if the drinking water sources are sustainable, including groundwater- and surface-water-based systems;
3. Identify key challenges affecting long-term source availability and functionality;
4. Analyse the role of community-level institutions, particularly Village Water and Sanitation Committees, in planning, implementation, operation and maintenance of rural water supply schemes;
5. Identify implementation gaps and operational challenges under the Jal Jeevan Mission, particularly in relation to community participation, institutional convergence and source sustainability; and
6. Develop an action agenda aimed at strengthening source sustainability, improving community engagement, and enhancing the overall effectiveness of rural drinking water supply systems in diverse hydrogeological settings.

Scope of the study

This study undertakes an evidencebased assessment of drinking water source sustainability in selected villages in Pali district (Rajasthan) and Banda district (Uttar Pradesh). It examines the performance and sustainability of rural drinking water supply systems—including household coverage, reliability, and adequacy—across groundwater and surfacewater-based schemes. The scope further includes analysis of institutional arrangements, particularly the role of Village Water and Sanitation Committees in planning, operation and maintenance, identification of key implementation and operational gaps under the Jal Jeevan Mission, and development of contextspecific recommendations to strengthen source sustainability, community engagement, and overall effectiveness of rural drinking water services.

What this study does not cover

This assessment prioritizes water supply conditions, source sustainability and community institutional participation over detailed infrastructure analysis. Findings represent a combination of surveyor observations and unvalidated stakeholder responses. As the study utilizes a statistically calculated sample, it does not capture the specific scenario of every household in the selected villages. Secondary research is based on publicly available data. Finally, this report focuses on sustainability; detailed greywater management documentation will be issued in a separate report

B. Methodology

Selection criteria for study area

The study area was selected based on different parametres required to understand the different ground situations.

The research areas for the landscaping study have been selected in Pali district of Rajasthan and Banda district of Uttar Pradesh. To conduct the landscaping study on the issues of source sustainability and greywater management in rural areas of Pali and Banda districts, villages have been chosen based on different criteria as mentioned below:

1. **Hydrogeology:** The villages from different blocks in Pali district have been selected from different hydrogeology formations—comprising granite, older alluvium, gneiss and phyllite, which are present in the entire district. So, the sample of villages selected would represent all kinds of formations in the district. The geology of Banda district is characterized by older alluvium, newer alluvium and granite.

2. **Household population:** The chosen sample of villages cover different numbers of households, ranging from 33–961 households in village in Pali district and 127–2,255 households in villages in Banda district.

3. **Percentage of households covered under drinking water supply:** The selected villages also represent different percentages of households covered under drinking water supply, as mentioned in Jal Jeevan Mission dashboard, ranging from 0 per cent coverage to 100 per cent coverage in selected villages.

4. **Har Ghar Status in JJM:** Out of all the villages where 100 per cent of households have been covered under JJM, the selected villages represent the Har Ghar Status as 'reported' and 'certified'.

5. **Type of water supply scheme:** The sample villages are selected based on water supply schemes and sources of water used for supplying drinking water. The sample villages cover both Single Village Schemes (SVS) and Multi Village Schemes (MVS).

The details of villages selected are given below (see *Table 3: Selected villages in Pali and Banda districts*).

Table 3: Selected villages in Pali and Banda districts

State	District	Block	Village	Total household	Population	Household coverage (in %)	Rock type	Har Ghar Jal status (reported*/ certified**)	Type of water supply scheme (SVS/ MVS)
Rajasthan	Pali	Bali	Velar	266	1,332	90.23	Granite		SVS
			Kothar	961	3,074	100	Granite	Reported*	SVS
			Bardi	353	1,911	60.97	Granite		SVS
			Khetarli	254	1,328	7.87	Older alluvium		SVS
			Goriya	641	3,448	4.06	Gneiss		SVS
		Sumerpur	Barli	151	585	100	Older alluvium	Certified**	MVS
			Gogra	364	1,956	0	Older alluvium		SVS
			Rojra	326	1,560	54.29	Granite		SVS
			Basant	598	3,018	100	Granite	Certified	MVS
			Dholasasan	221	1,378	100	Granite	Reported	SVS
		Rani	Keerwa	500	2,572	100	Older alluvium	Reported	MVS
			Vingarla	227	1,232	100	Phyllite	Certified	SVS
			Pratapgarh	333	1,133	100	Granite	Certified	SVS
			Septawa	167	754	100	Granite	Reported	SVS
			Nawagura	497	1,325	100	Older alluvium	Certified	MVS
Total				5,859	26,606				

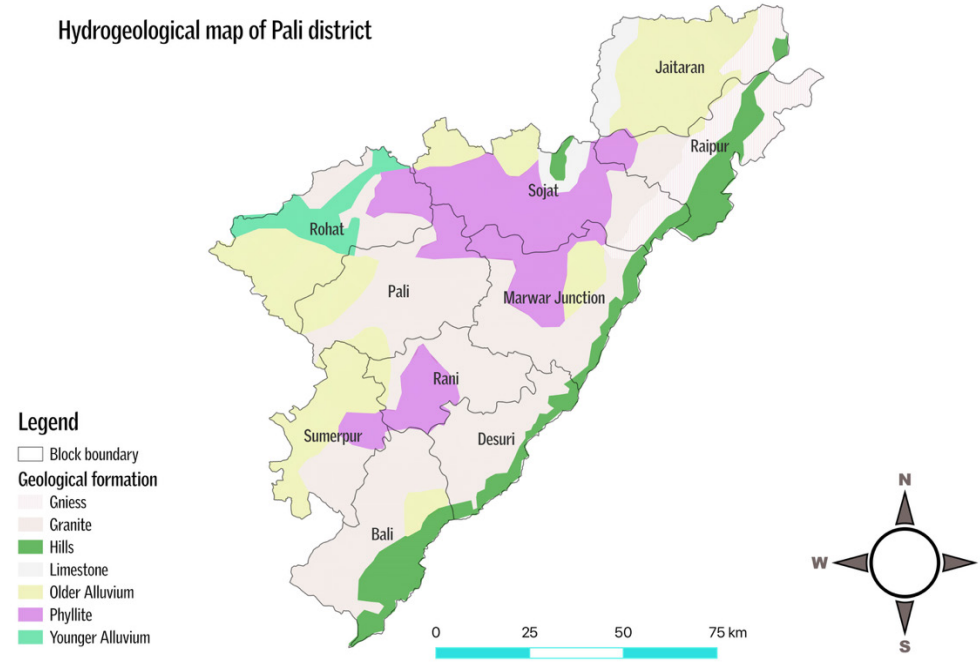
State	District	Block	Village	Total household	Population	Household coverage (in %)	Rock type	Har Ghar Jal status (reported*/ certified**)	Type of water supply scheme (SVS/ MVS)
Uttar Pradesh	Banda	Baberu	Samgara	815	5,402	100	Older alluvium	Certified	SVS
			Jugrehlee	159	1,011	100	Older alluvium	Certified	SVS
			Milathu	502	3,237	100	Older alluvium	Certified	SVS
		Jaspura	Bhatha	127	811	100	Newer alluvium	Certified	MVS
			Jaspura	1,406	8,057	100	Older alluvium	Certified	SVS
			Gadariya	1,549	9,107	100	Older alluvium	Certified	SVS
			Lasada	290	1,613	100	Older alluvium	Certified	SVS
		Badokhar Khurd	Lohara	133	691	100	Older alluvium	Certified	MVS
			Achharaund	609	3,840	80.62	Newer alluvium		SVS
			Mohan Purwa	639	3,684	85.92	Newer alluvium		SVS
			Jaurahi	547	3,666	100	Newer alluvium	Certified	SVS
			Tindwara	2,255	13,773	100	Newer alluvium	Certified	SVS
			Bhawani Purwa	232	1,395	100	Newer alluvium	Certified	SVS
		Naraini	Bahadurpur Kalinzar	706	3,805	100	Granite	Reported	SVS
			Sadha	1,329	7,550	100	Granite		SVS
Total				11,298	67,642				

District	Number of villages	
	Single-Village Scheme	Multi-Village Scheme
Pali	11	4
Banda	13	2

***Har Ghar Jal status (reported):** The Rural Water Supply Department of the state declares the village as having 100 per cent tap water coverage in the JJM Integrated Management Information System
****Har Ghar Jal status (certified):** The gram sabha passes a resolution confirming that all households, schools and anganwadis are receiving functional tap water, supported by a video documentation.

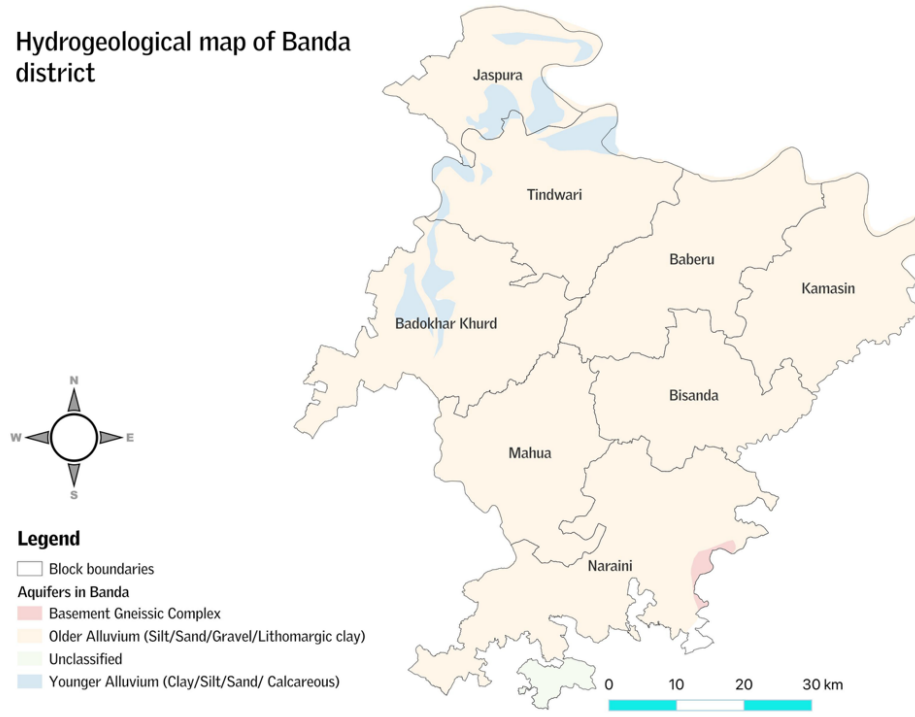
Source: JJM dashboard (https://ejalshakti.gov.in/jjmreport/JJMIndia.aspx) as viewed on September 10, 2025 and Central Groundwater Board

Map 1: Hydrogeological map of Pali district



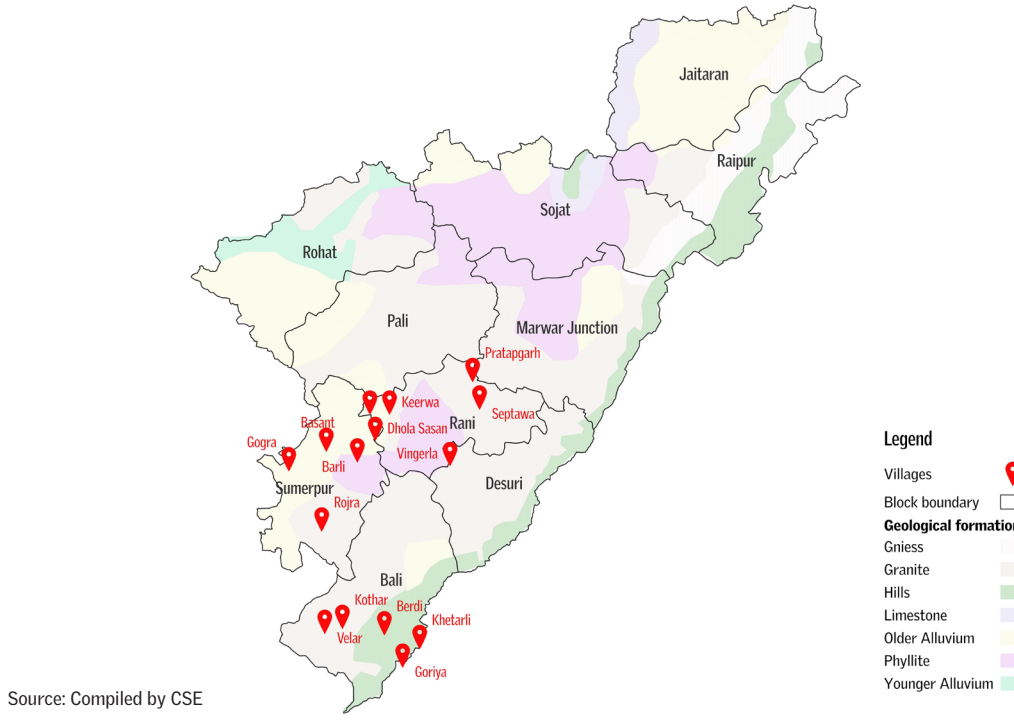
Source: Compiled by CSE

Map 2: Hydrogeological map of Banda district



Source: Central Groundwater Board/Bhuvan Portal

Map 3: Location of surveyed villages in Pali district



Source: Compiled by CSE

Map 4: Location of surveyed villages in Banda district

Source: Compiled by CSE

Selection of number of households to be surveyed in the study area

The study surveyed 281 households across 15 villages in Pali (Bali, Sumerpur and Rani blocks) and 308 households across 15 villages in Banda (Baberu, Jaspura, Badokhar Khurd, and Naraini blocks) (see *Table 4: Summary of households covered during the field survey*). The methodology prioritized spatial representation, ensuring that larger villages provided higher sample numbers while smaller villages maintained a minimum representation to capture local variations.

In Pali, the achieved sample of 281 households was marginally lower than the 301 target, but the shortfall of less than 7 per cent does not materially affect the robustness of the diagnostic assessment. In Banda, the 308-household sample exceeded 100 per cent of the calculated requirement, providing a statistically acceptable basis for district-level findings. Detailed survey summaries show these samples covered a total population of 3,481 residents across 30 villages.

Table 4: Summary of households covered during the field survey

Name of the district	Number of villages covered	Total no. of households	No. of households covered	Total population	Population covered
Pali	15	5,859	281	26,606	1,613
Banda	15	11,298	308	67,642	1,868
Total	30	17,157	589	94,248	3481

Source: Compiled by CSE

Data collection

1. This draft report assesses rural water sustainability and the implementation of the Jal Jeevan Mission (JJM) across specific districts like Pali and Banda. Through a combination of household surveys and field observations, the document highlights critical deficiencies, including declining groundwater levels, malfunctioning filtration plants, and the physical burden on women due to insufficient pipeline infrastructure. The data reveals a significant gap between official 'Har Ghar Jal' certifications and the actual availability of potable water, often hampered by challenging hilly terrain and technical failures. Beyond physical supply, the text examines community governance, noting that local water committees frequently lack the training or financial resources necessary for long-term operations and maintenance. Additionally, the sources include survey frameworks designed to evaluate greywater management and public awareness of water recycling initiatives. Ultimately, the report provides a technical and social critique of current water schemes, emphasizing the need for better recharge structures and active community participation to ensure resource longevity.

The assessment utilizes a comprehensive dual-methodology approach that integrates secondary records with primary field-level insights to evaluate water supply, source sustainability and community participation. Hydrogeological and lithological data from the National Aquifer Mapping and Management Programme (NAQUIM) and the Central Groundwater Board establish foundational terrain characteristics, while state groundwater reports provide essential trends for source sustainability planning. Rainfall data from institutions such as the Central Arid Zone Research Institute (CAZRI) is further utilized to analyse its specific impact on local groundwater levels, complemented by Jal Jeevan Mission Dashboard metrics to baseline household coverage and service delivery.

To address localized needs, primary household surveys were conducted to evaluate the domestic demand–supply gap, ensure equitable water distribution and assess community participation in sustaining village water systems. These findings are enriched by extensive stakeholder meetings with government officials, NGOs and gram panchayats, which identify ground-level implementation challenges and institutional convergence gaps. Ultimately, these combined household and community interactions provide a critical understanding of social perceptions regarding water supply conditions and long-term community-led governance.

Tools used in data collection

Various software programmes were used to prepare maps, graphs, charts and illustrations. Open-source software like QGIS were used to prepare maps, based on primary and secondary data. Free available data from different portals like www.data.gov.in and Bhuvan portal (www.bhuvan.nrsc.gov.in) were used for extraction of district boundaries and other data. Mobile-based applications were used for capturing photographs and geocoordinates of important locations.

-

C. Learnings from the ground—Gaps, challenges and opportunities for sustainability

Field visits to the selected villages in Pali district (Rajasthan) and Banda district (Uttar Pradesh) were conducted done to understand the current status, gaps and challenges on the ground regarding rural drinking water supply, source sustainability, community participation, operation and management and greywater management. The observations from the field have been documented as follows:

1. Pali (Rajasthan)

Source of water

Coverage of household tap connections: Out of all the 15 villages surveyed in three blocks of Pali district, the Jal Jeevan Mission (JJM) dashboard shows 100 per cent tap connections in nine villages. Five villages (33 per cent) are partially covered with tap connections, while one village does not have any tap connection under JJM. In six out of 15 surveyed villages, the percentage of households covered with a functional household tap connection (FHTC) varies from 0 to 90 per cent (see *Table 5: Details of surveyed households with tap connections vs those getting water supply under JJM*). The CSE field survey found that in nine villages with 100 per cent coverage, there is a gap in the quantity, quality, and regularity of the drinking water supply.

For example, JJM dashboard says that in village Septawa of Rani block, the coverage is 100 percentage, but the village does not receive water from JJM, due to some pipeline constructional issues. The taps and pipes have been provided in the households, but they are not functional. Similarly in village Nawagura, again the dashboard mentions 100 per cent coverage, but village people are compelled to fetch water from a common ground-level reservoir (GLR) constructed in earlier scheme (Janta Jal Yojana), as they do not get sufficient water from JJM. In other

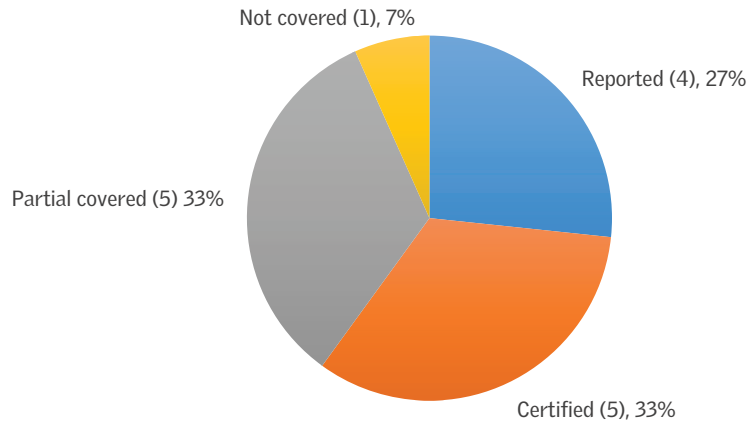
seven villages, where 100 per cent households have received FHTCs and water is supplied, the quantity and regularity of water supply is the issue.

Table 5: Details of surveyed households with tap connections vs those getting water supply under JJM

		AS per JJM		Household survey		
Block	Village name	Status of the village (Har Ghar Jal)	Percentage of households covered with tap connections	Number of HH surveyed	Number of housholds with tap connections	Number of households getting water supply
Bali	Kothar	Reported	100	35	35	35
	Velar	Partial covered	90.23	20	20	20
	Berdi	Partial covered	60.97	23	0	0
	Goriya	Partial covered	4.06	22	0	0
	Khetarli	Partial covered	7.87	16	0	0
Sumerpur	Basant	Certified	100	14	14	14
	Barli	Certified	100	10	10	10
	Dhola Sasan	Reported	100	14	14	14
	Gogra	Not covered	0	24	0	0
	Rojra	Partial covered	54.29	21	21	0
Rani	Nawaguda	Certified	100	21	21	21
	Pratapgarh	Certified	100	10	10	10
	Septawa	Reported	100	11	11	0
	Vingarla	Certified	100	15	15	15
	Keerwa	Reported	100	25	25	25
Total				281	196	164
Percentage				100%	70%	58%

Source: CSE field survey

Graph 1: Status of surveyed villages in Pali district

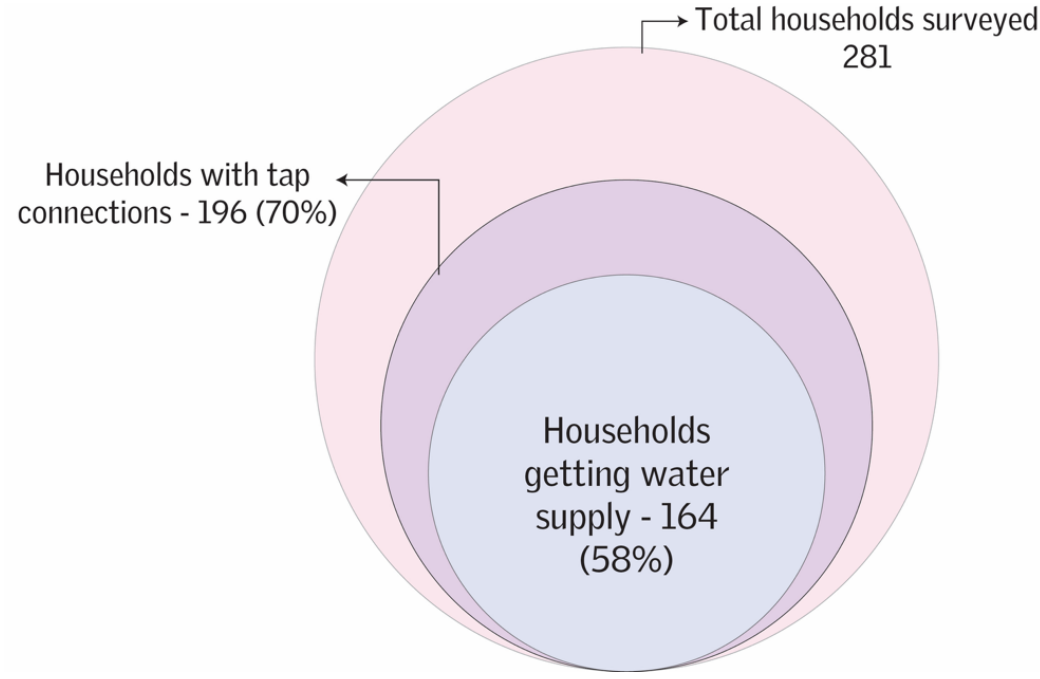


Source: JJM Dashboard as accessed on 10 September 2025

Out of the total 281 surveyed households, 70 per cent have been covered with tap connections. But all the households do not receive water supply. As per the field survey, only 58 per cent of the surveyed households get water from the tap connections provided (see *Figure 1: Details of households surveyed, provided tap connections and getting water supply under JJM*).

However, for the nine villages, as declared 'covered' by JJM, almost all the households have pipe connections and water supply, except for Septawa village, which has a connection but no water supply.

Figure 1: Details of households surveyed, provided tap connections and getting water supply under JJM



Source: CSE field survey

WATER SUPPLY IN BERDI, GORIYA AND KHETARLI

In Berdi, Goriya, and Khetarli, villages where over 90 per cent of the population belongs to the Scheduled Caste community, pipeline infrastructure under the Jal Jeevan Mission remains incomplete. The undulating terrain and scattered housing hinder infrastructure deployment, leaving residents without household connections and dependent on groundwater. Consequently, villagers must travel 2–3 kilometres to fetch water from open wells and handpumps. In Goriya, previously installed common standposts and overhead tanks are now defunct due to declining groundwater levels and lack of maintenance.

Sources of drinking water

All the 15 surveyed villages are dependent upon government as well as alternative sources (see *Table 6: Different sources of water in surveyed villages*). In the villages where JJM supply has not reached yet, people are fetching water from the nearby handpumps and standposts/ground-level reservoirs (GLRs). In villages where JJM supply is provided, alternative local sources still play a crucial role in providing drinking water. In Velar village, water supply from Jawai Dam covers 50 per cent of the total households of the village. The rest are supplied drinking water from open well of the village. In Basant village, an old open well plays as backup for household water supply. Keerwa supplies water from village's borewell to its households. Khetarli, Berdi and Goriya villages fetch water from handpumps, borewells and open wells. These village are yet to get water supply under Jal Jeevan Mission.

Table 6: Different sources of water in surveyed villages

Block	Village	Fully covered with tap connections under JJM (Y/N)	JJM sources	Alternative sources	SVS/MVS (as per PHED Pali and field survey)
Bali	Kothar	Y	Jawai Dam + Open well	Borewells	MVS
	Velar	Y	Jawai Dam + open well	Borewells	SVS + MVS
	Berdi	N	No JJM supply	Open wells + borewells + hand pumps	MVS
	Goriya	N	No JJM supply	Open wells + borewells + hand pumps + rivers	MVS
	Khetarli	N	No JJM supply	Open wells + borewells + hand pumps	SVS
Sumerpur	Basant	Y	Jawai Dam + open well	Handpumps + borewells	MVS + SVS
	Barli	Y	Jawai Dam + borewells	Hand pumps + borewells	MVS + SVS
	Dhola Sasan	Y	Jawai Dam + borewells	Hand pumps	MVS + SVS
	Gogra	N	No supply	Borewells + hand pumps + pond	MVS
	Rojra	N	No supply	Borewells + hand pumps	MVS
Rani	Nawaguda	Y	Jawai Dam	Borewells	MVS
	Pratapgarh	Y	Jawai Dam	Borewell	MVS
	Septawa	Y	Jawai Dam (supply paused)	Borewell	MVS
	Vingarla	Y	Jawai Dam	Open wells + borewells	MVS
	Keerwa	Y	Jawai Dam + borewell	Hand pump	MVS + SVS

Source: CSE field survey

Adequacy of water

Water supply at source and household water usage

There is no metreing system at the household level; the actual amount of supply was therefore difficult to calculate. Government however states the amount of water supplied from the source location in the JJM dashboard (see *Table 7: Household water consumption in surveyed village*). The survey interacted with the villages to understand the amount of water used and amount of water they fetch from alternative sources.

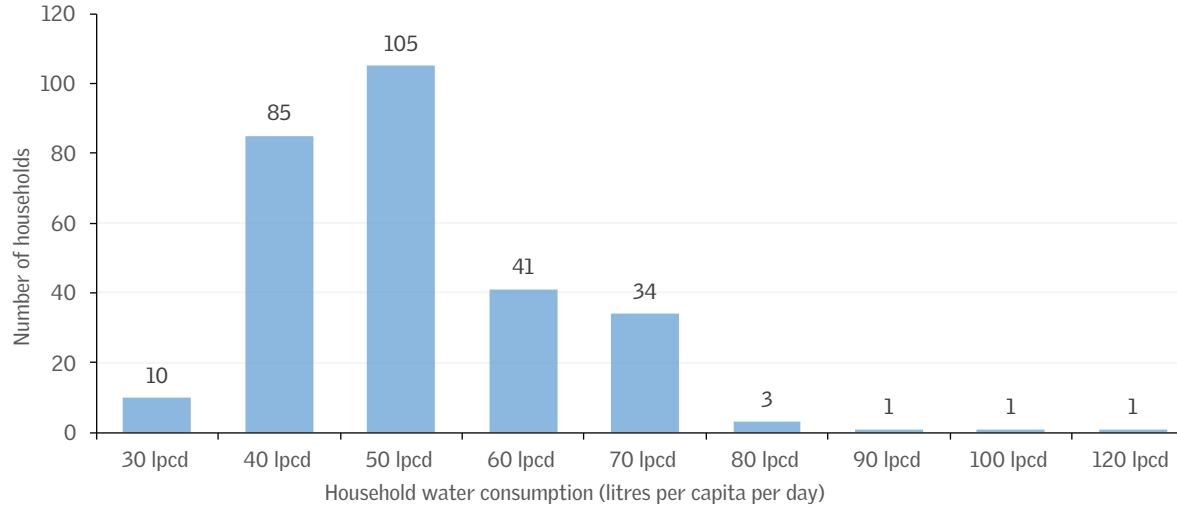
The CSE survey indicates that around 67 per cent of surveyed households utilize 40–50 lpcd for core domestic needs, including cooking, drinking, bathing and sanitation (see *Graph 2: Water utilization in surveyed households*). These are

Table 7: Household water consumption in surveyed village

District	Block	Village	According to JJM, average water supplied (lpcd)	Average usage by household (survey) (lpcd	Remarks
Pali	Bali	Velar	34.41	43	Actual quantity of water reaching household is lower. than claimed. Both MVS (Jawai Dam) and SVS (open wells in the village) are used for household water supply.
		Kothar	42.91	50	
		Bardi	12.34	41	Water supply has not started. People depend on local water sources provided by the government (hand pumps) and private sources (borewells/open wells)
		Khetarli	55	59	
		Goriya	55	53	
	Sumerpur	Barli	55	55	Actual quantity of water reaching at household is lower. Communities are compelled to fetch water from the nearby available water sources (open wells, hand pumps etc.)
		Basant	55	52	Village gets daily supply, both MVS and SVS (local village source) are used for water supply
		Dholasasan	55	59	
		Gogra	55	43	Water supply has not yet started
		Rojra	43.53	52	
	Rani	Keerwa	55	60	Village gets daily supply
		Vingarla	55	44	Actual quantity of water reaching household is lower than claimed. Communities are compelled to fetch water from the nearby available water sources (open wells, hand pumps etc.)
		Pratapgarh	55	51	
		Nawagura	55	47	
		Septawa	17.04	62	Water supply from Jawai Dam paused due to operational issues. People are fetching water from borewells, hand pumps and open wells in the village.

Source: CSE field survey

Graph 2: Water utilization in surveyed householdsin Pali district



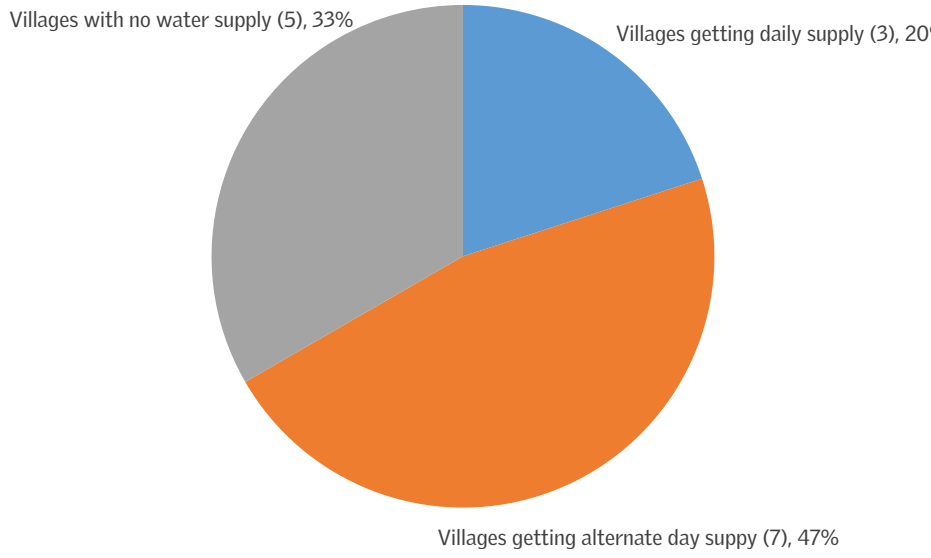
Source: CSE field survey

mainly conserved estimates developed on the basis of discussion with households. However personal discretion, understanding and size of storage shall affect the water consumption pattern data. These estimates exclude water used for laundry, which is typically performed at outdoor sources such as hand pumps or rivers, and cattle consumption, which is usually managed via communal village troughs.

Regularity of tap water supply

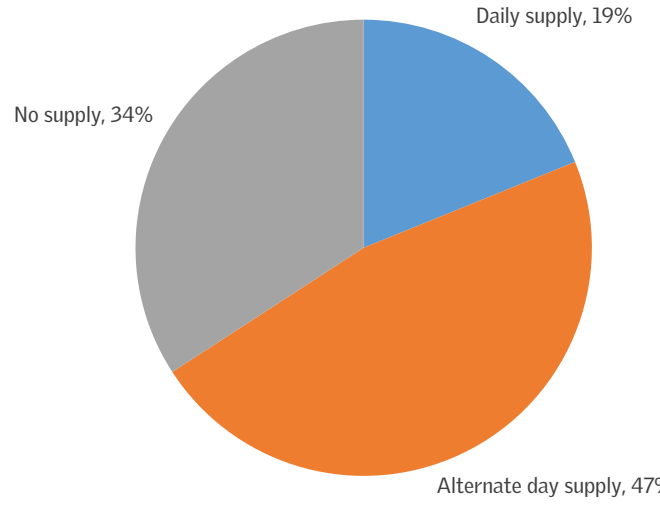
The survey reveals that only three out of 15 villages (20 per cent) receive daily water supply from a combination of the Jawai Dam and local sources such as open wells (see *Graph 3: Situation of village water supply in surveyed villages*). At the household level, access is even more limited, with just 19 per cent of households reporting daily water supply, while a significant 47 per cent receive water on alternate days (see *Graph 4: Condition of water supply in surveyed households*). The duration of water supply varies across these categories. Among households with daily supply, 70 per cent receive water for one to two hours, while 55 per cent of households receiving alternate-day supply report a similar duration. Notably, 26 per cent of households with daily supply receive water for three to four hours, compared to only 2 per cent among those with alternate-day supply (see *Graph 5: Duration of water supply in surveyed households—Daily vs alternate days' supply*). Overall, this indicates that the average duration of water supply remains limited to one to two hours, irrespective of whether supply is daily or on alternate days.

Graph 3: Situation of village water supply in surveyed villages



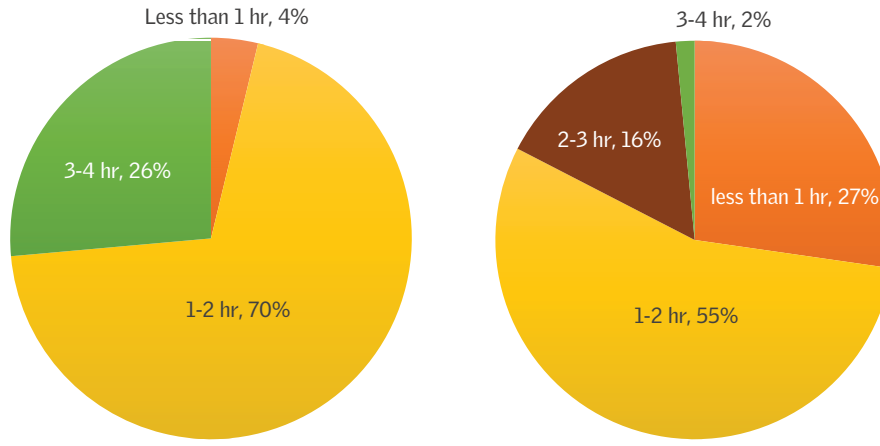
Source: CSE field survey

Graph 4: Condition of water supply in surveyed households



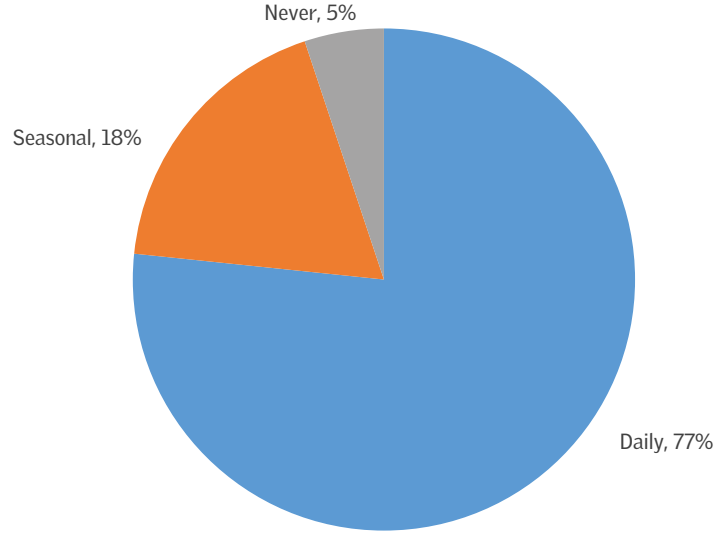
Source: CSE field survey

Graph 5: Duration of water supply in surveyed households—Daily vs alternate days' supply



Source: CSE field survey

Graph 6: Water shortage faced by surveyed households



Source: CSE field survey

Water irregularity and supply gap

Gaps in water supply cause daily shortages for 77 per cent of surveyed households; 18 per cent households reported seasonal scarcity (see *Graph 6: Water shortage faced by surveyed households*). Consequently, 76 per cent of households are forced to minimize their water usage, while many must fetch daily requirements from alternative sources like borewells, hand pumps or rivers. This scarcity creates significant drudgery for women, who face health risks and lose valuable time while

for bringing water from distant locations. The irregularity is due to supply gap from JJM supply and exists both for SVS and MVS. The tail end villages suffer the most, as due to loss of pressure, water supply doesn't reach distant households.

Addressing irregular water supply

Fifty per cent of surveyed households utilize 'tankas' (3,000–5,000 litre underground tanks) to store water during supply gaps. The tankas are integrated with both the Jal Jeevan Mission and Janta Jal Yojana pipelines, enabling a shift to groundwater sources when surface water from the Jawai Dam is irregular. In villages where piped infrastructure is incomplete, residents remain dependent on hand pumps, or common ground-level reservoirs (GLRs) supplied by local open wells and borewells.

Quality

Jal Jeevan Mission dashboard lists some villages of Bali and Rani blocks under fluoride-affected areas. But the villages which were surveyed by CSE, do not fall in this list. According to Jal Jeevan Mission dashboard, the quality of water supplied to the households are under the safe limits. JJM dashboard shows water quality parametre in safe limits for all the villages surveyed.

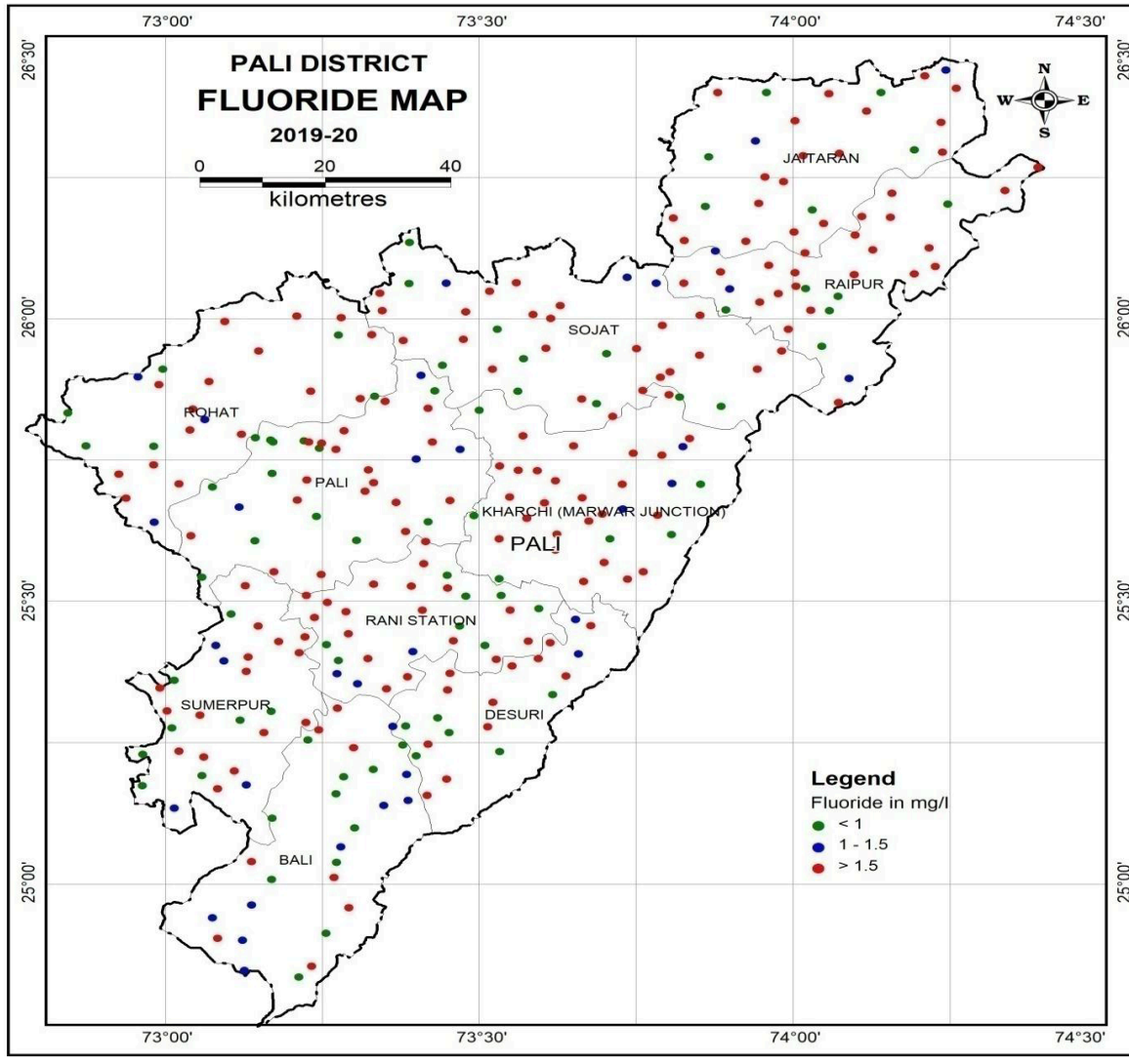
Some of the surveyed villages in the selected blocks lie near the spots marked in red, indicating fluoride concentration greater than the permissible limit (>1.5 mg/l) (*see Map 5: Fluoride in groundwater in Pali district*). In such villages, surface water sources is preferred over groundwater.

Quality of water as reported by the villagers

Villagers reported that the quality of surface water supplied through JJM is good. However, during interactions, some households have reported salinity and fluoride issues in local groundwater sources. In Kothar village in Bali block, there are three open wells, which used to supply water under the previous Janta Jal Yojana scheme, but two of them have been declared as defunct due to increased salinity. Similarly, in Khetarli village, one of the open wells has become defunct due to an increase in salinity in groundwater. Velar village reported that muddy water comes out of their taps sometimes when water is supplied from the local source (open well).

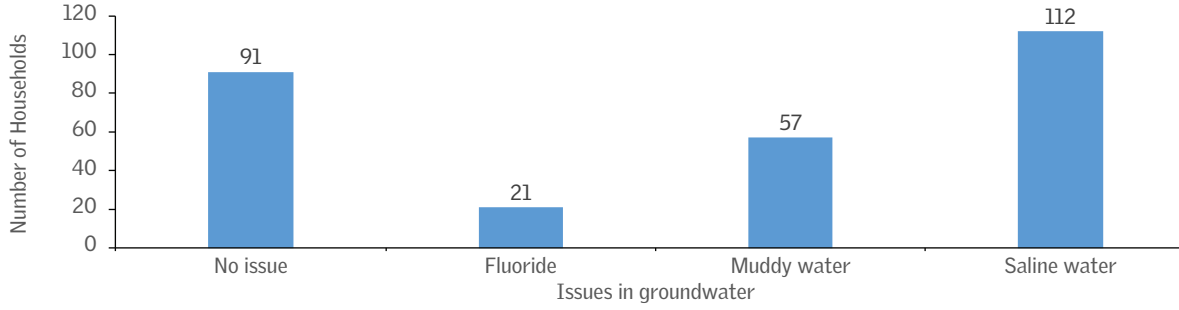
One hundred and twelve households (40 per cent) reported salinity in their supplied drinking water, when supplied from local groundwater-based sources; 20 per cent of the surveyed households get muddy water when water is supplied from the open well; 7 per cent of the surveyed households face fluoride issues (see *Graph 7: Quality issues reported by villagers during household survey*).

Map 5: Fluoride in groundwater in Pali district of Rajasthan



Source: Central Groundwater Board

Graph 7: Quality issues reported by villagers during household survey

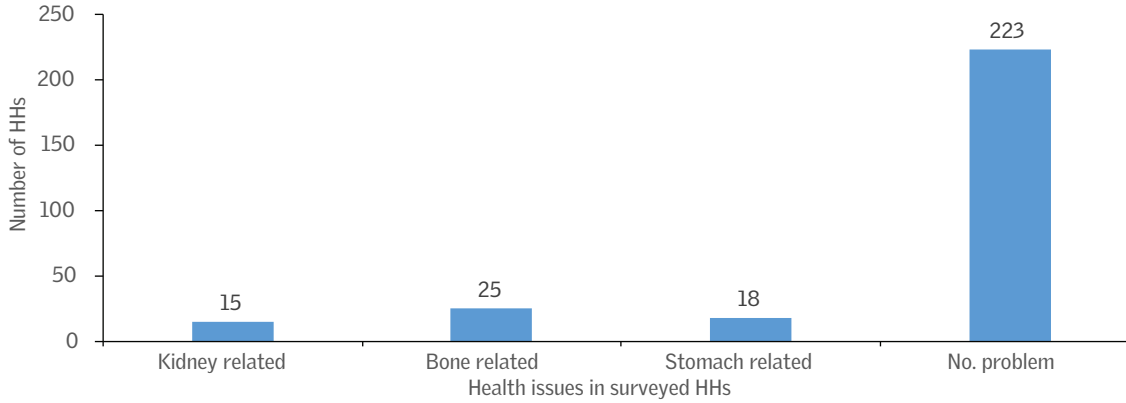


Source: CSE field survey

Health issues

The survey finds that households face certain health issues related to bone pain, kidney stones and stomach-ache (see *Graph 8: Health issues reported by*

Graph 8: Health issues reported by surveyed households



Source: CSE field survey

Table 8: Water quality and health issues reported by surveyed households

Village	Receiving water supply from	Water quality issues (in groundwater-based sources)	Reported by % of surveyed households	Health issues	Reported by % of surveyed households
Kothar	JJM (Jawai Dam + open well)	Salinity	74	No issue	
Velar	JJM (Jawai Dam + open well)	Salinity, muddy water	50	Bone-related problems, kidney stones, stomachache	65
Berdi	Local source	Fluoride, salinity	26	Bone-related problems	48
Goriya	Local source	Salinity	14	No issue	
Khetarli	Local source	Salinity	19	No issue	
Basant	JJM (Jawai Dam + open well)	No issue		No issue	
Barli	JJM (Jawai Dam + bore well)	No issue		No issue	
Dhola Sasan	JJM (Jawai Dam + open well)	No issue		No issue	
Gogra	Local Source	Salinity	17	No issue	
Rojra	Local Source	No issue		No issue	
Nawaguda	JJM (Jawai Dam + bore well)	Salinity, fluoride	50	Kidney stones, stomachache	29
Pratapgarh	JJM (Jawai Dam + open well)	No issue		No issue	
Septawa	Local Source (borewell)	No issue		No issue	
Vingarla	JJM (Jawai Dam + open well)	Yellowish water	13	No issue	
Keerwa	JJM (Jawai Dam + open well)	Salinity	76	Bone-related problems	48

Source: CSE field survey*
*However, further study is required to conclude the correlation between water quality and the disease reported.

surveyed households and *Table 8: Water quality and health issues reported by surveyed households*). Berdi village in Bali block reported suffering from fluoride contamination in the groundwater, causing tooth decay, bone-related problems and other health issues. Possibly, to address the fluoride issue, Public Health Engineering Department (PHED) had provided common RO plants with water-dispensing units in the village. But due to non-maintenance and lack of ownership, the plants became defunct. At the same time, groundwater level is declining, as evident from increasing number of defunct tube wells, further aggravating the groundwater quality. People are still dependent on ground water as the infrastructure under JJM is being built.

Functional household tap connections—are they functional?

Of the 15 surveyed villages, five still await pipeline completion, while functionality remains suspect in the nine villages officially reporting 100 per cent household coverage. According to the JJM Operational Guidelines, the functionality of tap connections depends on the quantity, quality and regularity of water supplied. A fully functional tap will deliver at least 55 litres per capita per day (lpcd) of potable water daily for 12 months. A tap delivering less than 55 lpcd but more than 40 lpcd is termed as partially functional, while that which delivers less than 40 lpcd is termed as non-functional.[9] CSE field surveys reveal that household water supply quantities are frequently insufficient. While JJM guidelines mandate water metres and Field Testing Kits to assess functionality, a lack of localized monitoring creates a significant gap in verifying service standards. These supply deficiencies force residents to continue relying on alternative sources—such as open wells, hand pumps and rivers—to meet their daily needs

Source sustainability

Declining groundwater

One of the biggest issues in the sustainability of Jal Jeevan Mission is source sustainability. The major reason being the source and catchment of the source are often situated under jurisdiction of different departments. CSE survey found that an average of 40 per cent of surveyed groundwater-based sources (open wells, hand pumps and borewells) were found defunct or have been abandoned due to high salinity (see *Table 9: Condition of groundwater sources in surveyed villages*).

Table 9: Condition of groundwater sources in surveyed villages

Open wells				Hand pumps				Borewells			
Community reported		Based on field visit		Community reported		Based on field visit		Community reported		Based on field visit	
Total numbers	Defunct/ not in use by village people	Number surveyed	Found defunct/ not in use due to salinity	Total numbers	Defunct/ not in use by village people	Number surveyed	Found defunct/ not in use due to salinity	Total number	Defunct/ not in use by village people	Number surveyed	Found defunct/ not in use due to salinity
79	31	27	11	257	142	36	17	27	9	18	6
	39%		41%		55%		47%		33%		33%

Source: CSE field survey

Villagers rely on groundwater sources

Vingerla village in Rani block has open wells and borewells, which provide water to households, as JJM supply through FHTCs is not sufficient and is irregular. People are still dependent on alternative local sources. In Keerwa village, the borewell plays a major role in providing drinking water, as surface water supply is insufficient and irregular. As discussed previously, all the villages depend on alternative sources.

The need for source sustainability

Jal Jeevan Mission mandates source sustainability at all levels of planning, i.e. in village action plans (VAPs), district action plans (DAPs and state action plans (SAPs). In VAPs, the current availability of water in the source and its long-term sustainability has to be identified. In DAPs, the source sustainability measures have to be taken. To plan for the sustainability of the drinking water sources, the DAP shall identify the source of convergence to meet the requirements emerging from VAPs. At the state level, the SAP will plan for the convergence for source sustainability on the basis of DAPs. After the SAP is finalized, it is the responsibility of the Department of Drinking Water and Sanitation (DDWS), to ensure availability of funds for source sustainability works and greywater management in villages through convergence.[10]

The operational guidelines of Jal Jeevan Mission mentions that the priority has to be given to the local sources for water supply. In absence of adequate water in local sources or in case of water quality issues, alternative source can be used.[11] It is recommended that there should be a conjunctive supply of water from both local groundwater sources as wells as surface-water sources (Jawai Dam) to ensure regularity and equity in drinking water supply.

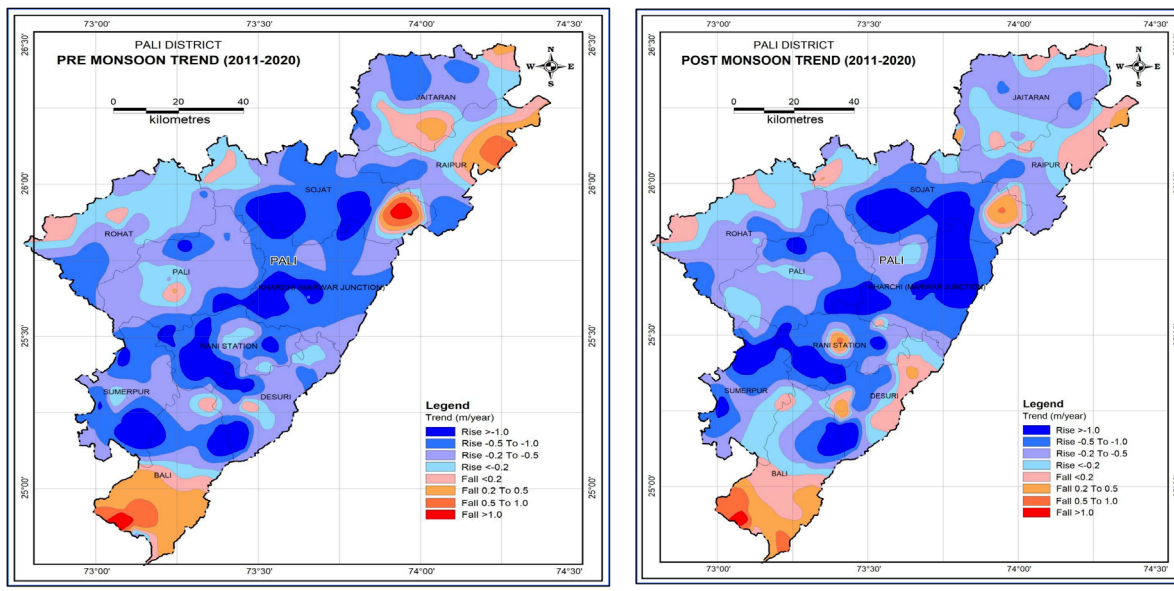
The Village Action Plans of surveyed villages in Pali district list the sources to be tapped for providing drinking water supply and also the potential sources that can be used. But according to the field survey, no sustainability measures have been taken for these water sources. In multi-village schemes, where heavy infrastructure is being laid for a long-distance supply, from Jawai Dam to remote villages, there is always a risk of water shortage if there is an operational or maintenance issue in the pipe infrastructure. Therefore, merely depending upon faraway sources can create a water supply gap. Local sources for villages must not be overlooked as they play a crucial role during lean times.

Planning for source sustainability

Rainfall and groundwater level: The rainfall pattern is irregular. The CGWMB data shows that there is no significant changes in the groundwater level even after monsoon (see *Map 6: Groundwater levels in Bali block declined at the rate of more than 1 metre per year*). However, since in the majority of villages, groundwater lies in unconfined aquifers, water levels may increase if rainwater is captured through harvesting structures.

Proper study for effectiveness of water-harvesting structures: In Bali block, the existing water-harvesting structures are not as effective as groundwater lies in a confined aquifer and recharge is difficult. This indicates that the creation of harvesting structures needs proper study for their effectiveness.

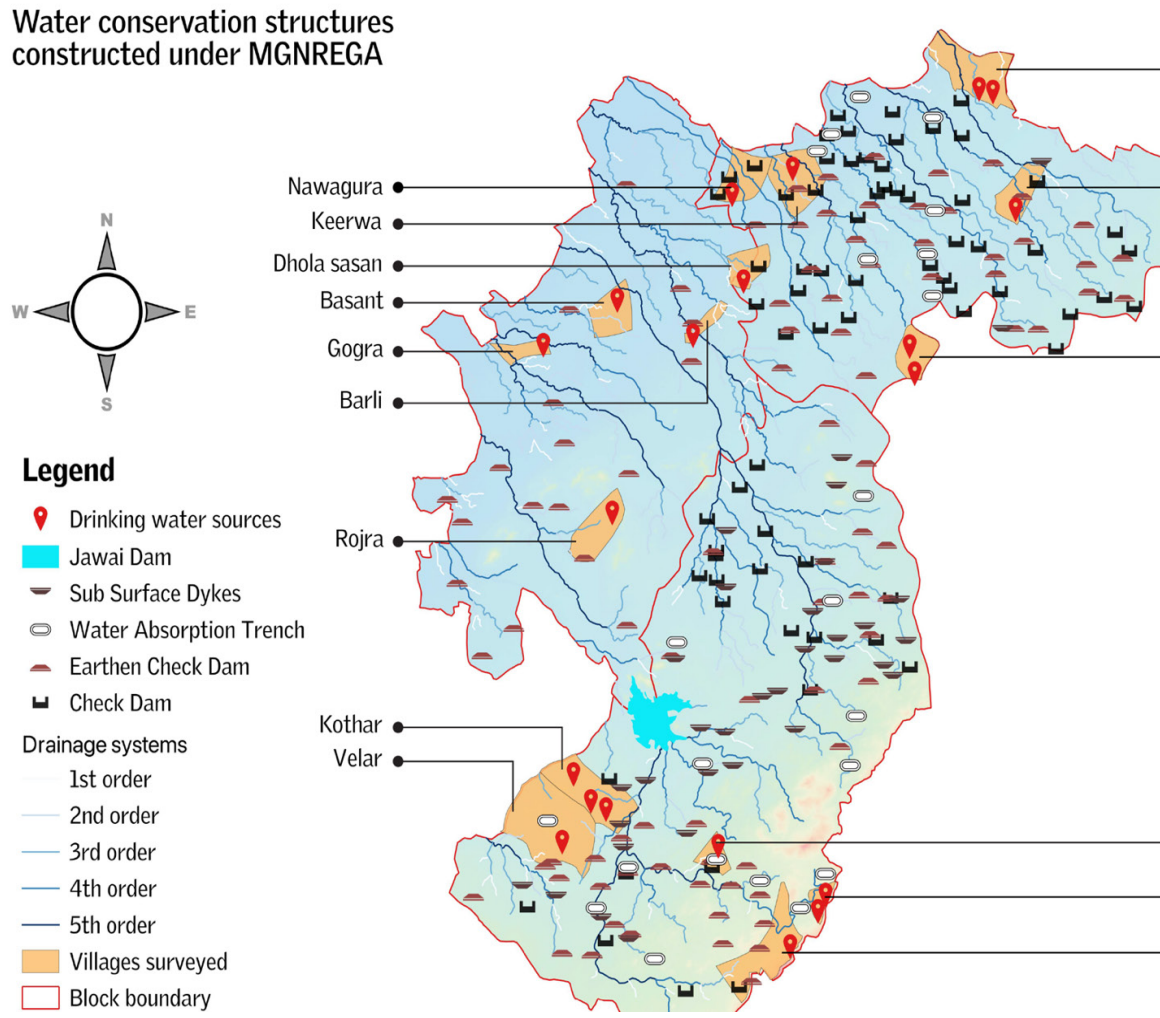
Map 6: Groundwater levels in Bali block declined at the rate of more than 1 metre per year



Source: Central Groundwater Board

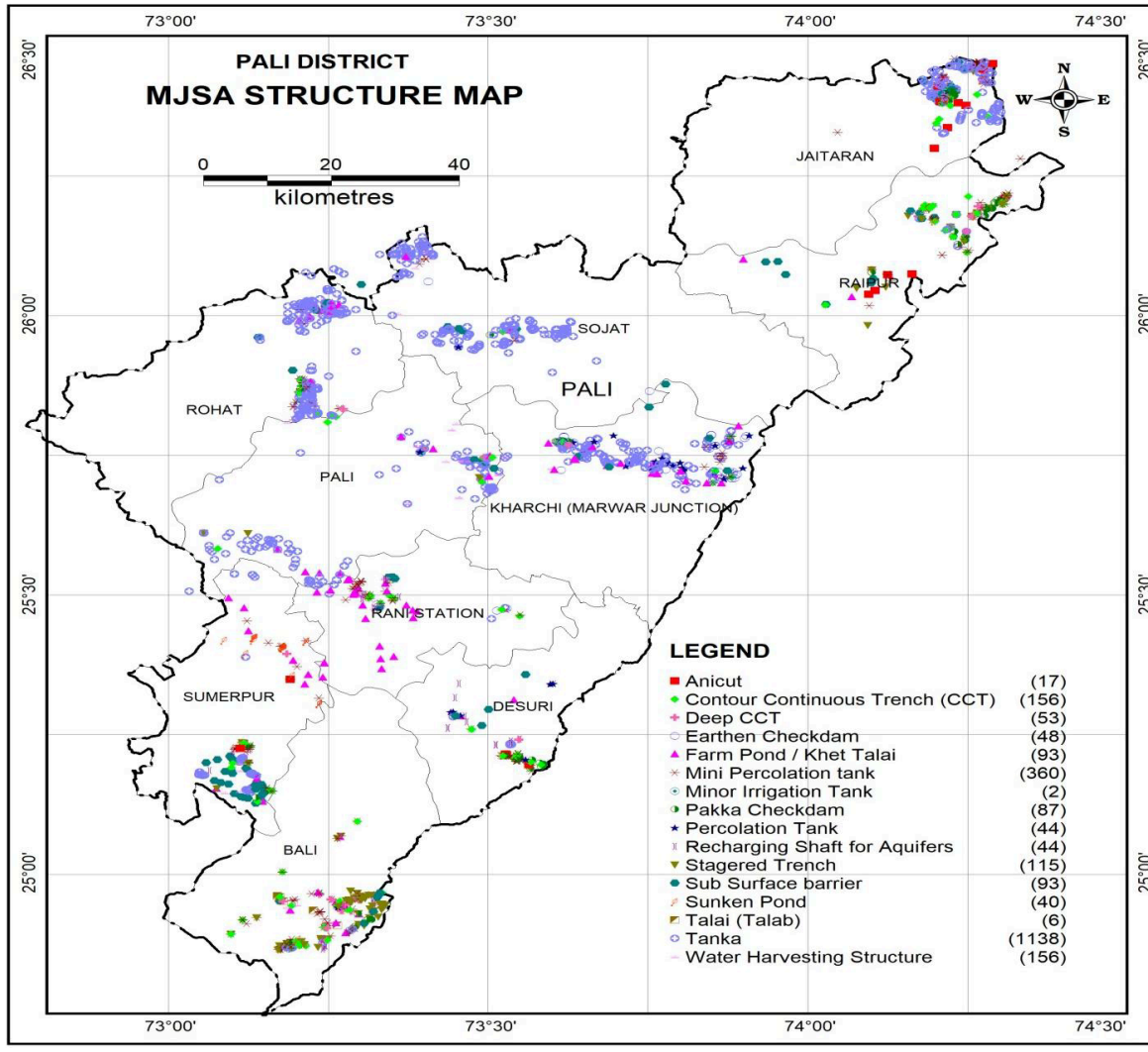
Several structures under Mahatma Gandhi National Rural Employment Guarantee Act (MGNREGA) and Mukhyamantri Jal Swavalamban Abhiyan (MJSA) were constructed for augmentation of groundwater in the state (see *Map 7: Water-conservation structures constructed under MGNREGA in Pali district* and *Map 8: Water-conservation structures constructed under Mukhyamantri Jal Swavalamban Abhiyan*). *Map 7* shows the structures constructed under MGNREGA and *Map 8* shows the type and concentration of structures in different patches of Pali district constructed by MJSA. Even after so much intervention by both the programmes, the groundwater levels in Bali block show a steep decline,

Map 7: Water-conservation structures constructed under MGNREGA in Pali district



Source: Bhuvan portal (www.bhuvan.nrsc.gov.in), as viewed on 1 January 2026

Map 8: Water-conservation structures constructed under Mukhyamantri Jal Swavalamban Abhiyan, Rajasthan



Source: Central Groundwater Board

at the rate of 1 metre below ground level per year (see *Map 6: Groundwater levels in Bali block declined at the rate of more than 1 metre per year*). This may be due to the following three reasons: the number of structures constructed is insufficient to recharge groundwater in Bali block; the structures were not planned at appropriate locations; or more water is extracted than recharged, possibly due to irrigation. For groundwater recharge, this work needs more attention, detailed survey and more technical analysis. Additionally, groundwater recharge structures should be planned keeping the drinking water sources in focus. They should be planned and constructed in the catchment of these local water sources.

The need for collaborative efforts

In Rajasthan, groundwater recharge and soil and water conservation work are mainly carried out by the Watershed Development and Soil Conservation Department (WDSC). Water supply under Jal Jeevan Mission, however, is by the Public Health Engineering Department (PHED). Many groundwater recharge structures have been constructed under the Mahatma Gandhi National Rural Employment Guarantee Act (MGNREGA). There is scope for convergence in planning and coordination among departments regarding the sustainability of drinking water sources.

The Watershed Development and Soil Conservation Department is working towards soil and water conservation in selected blocks of Pali district, where some villages fall within the catchment of Jawai Dam, the district's major drinking water source. But work in those areas has not been done, keeping sources under JJM in the planning.

Various departments in Rajasthan work on water-related work and/or projects, including:

a. Public Health Engineering Department (PHED)
b. Water Resources Department
c. State Water Resources Planning Department
d. State Groundwater Department
e. Rajasthan Water Grid Corporation Limited
f. Rajasthan River Basin and Water Resource Planning Authority
g. Watershed Development and Soil Conservation department
h. Central Groundwater Board
i. Department of Rural Development
j. Panchayati Raj Development

According to the official website of the state, the State Water Resources Planning Department has emerged as part of Rajasthan Water Sector Restructuring Project (RWSRP).[12] It supported in the development of the Rajasthan state water policy, 2010 as well as in basin-level planning. The State Water Resources Planning Department's is supposed to create a synergy between various departments linked to water and work in coordination to boost the efficiency of the state of water management.

Sustainability of Jawai Dam for drinking water supply: Since the drinking water supply under JJM is done through the Jawai Dam Cluster IV project, and a larger number of villages are covered, it is also important to sustain the Jawai

Dam for long-term and regular supply. The catchment of Jawai Dam should be considered for planning of interventions that would sustain the dam in terms of water availability. The villages in the catchment of Jawai Dam should be sensitized for planning recharge structures in the villages by involving the Panchayati Raj Institutions (PRIs) and Village Water and Sanitation Committees (VWSCs). The role of village communities and community institutions (VWSC/SHG/gram panchayats) is crucial in planning the sustainability of drinking water sources.

Source sustainability can be achieved only with joint effort, both from government department and community. Existing and potential sources of drinking water supply should be mapped in the village. These sources must be made sustainable through required interventions. The planning and implementation of source sustainability interventions should be done at the village level, where all the stakeholders should work together. The community institution must be involved in all steps of interventions.

Community participation and ownership (gram panchayats, Village Water and Sanitation Committee (VWSC) and self-help groups)

To make the rural water supply programme sustainable, village communities have been the largest focus of Jal Jeevan Mission. The guideline mandates that the VWSC should hold periodic meetings at least four times in a year and maintain minutes/records of the same.

To achieve this, JJM has partnered with an Implementation Support Agency (ISA) at the district level for the formation, training, strengthening and formalization of the VWSC. In Pali district Arthik Samajik Vikas Sansthan, an NGO headquartered in Jaipur, worked as the ISA under JJM. According to the ISA, they created VWSC in all the villages in Pali district and have uploaded the details in the JJM portal. They have also created the Village Action Plan (VAP) in consultation with VWSC, gram panchayats and the Public Health Engineering Department (PHED).

But the ground reality during the field survey was found be slightly different. During the survey of 15 selected villages, it was found that most of the VWSC members did not know about their membership in the committee. During the community interaction, it was found that most members in VWSC were never informed, and no formal training programmes were carried out. The ISA states that once the village receives 100 per cent tap connections, they get the gram sabha resolution for declaring the village as 'certified' under Har Ghar Jal status. According to Arthik Samajik Vikas Sansthan, the role of ISA ends here. In Bali block, the Centre for

Microfinance (partner of Tata Trusts) carried out training programmes for VWSC members on the issues of water supply, community participation, strengthening of VWSC, monitoring of water quality and inclusion of women all these activities.

But since CMF largely works with small water-user groups, the VWSC did not further receive any training from PHED/JJM. In Rani and Sumerpur blocks, the situation is even worse. In eight out of 10 villages, the VWSC meeting never happened. Although migration of village people, in search of livelihood to metro cities is a big issue the villages of Pali district, lack of awareness and neutral behaviour from the government was another major reason of non-functional VWSC. It was also found that the no-water-tax policy of the state government is also one of the major causes where VWSC is not active in the villages. Infrastructure planning, implementation, operation and maintenance is all done by PHED and contractors. VWSCs thus don't have an active role under Jal Jeevan Mission.

Community contribution towards O&M

According to the JJM operational guidelines, community contribution is seen as a willingness to play a role in planning, implementation, management, and operation and maintenance of in-village water supply system. The guideline suggests that 5–10 per cent of the in-village infrastructure cost shall be contributed from the village community, in the form of cash and/or kind and/or labour. The existing accounts of gram panchayat can be used to deposit the community contribution, or a new VWSC account can also be opened. The water tariff should also be collected from the households and deposited in the same account. There has to be a separate ledger/record register to keep the record of the financial transactions. JJM operational guidelines clearly indicate the importance of community contribution towards the sustainability of rural water-supply systems, operation and maintenance and ownership of the community towards the entire programme. In Pali district, the ground condition was found to be different. In April 2019, Rajasthan government announced that no water tax would be charged from rural communities up to a supply of 40 litres per capita per day (lpcd).

During the start of the Jal Jeevan Mission, some gram panchayats initially collected infrastructure cost (Rs 2,500 per household) and deposited it in the accounts of Village Water and Sanitation Committee, with the aim to use it for operation and maintenance of piped infrastructure. Village Kothar in Bali block collected a community contribution of around Rs 5 lakh and has deposited in the VWSCs bank account. Pratapgarh village in Rani block collected Rs. 2,500 per household and deposited the amount in the VWSC account.

The circumstances have shifted, and community contribution efforts face bottlenecks. Due to the state government's announcement of a waiver of community contribution in April 2019, prior to the launch of JJM, no water tax or community contribution is taken from the households for maintenance of the pipes, storage systems etc. of the household supply under JJM. The O&M of the water supply system is done by PHED or the contractor. In multi-village schemes, where infrastructure has been laid by the contractors, they have been given the responsibility of O&M for 10 years, followed by retendering process.

In single-village schemes, O&M is taken care by the PHED. There is no focus on future O&M of the JJM supplies to the households. Even if the money is paid by households, the VWSC does not know how to use the money effectively for O&M due to lack of capacity. For example, in Kothar (Bali district) and Pratapgarh (Sumerpur district) village districts, the households had initially deposited a contribution for water supply few years back, to the VWSC but the money is still not spent.

Greywater management

Greywater management is another major focus of Jal Jeevan Mission aimed at treating and reusing used water in rural areas. The survey found that no greywater management structures, such as soak pits, magic pits, leach pits etc., have been constructed in the surveyed villages of Pali district. Drains have, however, been constructed in the villages for the conveyance of household greywater. The greywater generated in villages receiving a regular and secure supply under JJM is dumped into nearby open areas, seasonal streams and waterbodies. Since the soil is mainly porous and dry, mostly the greywater is absorbed into the soil, increasing the risk of contamination of the soil and shallow groundwater. In Pali district, the volume of greywater is not large due to the low supply of water. Also, the greywater generated is easily absorbed by the porous soil this makes the soil and shallow groundwater vulnerable to pollution.

Conclusion

The assessment shows that household supply through Jal Jeevan Mission is still facing roadblocks. The question arises on the functionality of household tap connections, as per the definition of functionality in JJM operational guidelines. A tap can be said to be fully functional only if it delivers at least 55 lpcd of drinking water of prescribed quality on a regular basis. But households face challenges in getting adequate water. Further, the local sources of the villages of Pali district are becoming defunct. The groundwater source of the district has become highly saline and has a high TDS due to over-extraction and hence the district is moving towards surface water source. The district is moving completely towards a multi-

village scheme (MVS) where the Jawai Dam on the Jawai River is the source of water supply. The problem with this multi-village scheme is that villages at the tail end do not receive enough water, which compels them to depend again on the groundwater. Hence secure and safe groundwater source is equally important in the district. The problem of water scarcity is worse in tribal villages, where the progress of JJM is slow and water supply depends on groundwater.

The Jal Jeevan Mission dashboard showed that 11 out of 15 selected villages had single-village schemes (SVS) for drinking water supply. The survey in these villages showed that previously the villages were supplied water with groundwater sources (open wells and borewells) existing in the village, and they were marked as SVS. But now, most of these villages are being supplied with surface water sourced from Jawai Dam. All 13 villages, except for two, from the selected list of villages are being covered under the multi-village scheme where Jawai Dam's water is being supplied. But local groundwater sources are not merely supplementary—they are critical to in sustaining the water supply system—and it is the need of the hour to plan for their sustainability.

Why is Rajasthan failing to sustain its drinking water sources?

Fractured governance is one of the leading reasons for Rajathan failing to sustain their drinking water sources. The Public Health Engineering Department (PHED) is in charge of connecting every household with the source, but they are not making plans for the sustainability of sources, especially groundwater sources. The groundwater recharge in the state is the mandate of the Watershed and Soil Conservation Department. The planning and implementation of the recharge projects are done solely by this department without involving the PHED department.

Second, the role of the communities, who are at the recipient stage, is completely ignored in the planning and implementation stages for the drinking water supply schemes as well as the groundwater recharge schemes. Recently a list of 3,000 villages from Rajasthan was shared with the Watershed and Soil Conservation Department by PHED. These villages have very poor quality of groundwater, and surface water is also not available for drinking purposes. Alwar is one of the prominent districts that has such problems with drinking water.

Tanka, traditional rainwater harvesting structures—where communities can store the rooftop rainwater for domestic needs—can be a solution. But such solutions do not come in the forefront due to absence of communities in the planning stage of drinking water supply projects and high-cost engineering solutions are proposed.

Third, there is no mapping of the drinking water sources—which should be the first step to sustainability of drinking water sources. In absence of such maps, the recharge structures implemented by the Watershed and Soil Conservation Department fail to recharge the drinking water sources. Also, there is a problem here: the designing and planning groundwater recharge structures by this department are usually done without an understanding of the impact of recharge on the aquifer structures below. Impactful groundwater recharge structures are rarely planned for, and implementation becomes routine work. The role of communities becomes important here as their inputs on the impacts of groundwater recharge become important here.

Fourth, lack of funds pushes sustainability to the back seat. Drinking water projects are planned without allocating any dedicated fund for sustainability.

There is critical gap in community involvement in the planning and implementation of the household supply systems. As per the JJM dashboard, every village has a VWSC, but in reality they are not active.

Snapshots from the field

PRADEEP KUMAR MISHRA/CSE

Jawai Dam Reservoir, in Sumerpur block, is a major drinking water source under Jal Jeevan Mission for villages in Pali district.

PRADEEP KUMAR MISHRA/CSE

A defunct handpump in Barli village, Sumerpur block, Pali district

PRADEEP KUMAR MISHRA/CSE

A 5,000-litre tanka to store supplied water

PRADEEP KUMAR MISHRA/CSE

Pipes under Jal Jeevan Mission (JJM) given to households as functional household tap connections (FHTCs) in village Berdi, Bali block, Pali district

PRADEEP KUMAR MISHRA/CSE

An open well in Basant village, Sumerpur block, Pali district. The well acts a backup for the village drinking water supply when the JJM supply from Jawai Dam is insufficient.

2. Banda (Uttar Pradesh)

Sources of water

Coverage of household tap connections

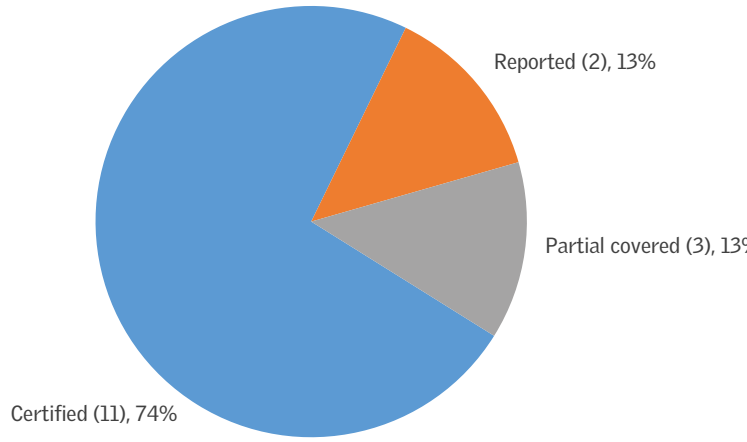
Out of the 15 surveyed villages in three blocks of Banda district, JJM dashboard shows 100 per cent tap connections in 13 villages (see *Table 10: Details of number of households surveyed, those with tap connections and those with water supply*). Villages to be considered as 100 per cent are marked as either 'certified' or 'reported'). Two villages (13 per cent) are partially covered with tap connections (see *Graph 9: Status of surveyed villages in Banda district*); these two villages have 80–86 per cent coverage. The CSE field survey found that in the nine villages that have 100 per cent coverage, there is a gap in the quantity and regularity of drinking water supply (see *Table 10*).

Table 10: Details of number of households surveyed, those with tap connections and those getting water supply

		As per JJM		Household survey		
Blocks	Village	Status of the village (Har Ghar Jal)	Percentage of households covered with tap connections	Number of households surveyed	Number of households with tap connections	Number of households getting water supply
Jaspura	Lasada	Certified	100	16	16	15
	Gadariya	Certified	100	40	35	32
	Jaspura	Certified	100	42	42	39
	Bhatha	Certified	100	6	6	6
Baberu	Jugrehlee	Certified	100	10	10	10
	Samagra	Certified	100	27	23	23
	Milathu	Certified	100	20	12	11
Badokhar Khurd	Lohara	Certified	100	6	6	6
	Achharaund	Partially covered	80.62	16	14	6
	Mohan Purwa	Partially covered	85.92	20	12	10
	Jaurahi	Certified	100	18	15	15
	Tindwara	Certified	100	28	28	26
	Bhawani Purwa	Certified	100	8	6	0
Naraini	Bahadurpur Kalinjer	Reported	100	18	13	10
	Sadha	Reported	100	33	19	0
Total				308	257	209
Percentage					83%	67%

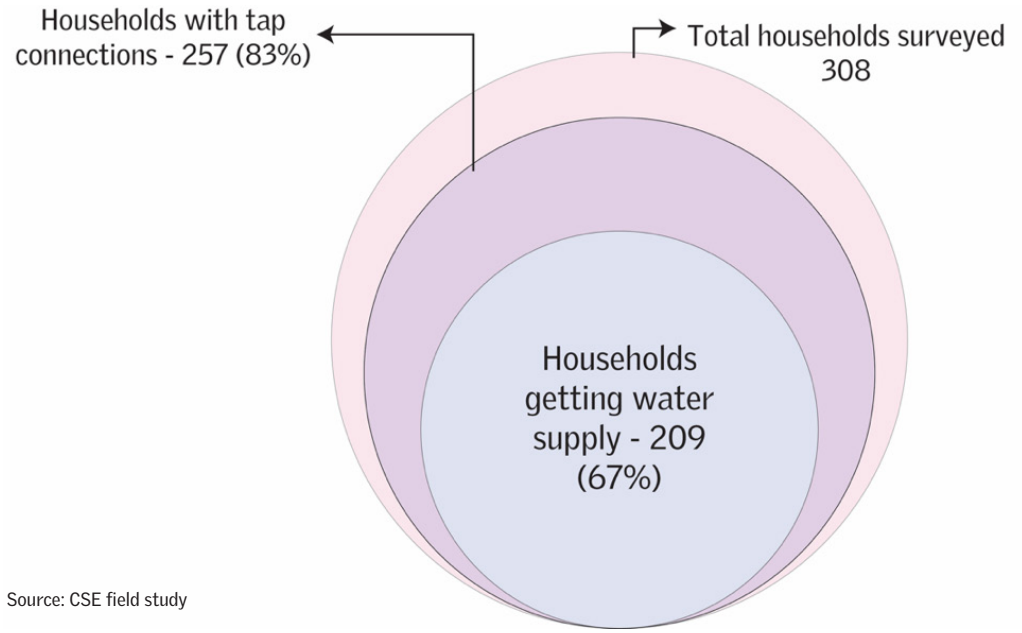
Graph 9 represents the status of Har Ghar Jal, as mentioned in the JJM dashboard. Out of the total 308 households surveyed, 83 per cent have received household tap connections. But only 67 per cent of the surveyed households receive water from the provided taps (see *Figure 2: Details of households surveyed, provided tap connections and getting water supply under JJM*).

Graph 9: Status of surveyed villages in Banda district



Source: JJM Dashboard (https://ejalshakti.gov.in/jjmreport/JJMState.aspx) as accessed on 10 September 2025

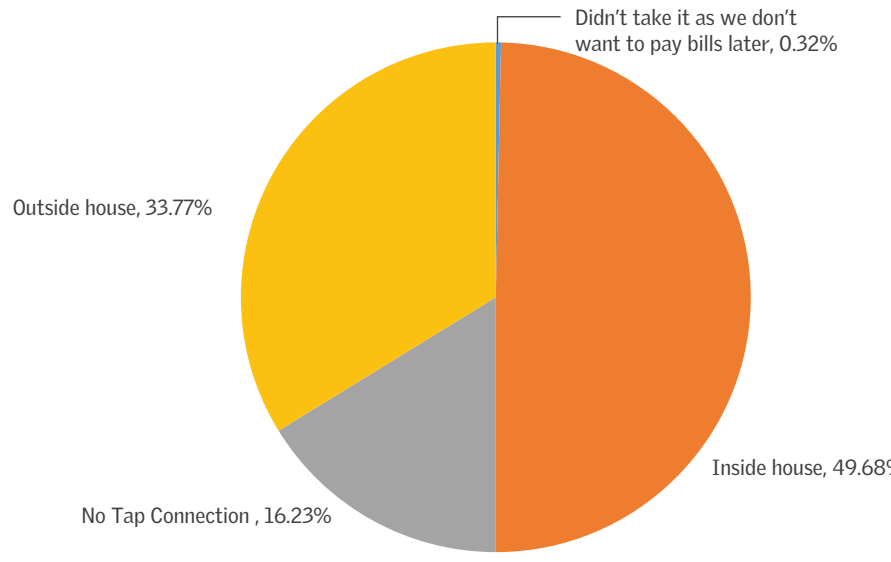
Figure 2: Details of households surveyed, provided tap connections and getting water supply under JJM



Source: CSE field study

A small 0.32 per cent of surveyed households does not want to take up a tap connection as they feel they would have to pay bills and they are sufficiently dependent on the in-house groundwater sources (see *Graph 10: Status of tap connections in surveyed households of Banda district*). This was prevalent predominantly in Bahadurpur Kalinjhar and Gadariya villages, where every alternate household had a hand pump. This also means they are not entirely dependent on JJM sources and remained unbothered about the JJM connection. This has led to abundant supply of water, hence less of ownership. This was evident in a lot of villages, where metal taps had been stolen and water flowed out, flooding nearby agricultural fields, creating unrest and disruption in the communities. Most of the households surveyed had taps outside the households, in the verandahs or barricaded areas. We considered it to be inside the household as these households were apprehensive about having tap connections inside their houses on the ground that the government could consider formalizing services such as water connections as encroachment and ground for eviction.

Graph 10: Status of tap connections in surveyed households of Banda district



Source: CSE field survey

Sources of drinking water

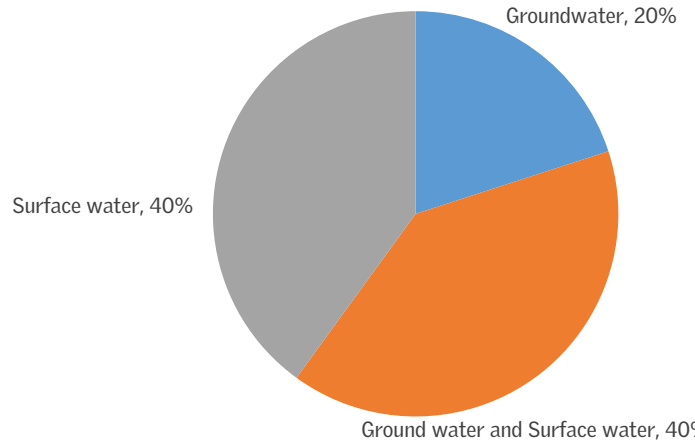
Table 11: Different sources of water in surveyed villages

Block	Villages	Fully covered with tap connections under JJM (Y/N)	JJM sources	Alternative sources
Baberu	Samgara	Y	Shallow tube well	Borewell + hand pump + open well
	Jugrehlee	Y	Yamuna water	Hand pump + borewell + open well
	Milathu	Y	Shallow tube well + Yamuna water	Hand pump + borewell + open well
Jaspura	Bhatha	Y	Shallow tube well	Hand pump + borewell + open well
	Jaspura	Y	Shallow tube well + Yamuna water	Hand pump + borewell + open well + ponds
	Gadariya	Y	Yamuna water + shallow tube well	Hand pump + borewell + open well + ponds
	Lasada	Y	Yamuna water	Hand pump + borewell + open well + ponds
Badokhar Khurd	Lohara	Y	shallow tube well	Hand pump + borewell + open well + ponds
	Achharaund	N	Ken River + shallow tube well	Hand pump + open well + ponds
	Mohan Purwa	N	Ken River + shallow tube well	Hand pump + open well + ponds
	Jaurahi	Y	Yamuna water	Hand pump + borewell + open well + ponds
	Tindwara	Y	Yamuna water + shallow tube well	Hand pump + borewell + open well+ ponds
	Bhawani Purwa	Y	Yamuna water	Hand pump + borewell + open well + ponds
Naraini	Bahadurpur Kalinzar	Y	Yamuna water	Hand pump + borewell + open well + ponds

Source: CSE field survey

All the 15 surveyed villages in Banda district depend upon sources under JJM as well as alternative sources (see *Table 11: Different sources of water in surveyed villages*). Even in the villages that have JJM supply, people fetch water from their private borewells, nearby hand pumps and/or open wells for their domestic needs. CSE observations from the field study found that 40 per cent of the surveyed villages were sourcing water from surface water, largely rivers passing through the district (Yamuna and Ken Rivers); 20 per cent of the surveyed village rely purely on groundwater while the remaining 40 per cent were getting water from both surface and groundwater sources (conjunctive supply) (see *Graph 11: Sources of drinking water supply in surveyed villages*).

Graph 11: Sources of drinking water supply in surveyed villages



Source: CSE survey

As per interaction with JJM officials, water is being transported from more than 100 km. However, the cost of transporting water from these sources was not shared. In case of Achhraundh and Mohan Purwa, not enough water reaches the villages for several reasons.

Adequacy of water

As there is no metering system at the household level, the amount of supply was difficult to calculate. However, government data on the amount of water supplied from the source location is available (see *Table 12: Details of water supplied through JJM and water utilization by households*). The survey interacted with the villagers to understand the amount of water used and amount of water they fetch from alternative sources.

The CSE survey found that average per capita consumption in surveyed households was in the range of 30–50 lpcd for 55 per cent of surveyed households; 25 per cent of the households reported consumption of 50–75 lpcd; 16 per cent of surveyed households were reported to consume 70–90 lpcd; and the remaining 4 per cent were found consuming more than 90 lpcd, mostly in households with more hours of water supply and more storage capacity (see *Graph 12: Quantity of water used by surveyed households*). These are mainly conservative estimates based on discussions with households. However, personal discretion, understanding, size of storage shall affect the water consumption pattern data. In areas where direct groundwater is supplied, such as in case of Jaspura, where there is no storage, the tube well runs for four to five hours twice a day to ensure those at the tail end get water supply. In such cases, it is difficult to estimate water supply as the

Table 12: Details of water supplied through JJM and water utilization by households

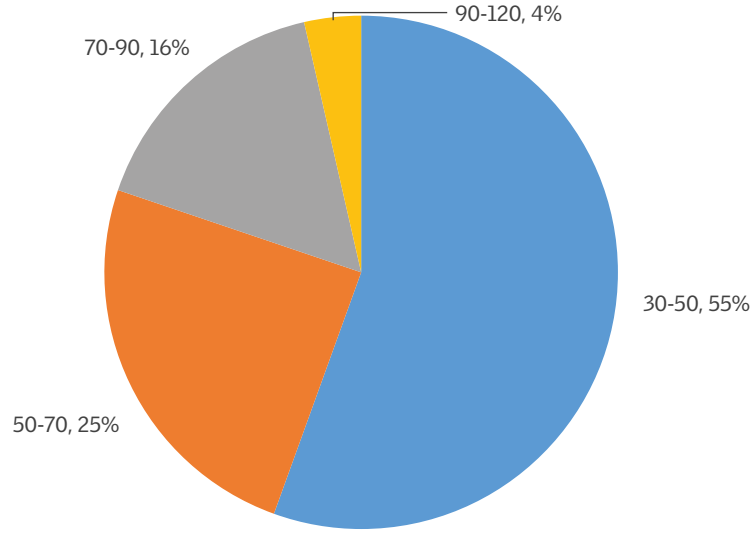
Block	Village	According to JJM, average water supplied (lpcd)	Average usage by household (survey) (lpcd)	Remarks
Baberu	Samagra	103.48	50	The JJM water supply is not fully connected. Of the three pumps onlyone was in working condition during survey. Households depend on handpumps and borewells
	Jugrehlee	52.43	56	JJM supply is enough except for households in small hamlets. People are largely satisfied—if needed they get water—not much—from handpumps
	Milathu	55	54	Communities complain of irregular water supply and irregular timings due to technical issues
Jaspura	Bhatha	55	50	Groundwater is saline even at 90 feet, and communities drill deeper for good-quality water. Households at higher elevations do not receive water. Sometimes water is dirty and has an odour. There are leakages in the pipeline.
	Jaspura	40	75	The village had an old tank under Chitrakoot Dham Mandal Scheme, providing water to almost half the village for the last 20–30 years or more. The tank continues to be under operation. To serve households at higher elevations, a new pump was installed, thereby serving the other half of the village. Despite this, a few households struggle to get proper supply of water, due sometimes to technical issues or pipe leakages. The new submersible pump installed under JJM directly operates for four to five hours to be able to provide water to households at higher elevations. No intermediate tank for storage of water has been made—this results in shutdown of water supply in absence of electricity and pump running for more than required hours. Tracking of water supply per capita is often not done. On the basis of community interviews and interaction with the pump operator, we found every household generally ends up using at least 80–100 LPCD of water.
	Gadariya	40	71.5	A few households on the slopes do not receive water. Households depend on hand pumps and borewells.
	Lasada	172.8	58	The village does not have any leakages, but tap connections were mainly at the doorstep. Wastage of water was visible as once the existing storage (small 10–15-litre buckets and 200-litre drums) is filled, taps are often left open, or if the taps are missing the pipes overflow. At higher slopes, roughly 50–55 households do not get water and people have bored directly into the ground to access groundwater.
Badokhar Khurd	Lohara	70	57	All the households in Lohara receive water supply. It has been receiving water supply under previous schemes for more than 15 years. Households only suffer in the absence of electricity. The villagers still depend on handpumps.There are leakages and wastages in extra water supply.
	Achharaund	40	57	Households at higher elevations have suffered significantly in the absence of water. Hand pumps were few as groundwater was saline and had iron present. Households spent a considerable fraction of time getting water from the river. Several households do not want to take connections in this village as they believe it

Block	Village	According to JJM, average water supplied (lpcd)	Average usage by household (survey) (lpcd)	Remarks
				would submerge their household or government would take away their houses. They spend up to 30 minutes per trip fetching water from the river on cycles or on foot. Marriages and other functions are usually chaotic due to the scarcity of water.
	Mohan Purwa	60.26	54	Housholds receive irregular water supply—at times twice a month. Leakages from the pipelines were confirmed during the visit. Households depend on hand pumps.
	Jaurahi	60.32	67	Households depende on handpumps as actual supply is less than claimed.
	Tindwara	55	54	Wastage of water was verified during the visit. There were open pipes without taps in the village, with water flowing down the drain for hours. Households at higher elevations do not receive water. Communities remain satisfied with quantity of water supply.
	Bhawani Purwa	94.22	57.65	Bhawani Purwa doesn't have water supply started yet. Households depend on hand pumps.
Naraini	Bahadurpur Kalinzar	68.63	68	Almost every household has a hand pump and/or borewells. Work on water supply is still in process.
	Sadha	69.02	51	The entire village does not get water. It is still in the testing phase. Households depend on handpumps.

Source: JJM dashboard and CSE field survey

surveyors saw open tap-less pipes overflowing into drains. These would be only highly conservative estimates if per capita consumption patterns or a decision to treat wastewater is to be made.

Graph 12: Quantity of water used by surveyed households

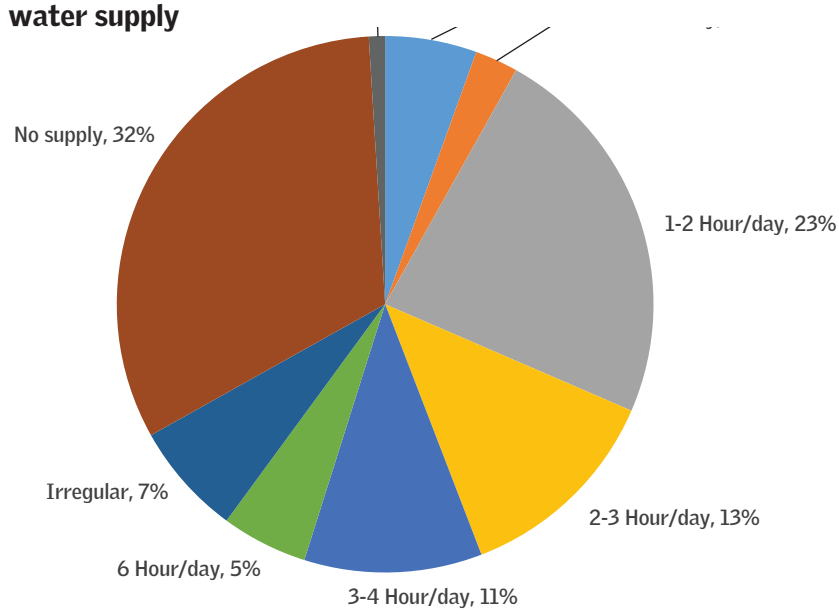


Source: CSE field survey

Regularity of water supplied

The survey found that 2 per cent of the surveyed households located near to the source get water for the entire day and with good pressure. Another 66 per cent of the households can be categorized on the basis of hours of water supply; 32 per cent of the surveyed households responded that they were not getting any water supply yet. Of the latter, villages like Sadha are in the testing phase, Bahadurpur Kalinjhar is still under process while in many villages pipelines are laid but the overhead tank (OHT) is not of adequate capacity to meet the village demands or the houses are at the tail end. Some households get an irregular supply, e.g. once in a week or twice in a week or sometimes once in 15 days. Up to 50–60 per cent of the surveyed households claimed to have received water for different durations, ranging from one to six hours per day (see *Graph 13: Data showing surveyed households getting different durations of water supply*). Some villages also mentioned that the overhead tank is not of enough capacity and that most of the supply water was diverted to a particular habitation, on the personal bias of the operator. The other habitations received less water.

Graph 13: Data showing surveyed households getting different durations of water supply



Source: CSE field study

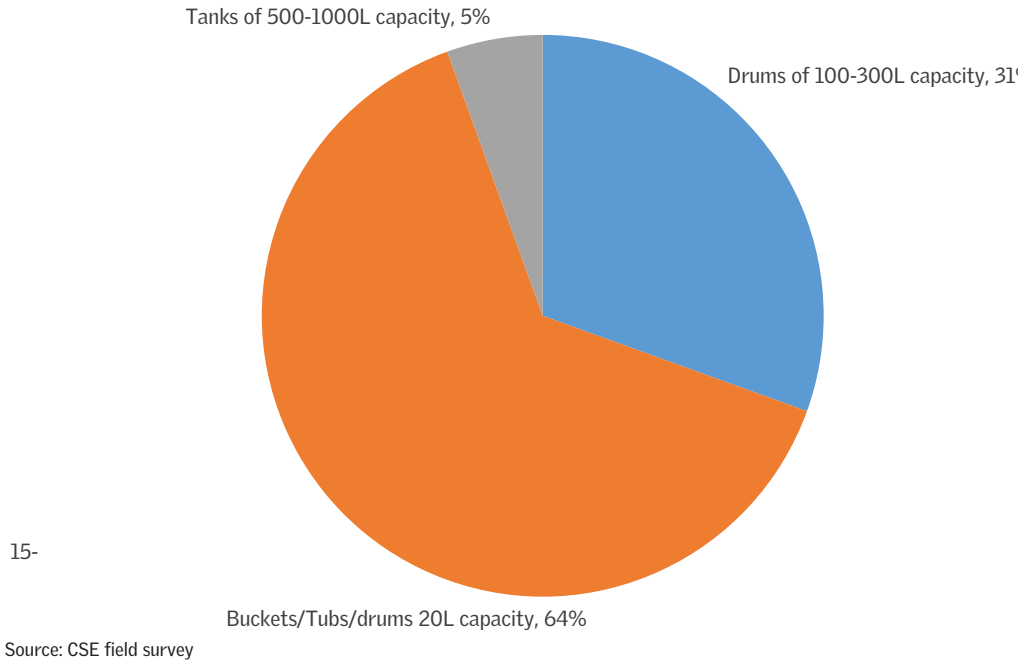
Water irregularity and supply gap

Addressing irregular water supply

Due to dependence on hand pumps (in-house or government) or the presence of a river or open well, some households do not have the habit of water storage. Overhead or underground tanks not found anywhere. Only some households—roughly 5 per cent of the surveyed households—had 500–1,000-litre tanks in the verandah. Another 31 per cent had 100–300-litre storage drums in which they would store water for entire day and drinking purpose. About 64 per cent households stored water in buckets, tubs or drums of 10–20-litre capacity. It was not possible to count the number of buckets in the households. But we estimated every household managed to store 100–200 litres of water through these smaller storages (see *Graph 14: Water storage practices of households in Banda)*.

This could also be translated to the reason for dissatisfaction. As despite 60 per cent households getting water supply for one to six hours in a day, they found JJM supply to be insufficient. Since they have not cultivated the habit of water storage, they resort to previous storage habits in which they store enough water for sustenance during working hours and fetch it from nearby source if needed.

Graph 14: Water storage practices of households in Banda



Source: CSE field survey

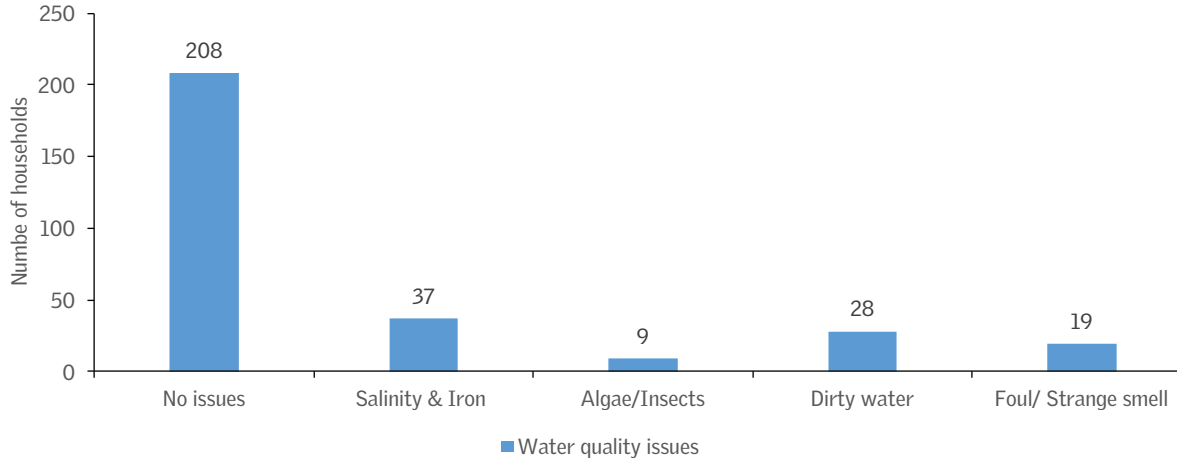
The supply from only JJM sources is sufficient for only 17 per cent of the surveyed households. 51 per cent of the households reported that the supplied water is not sufficient, and they have to rely on alternative local sources. The remaining 32 per cent do not receive water supply. When discussing the availability of water for households, including sources other than JJM, 86 per cent of the respondents said that they have access to sufficient water to meet their daily needs though some of them also said that they have to spend more time to fetch water from alternative sources. The remaining 14 per cent of the surveyed households suffered water shortage issues.

Communities facing water shortage: About 32 per cent of households faced water shortages on a daily basis. The shortage was more prevalent in villages such as Acchharaundh and Mohanpurwa or in the tail-end areas that were not receiving water. Roughly 50 per cent reported issues during the summer—this may be attributed to continued dependence on hand pumps when the JJM water supply stops to insufficient water supply hours, pumps going out of order or no electricity supply. Even JJM officials claimed that electricity issues was one of the major concerns in stoppage of water supply to these villages. People in villages like Acchraundh walk several kilometres to get water from nearby rivers. Both men and women walk or cycle for around 5 km to fetch water from the river, taking up to 30–45 minutes per trip. About 63 per cent of households get water from personal or government hand pumps or existing open wells or depend on neighbours. Many households told the surveyors they spend an average of 15–20 minutes per trip, sometimes waiting for their turn in case of seasonal shortages. This also results in community fights. People also have to walk farther if the nearby hand pump is saline or is defunct, increasing the time for fetching water or community conflicts. Also, the community dependence on wells declined as the hand pumps were installed under Accelerated Rural Water Supply Programme (ARWSP). Only 6 per cent of the respondents claim to be dependent on well water for drinking purposes, which in many cases is dirty or has insects, but people are forced to drink in the absence of a water supply. Even the personal hand pumps have gone into disuse and dried up. Some of them have now been built over or covered up.

Quality

This section covers all sources of water supply, including JJM and alternative sources in the surveyed villages. Of 211 households receiving water under JJM, 208 reported receiving good-quality water. Around 19 of the 308 households surveyed reported a strange smell, which according to the community may be due to bleaching agents, and hence they opt for hand pumps as their drinking water source; 28 households reported dirty water, stating it was due to contamination

Graph 15: Water-quality issues in surveyed villages



Source: CSE field survey

at leakage points in the conveyance system; 37 households encountered salinity and iron contamination in their water sources. Surveyors also found places where drinking-water pipelines were passing through drains. In the event of leaks, this may further contaminate the water (see *Graph 15: Water-quality issues in surveyed villages*). No major health issues were reported during the field survey.

Source sustainability

Declining groundwater

The CSE field survey shows that groundwater sources play an important role in sustaining rural drinking water supplies in the villages surveyed. The survey also assessed that around 34 per cent of the groundwater sources surveyed (including hand pumps, borewells and open wells) were found to be defunct (see *Table 13: Conditions of groundwater-based sources in selected villages of Banda.*). The number of sources becoming defunct is increasing due to high stress on groundwater, which is being pumped for various uses.

Groundwater levels in some surveyed villages were assessed to understand the ground condition. Though several groundwater recharge structures have been constructed in these villages, there impact on groundwater levels has been minimal. Rainfall in Banda district in 2011–20 varied in the range of 592–942 millimetres. Rainfall was plotted against groundwater levels to assess the impact of recharge on groundwater levels.

Table 13: Conditions of groundwater-based sources in selected villages of Banda

Open wells				Hand pumps				Borewells			
Community reported		Based on field visit		Community reported		Based on field visit		Community reported		Based on field visit	
Total number	Reported defunct/ not in use	Surveyed	Found defunct/ not in use due to salinity	Total number	Reported defunct/ not in use	Surveyed	Found defunct/ not in use due to salinity	Total numbers	Reported defunct/ not in use	Surveyed	Found defunct/ not in use due to salinity
190	145	31	14	1636	396	69	19	934	138	45	16
	76%		45%		24%		28%		15%		36%

Source: CSE field survey

The need for source sustainability

As previously mentioned, Jal Jeevan Mission mandates source sustainability at all levels of planning, i.e. in Village Action Plans (VAPs), District Action Plans (DAPs) and State Action Plans (SAPs). After the finalization of SAPs, it would be the responsibility of the Department of Drinking Water and Sanitation (DDWS) to ensure availability of funds and convergence for source sustainability. Water supply from the Yamuna River needs long planning and large investment for pipe infrastructure to supply water at longer distances. There may be problems in water supply during operational issues. Hence, the local sources must be strengthened and their sustainability has to be planned.

It has been observed that Banda district is moving towards surface water supply from the Yamuna as there is a decline in the levels of groundwater. In many villages, a shift from groundwater to surface-water supply can be seen. There is a discrepancy between what is recorded on the JJM dashboard and the ground reality for household connections.

The CSE survey finds that the ground situation regarding the functionality of functional household tap connections (FHTCs) is as follows (see *Table 12: Details of water supplied through JJM and water utilization by households*). Non-operational water supply systems and incomplete pipe layouts have even been marked as completed schemes. Communities reported that an erratic electric supply and low source potential hinder water supply systems for schemes marked as completed and operational on the JJM dashboard. There are instances where the pipe layout has been designed without considering the area's undulating slope—consequently, pipe connections to households remain pending. To overcome water stress, communities have fallen back on borewells and hand pumps; in some cases, they fetch water from distant rivers and streams.

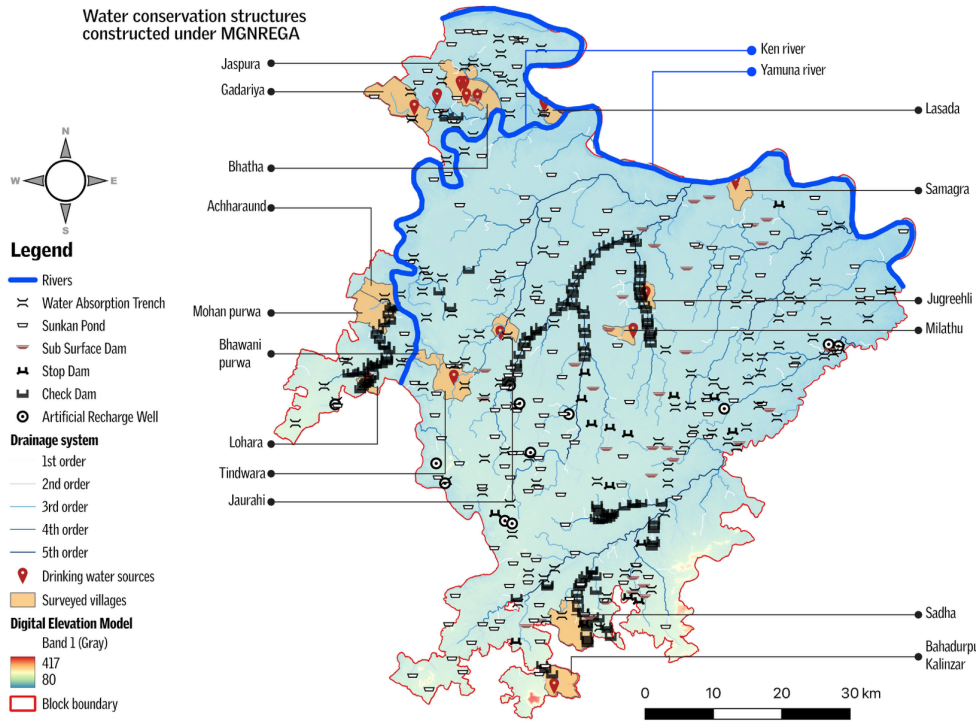
Planning for source sustainability

Rainfall and groundwater level

In Banda, the rainfall pattern is irregular. The last data for groundwater level maps is available for 2018, which shows that the groundwater levels in Jashpura are declining substantially. As per the data available for some villages, however, groundwater lies in an unconfined aquifer, which can be recharged if rainwater is captured through rainwater harvesting structures.

To recharge the groundwater, several structures were constructed under MGNREGA. As per the data in Bhuvan portal (www.bhuvan.nrsc.gov.in), a huge number of check dams are constructed in the district (see *Map 9: Water-conservation structures constructed under MGNREGA in Banda district*). Also, the National Aquifer Management Plan (NAQUIM) mentions that a lot of water

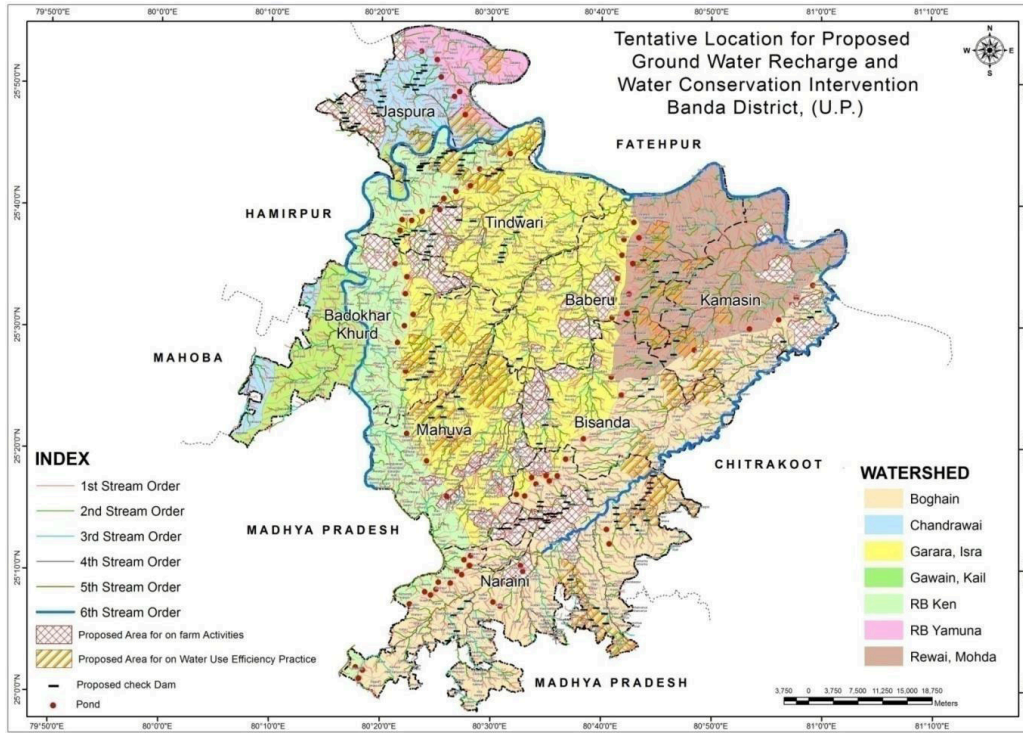
Map 9: Water-conservation structures constructed under MGNREGA in Banda district



Source: Bhuvan Portal (www.bhuvan.nrsc.gov.in), as viewed on 1 January 2026.

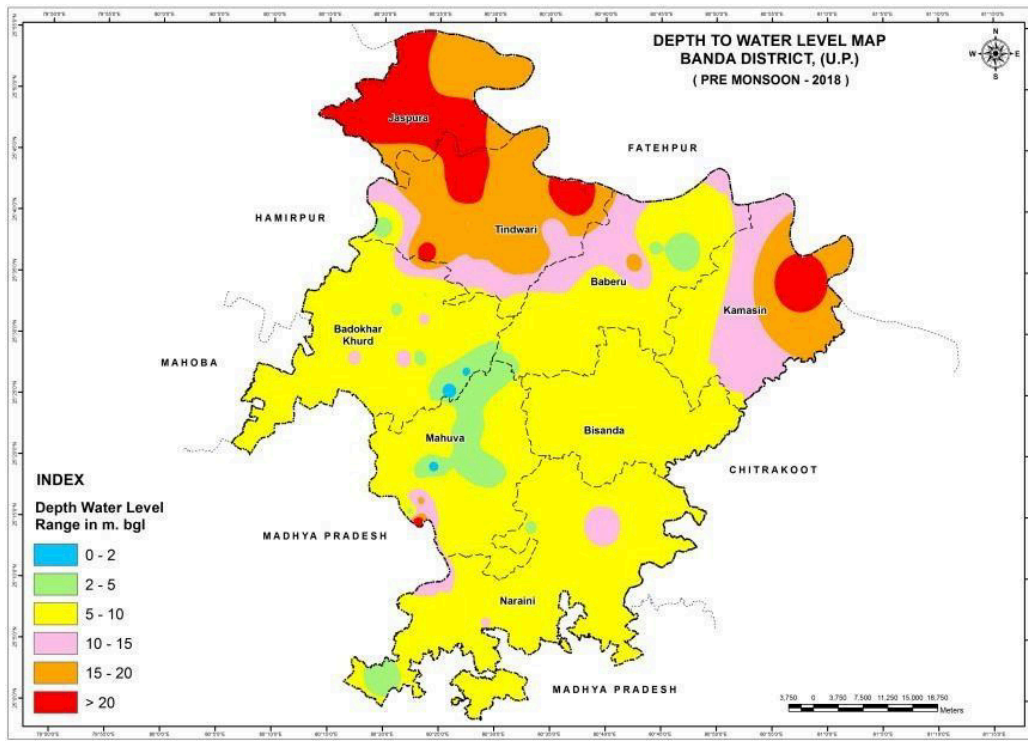
conservation and groundwater recharge activities were planned in 2018 (see *Map 10: Locations and proposed groundwater-recharge structures in Banda district*). But there is no significant improvement in the groundwater. Jashpura block is under severe groundwater stress (see *Map 11: Groundwater levels in Jashpur block of Banda district are declining by more than 20 mbgl*).

Map 10: Locations and proposed groundwater-recharge structures in Banda district



Source: Central Groundwater Board

Map 11: Groundwater levels in Jashpur block of Banda district are declining by more than 20 mbgl



Source: Central Groundwater Board

The need for collaborative efforts

Groundwater recharge structures have been implemented in Banda district by the Rural Development Department, but these structures do not focus the sources that are used for drinking water supply. There are some water conservation initiatives at village level in blocks not assessed by CSE. For instance, Jhakni village in Mahuva block has made provisions for sustainable irrigation sources by constructing farm bunds and farm ponds. 'Khet mein med, med par ped' (bunds in fields, trees on bunds) was a community initiative here to increase productivity of the agricultural fields. Some initiatives for contour trenches and water budgeting can be seen in the Mahuva block to increase the sustainability of drinking water sources. There is an abundance of open wells in the villages, but they are dry, filled up or built over.

To attain the sustainability of these sources, there is a strong need for collaboration between key departments such as Uttar Pradesh Jal Nigam (Rural), Rural Development Department and Water Resources Department.

Community participation and ownership

According to the JJM guidelines, gram panchayats or its sub-committees, also known as Village Water and Sanitation Committees (VWSCs), have to be strengthened to ensure sustainability of water supply under JJM. The formation of VWSCs, their strengthening, awareness and education are key activities intended to create a community-based sustainable model of rural drinking water supply.

The guideline mandates that the VWSC should hold periodic meetings at least four times a year and maintain minutes/records of the same. To achieve this, JJM has partnered with an Implementation Support Agency (ISA) at the district level for the formation, training, strengthening and formalization of the VWSC.

CSE observed that the VWSC is not active in the surveyed villages. As per the survey, the list of VWSC members is uploaded in the JJM dashboard portal. According to JJM guidelines, in every village, a VWSC has to be formed which shall be made responsible for collection of community contribution, work towards O&M, monitoring of drinking water quality and also should be responsible for overall sustainability of the programme in the village.

But in reality, the VWSC is not functional. The Jal Nigam (Rural) and the contractors are taking care of the infrastructure under JJM, with no plan of involving community in the picture. On 4 December 2025 a press release from Ministry of Jal Shakti,[13] Nal Jal Mitra Programme (NJMP) has been launched in collaboration with Ministry of Skill Development and Entrepreneurship for enabling the local village community to operate and maintain the supply system; training was conducted to a person—a Nal Jal Mitra—identified by the village head to equip him with a comprehensive set of skills. This will help the Nal Jal Mitra to function as scheme operator and carry out minor repairs and maintenance, including preventive maintenance, of the piped water supply scheme in his village. Around 144 Nal Jal Mitras have been listed for Banda district.[14]

Community contribution towards O&M

JJM operational guidelines mandates to collect the community contribution from households. The objective is to bring ownership, ensure O&M and sustainability of water supply system. In Banda district, it was found during the survey that wherever the source is surface water, the O&M cost is very high as the water is brought from a distance of 100 km. The O&M cost (currently 1 per cent of the supply cost) will increase every year. The consultant hired for household connections takes care of O&M but there is no plan with the VWSC for future O&M. Since water supply that

depends on surface-water sources comes from long distance, O&M in future will be difficult and costly for the villager to bear.

Greywater management

A different set of problems is associated with the villages in the forefront of supply in the multi- village schemes (based on surface water)—this is of wastage of water. These households seem to extract water from private borewells and hand pumps even though they are receiving good and sufficient supply. Water wastage is definitely a concern here. This generates huge amount of greywater from the washing areas, bathrooms and kitchens. Open drains in villages are clogged with solid waste and plastics. As a result, waterlogging becomes evident after a short shower. In some cases greywater overflows back into the households creating problems for the women folk. Greywater flows into nearby depressions or ponds in the villages. In many cases, the supply taps were stolen or broken in different villages, which also causes significant water wastage. Awareness on judicious use of water is lacking in the villages receiving surplus water.

Despite the large volume of greywater is generated in the villages, communities have low awareness of this. The structures listed on the SBM-G dashboard are either missing on the ground or dysfunctional. There is no greywater management at the source (household level). Soak pits are generally located around hand pumps. Only very small numbers of soak pits in the assessed village were found to be fully functional. O&M for many of these structures is lacking due to insufficient knowledge and funding. Kitchen gardens are found in a few villages, where households use greywater from washing areas and kitchens to grow vegetables. The volume of greywater generated in Banda district is large, and it floods the roads, clogs the drains, creates overflow, and even pollutes the ponds and lakes due to the entry of greywater.

Conclusion

Banda district fetches drinking water both from the groundwater (borewells) and surface water (Yamuna and Ken Rivers). Though the JJM dashboard shows more than 85 per cent of surveyed villages covered with functional household tap connections (FHTC), only 201 out of 308 households surveyed (69 per cent) get household water supply. The variation of water supply ranging from 24 hours running water to less than one hour per day indicates that the supply is not regular. Water quality may not be the major issue now, but digging deeper and deeper borewells may cause geogenic contamination.

The JJM Operational Guidelines define functionality of a tap connection on the

basis of delivery of adequate water of prescribed quality (BIS:10500) on a regular basis. But the ground reality found during the field survey finds a question on the functionality of the tap connections provided. Fetching water from longer distances causes health issues, especially to women and girls.

Groundwater plays a very important role in providing the water to rural households in surveyed villages and sufficing their daily needs. Due to over dependency and increased extraction, around 34 per cent of the surveyed groundwater sources have become defunct, and more will be added to this category if stringent measures are not taken. Uttar Pradesh Jal Nigam, the Rural Development Department, and community institutions need to come together to coordinate the planning, implementation, and monitoring of groundwater recharge structures. Existing and potential drinking water sources should remain a focus when planning groundwater recharge to ensure source sustainability. For the sustainability of surface water sources, well-coordinated planning and implementation are required within their catchments. Community institutions should be involved in mapping the water sources and planning for their sustainability.

The CSE team's interaction with Nal Jal Mitras in Banda district have shown that some surveyed villages have Nal Jal Mitras who have been trained and issued a certificate. According to a recent statement by Jal Shakti, after reading the work completion report in its gram sabha meeting, the gram panchayat formally passes a resolution certifying itself as a 'Har Ghar Jal' village. However, in the surveyed villages, gram panchayat members rarely meet and even when they do, the water is never a priority.

The household water supply in Uttar Pradesh is managed by the state water utility, the Jal Nigam (rural). As in Rajasthan, the sustainability and recharge of the source are managed by the Department of Rural Development. The O&M is under the Panchayati Raj Department, and greywater management is also under this department. These key departments work in silos, data are fragmented, and as a result there is no monitoring of the source. A connection between water and greywater for the sustainability of source is rarely established.

Even after six years since the launch of the Jal Jeevan Mission, a significant number of villages in both districts struggle to get access to clean, safe and adequate water supply, especially remote and tribal villages in difficult, steep terrains. The JJM dashboard marks villages as 'covered' if pipe connections to households are laid, but the supply to households has not yet started. The planning and implementation of source sustainability measures have not yet taken root on the ground.

Snapshots from the field

MANISH MISHRA/CSE

A defunct tap in Bhath village, Jaspura block, Banda district

SWATI BHATIA/CSE

An FHTC in Acchraund village, Badokhar Khurd block, Banda district

SWATI BHATIA/CSE

A handpump in Milath village, Baberu block, Banda district, used as a drinking-water source by the village community

VIVEK KUMAR SAH/CSE

FHTCs in Jaspura village, Jaspura block, Banda district, provided under JJM

ROLE OF THE COMMUNITIES IN THE SUSTAINABILITY OF THE DRINKING WATER SOURCES: STORIES FROM THE GROUND

A water user group in Goriya village, Bali block of Pali district, Rajasthan, takes care of the O&M of their drinking water supply

Introduction: Goriya village in Bali block of Pali district is one of the most deprived villages in terms of rural drinking water supply. Ever since the rural drinking water programmes have been launched in India, the village has been out of reach for various reasons. One of the main reasons being its geography and topography. The village has extremely undulating terrain with scattered households, situated on small hillocks. The village is inhabited with a tribal population of 641 households, covering a total population of 3,844 persons.

Water supply has been a problem in Goriya village due to the scattered distribution of resources and habitations. There are around 80 hand pumps in the village, but most are defunct. Hence, people of the village would go to distant sources, generally open wells—which had water—to meet their drinking requirements.

Status of Jal Jeevan Mission in Goriya: Jal Jeevan Mission was launched in 2019, but the progress of the mission in Goriya village has been slow. So far, the households have not received any functional household tap connections, and the community of the village is dependent on open wells, hand pumps and some private borewells. There are around 80 hand pumps in the village that cater as the source of water to the village community. Apart from this, open wells are also a source of water in the village. The pipelines under JJM are

being laid. As per the JJM dashboard, the household coverage under JJM in Goriya village is around 4 per cent. The water supply under JJM has not started yet in the village.

The village has an undulating terrain, and groundwater is around 200 feet deep. The Jawai River runs through this village, providing water to the community for their domestic and agricultural needs. Many households of the Goriya village are dependent on this river for their daily needs.

Need for drinking water supply: Prabhuram and his family also used to go to a nearby open well, situated beside a nearby stream, to fetch water for their domestic needs. The women in his family and nearby families had to carry the water to their homes, which are situated in elevated areas. Women had to face the severe burden of bringing water from distant and inaccessible places, causing serious health issues.

The intervention: In 2019, the Centre for Microfinance (CMF), a Jaipur-based organization, took the initiative of providing clean and adequate drinking water to a cluster of eight households, arranging them in a cluster. Under their initiative 'Water Sanitation and Hygiene (WASH)', the organization proposed to create a cluster of households residing nearby and provide a water tank and necessary connections near those households so that they can get drinking water at their homes. The households accepted the proposal and came together to form a water user group.

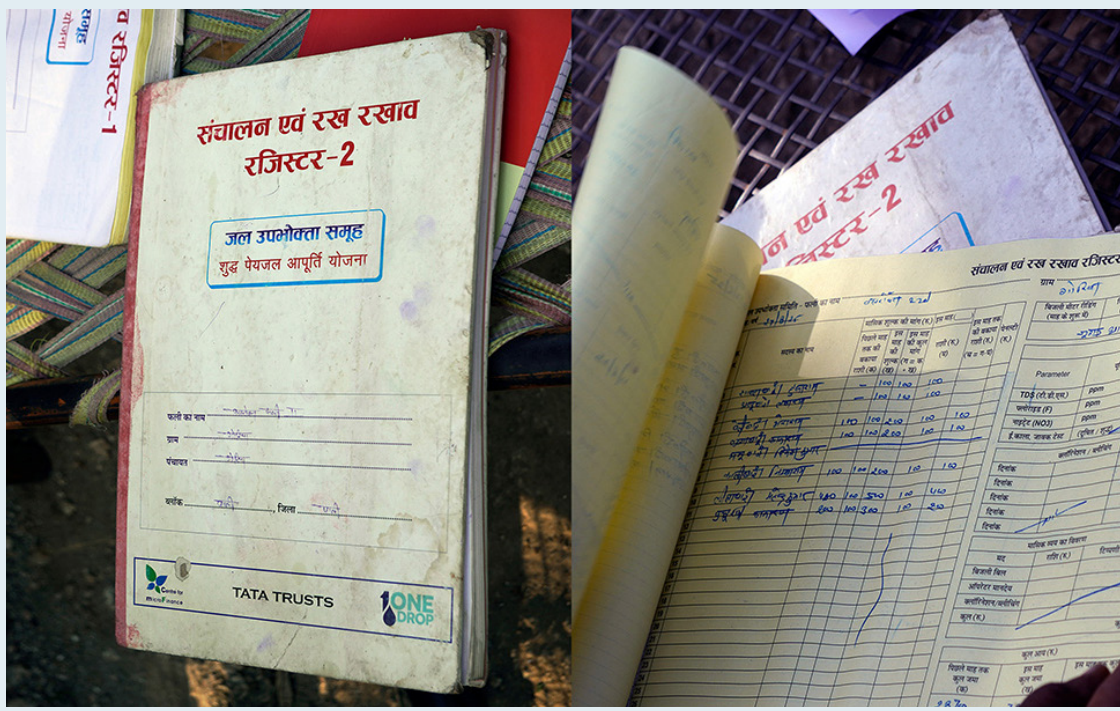
To supply the drinking water, an open well was selected, owned by the gram panchayat Goriya, for the community. The well is at a distance of around 500 metres from the village. Initially, Rs 2,000 was collected from each household, as a part of the community contribution. Every household paid this amount, which was kept with the user group itself. The infrastructure, including pipes, electric motor, water tanks etc., was provided by

PRADEEP KUMAR MISHRA/CSE

Water supply system developed by the Centre for Microfinance (CMF), with the support of Tata Trusts, in Goriya village, benefitting eight households

PRADEEP KUMAR MISHRA/CSE

An open well used for supplying of drinking water in Goriya village, Bali block, Pali district



PRADEEP KUMAR MISHRA/CSE

Register maintained by the user group for their monthly contribution towards the O&M of the water system in Goriya village

PRADEEP KUMAR MISHRA/CSE

A child from the user group drinking water from the community tap

the CMF. It provided two tanks of 1,000 litre and 300-litre capacities respectively to provide water to the group. The total project cost was Rs 1,12,870. A total of eight households were able to get the drinking water near their homes, reducing the drudgery of women members and young children.

Operation and Maintenance (O&M)

The operation and maintenance of the entire system is done by the user group. Every household of the user group deposits Rs 100 per month as a contribution towards O&M. The amount is kept in the group itself under the leadership of the group head, Prabhuram. The user group had elected Prabhuram as their president. Along with this, the group also elected their secretary and treasurer. The group conducts regular monthly meetings and discusses the matters related to water supply and maintenance. The electricity bill for water supply is paid by the group from their monthly contribution. Whenever there is a requirement of any repair and maintenance, the group conducts a meeting and takes the decision. For any technical support, the user group invites and consults with CMF as well.

D. Issues, learnings and the way forward

1. Towards addressing the functionality issues in rural water supply programme

Learnings from both Pali and Banda districts indicate that accelerating last-mile FHTC delivery remains a critical priority. MVS has been planned in both districts. However, due to irregular supply, villagers depend on the nearby local sources (groundwater and ponds). In Pali, around 90 per cent of the borewells in the surveyed villages belong to JJM. In Banda, groundwater sources in 30 per cent of the surveyed villages were primarily private borewells/hand pumps. The remaining villages depended on government borewells belonging to JJM.

The households in the surveyed villages in both districts receive water under SVS and MVS through the same pipe connection. Wherever the MVS water supply is inadequate or irregular, JJM supplies groundwater to meet the water demand under SVS (which is village-based). Hence, there is a need to protect and recharge the groundwater sources to maintain a safe and secure drinking water supply to the villages. The role of the gram panchayat/VWSC is extremely important in ensuring the sustainability of the drinking water supply infrastructure, monitoring water quality in the village, ensuring the functionality of the taps, and overall management of the in-village water supply.

As per the JJM dashboard for Pali district 85.72 per cent of total households have tap connections. In Banda district, coverage of households under FHTC is 99.91 per cent, as per the JJM dashboard.[15] However, a field survey in selected villages in both these districts shows that the JJM supply has been affected by inadequacy, irregularity, and poor water quality (only in the case of groundwater-based sources) supplied to the households.

According to CGWB data for 2024–25 (ingres.iith.ac.in), eight out of 10 blocks in Pali district fall under the over-exploited category, and around 40 per cent of the wells, hand pumps or borewells are defunct in the surveyed villages. In Banda, four out of eight blocks fall under semi-critical category as per the CGWB report. However, around 37 per cent of the groundwater-based sources in Banda are defunct or not in use, which clearly indicates that the ground situation is much more adverse than what has been reported. In both districts, water is supplied

to the villages either through Single-Village Schemes (SVS) (groundwater-based sources located in the village) or the Multi-Village Scheme (MVS) (distant sources like rivers, dams, etc.). In Banda, a heavy dependence on private hand pumps or borewells has been observed in the surveyed villages. Wherever communities fail to receive the JJM supply (either MVS or SVS), they fetch water from nearby handpumps in Banda. The panchayat has installed hand pumps every 50–100 metres to cater to the villagers in case of insufficient JJM supply.

The water stress in Pali is mainly due to plunging groundwater levels, but in Banda the water stress is because of mismanagement of water sources and poor groundwater quality. This highlights that infrastructure expansion alone is insufficient without sustainable resource management and community participation. The community participation for management, protection and recharge of water supply in both the districts is very low, this needs to be filled through regular interactions, capacity building and ensuring their engagement in Operation and Maintenance.

Some of the key initiatives which could be taken for the sustainability of the drinking water sources at the district level to ensure the functionality of the tap connections and community participation are listed below:

i. Integrated use of SVS and MVS in sustainability of rural household water supply

SVSs (groundwater-based systems)

In Pali and Banda districts, SVSs rely on local groundwater sources such as open wells, borewells, and hand pumps. Field evidence suggests a high proportion (around 40 per cent) of groundwater sources are either defunct or abandoned, indicating a statistically significant trend of depletion of groundwater sources. As per the discussion with the PHED, out of 15 surveyed villages only one village will be supplied drinking water from the SVS in Pali. Though, all the surveyed villages in Pali district depend upon groundwater sources in absence of or during insufficient supply from the Jawai Dam. Whereas in Banda SVS is prominent in 12 villages.

Decline in groundwater-based sources affecting SVS efficiency: Declining groundwater levels and deterioration of groundwater quality is affecting the back-up of village water supply. The hand pumps, borewells and open wells are going defunct. However, this decline is not solely attributable to poor planning of recharge structures but reflects a systemic imbalance in the water budget,

where groundwater extraction—especially for irrigation—exceeds the rate of groundwater recharge.

MVS (surface water/long-distance systems)

MVS, which relies on distant sources, such as the Jawai Dam in Pali and Yamuna River in Banda, was introduced to address groundwater quality and quantity constraints. In Pali, 14 out of 15 villages have been planned for MVS, while in Banda all the villages have been planned under MVS. However, field findings indicate significant variability in service delivery, particularly in tail-end villages.

Challenges in MVS: None of the MVS villages surveyed depend entirely on the MVS scheme. The supply from the Jawai Dam (source of MVS) has not started for five villages (36 per cent) yet. So, the Ground Level Reservoirs (GLRs) in all these villages are filled up by groundwater (borewells, open wells, hand pumps or ponds). Communities come here to fetch water. On days when the water does not reach the households as per schedule, PHED connects existing supply network with the local groundwater sources. PHED also provides standposts connected to local groundwater sources to supply water to villagers in the absence of any planned supply to households. Communities, in the absence of any arrangement by PHED, collects water from private borewells, open wells or hand pumps, or even go to nearest waterbody (at least 10 per cent of the population in each of the surveyed households face similar issues, even in case the villages are 100 per cent covered by JJM).

Despite high reported coverage, only a small fraction of households receives reliable supply, indicating a gap between infrastructure provision and functional service delivery.

Dual water supply system approach—a sustainable solution for regularity of drinking water supply

In water-scarce regions such as Pali and Banda, dual water supply systems can be advantageous to rural households. Instead of depending upon only one source of water, communities should be provided with the supply from local sources (in the village) and distant sources (Jawai Dam in Pali and Yamuna in Banda) as well. This will supplement the demand of the community and ensure regularity in water supply.

According to the operational guidelines of Jal Jeevan Mission, the primary sources of village water supply should be the local water sources. In case local sources

DUAL WATER SUPPLY MODEL IN BHAVNAGAR DISTRICT, GUJARAT

Bhavnagar district in Gujarat presents a strong example of a 'dual water supply' model under the Jal Jeevan Mission (JJM), demonstrating how local and regional water sources can be strategically integrated to ensure reliable and sustainable rural water supply. This model is particularly relevant in semi-arid and water-stressed regions where dependence on a single source often leads to seasonal shortages.[16]

The system is based on seasonal optimization of water sources. During the monsoon and post-monsoon periods, villages primarily rely on local groundwater sources, such as open wells that are naturally recharged by rainfall. Field observations indicate that groundwater levels in wells often rise significantly (e.g., 8–18 feet in good monsoon years), making them a viable and cost-effective source for drinking water supply during this period.

However, during the dry summer months, when groundwater levels decline and local wells become unreliable or dry, the system switches to a regional surface-water supply. Villages receive water from the Mahi Pariage Regional Water Supply Scheme, which draws from the Mahi River and supplements it with Narmada water as required.

A common overhead water storage tank is used to store water, from both SVS and MVS. Water from either source is transported through separate pipeline connections to the common storage tank in the village. The village uses common distribution network to supply water to households, from the common overhead storage tank, using the SVS source during the monsoon and the MVS source during dry periods.

Institutionally, this model is supported by a clear division of roles. The Gujarat Water Supply and Sewerage Board (GWSSB) is responsible for bulk water transmission and supply up to the village level, ensuring reliable infrastructure for long-distance water transfer. It supplies bulk water from MVS to the village, storing it in the overhead tank. At the village level, the Water and Sanitation Management Organization (WASMO) plays a critical role in planning and implementing the distribution network to supply drinking water to households. WASMO also focuses on capacity building and working through community institutions such as pani samitis and gram panchayats to manage in-village distribution systems.

This dual approach enhances resilience, reduces pressure on groundwater, and ensures continuity of supply, making it a replicable model for other regions facing similar hydrogeological and climatic challenges.

are not sufficient to supply drinking water or has water quality issues, the other sources can be used. This ensures the regularity and adequacy of water supply.

To address the challenge, a dual water supply system can be promoted, which taps both local and distant sources, as required. The infrastructure for in-village water supply to the households should be connected to both local and distant sources. Local sources, particularly groundwater-based (open well, hand pumps, borewells) that use shallow aquifers are recharged during monsoon. Hence, they can be used during and after the monsoon period. These local sources can be used as the primary source of water supply. During lean periods, when local water sources decline or water quality deteriorates, a surface-water source (MVS) can be used as a supplementary arrangement. This will reduce the burden on either source

and will also ensure the adequacy, regularity and quality of drinking water supply. Gaps in the water supply due to seasonal variability could also be addressed.

The use of SVS and MVS should be planned so that they supplement the water supply to the rural households. Planning should not be dependent on only one source, but should integrate both local sources (SVS) and distant sources (MVS), which could sustain the supply and ensure equitable distribution of water. This will also reduce the load on MVS schemes, resulting in reduction in water leakages and reduced cost of O&M and leakages.

This approach can be implemented and scaled up at the district level both in Pali and Banda to ensure tap functionality, equity and social inclusion. Both districts, though diverse, need a comprehensive approach to sustain their drinking-water-supply systems.

ii. Equity and gender inclusion in rural water supply

Water supply challenges disproportionately affect women and marginalized communities. To ensure the social and spatial aspects in supply of drinking water, gender-sensitive and equity-focused planning is essential.

Water supply challenges in rural areas of Rajasthan and Uttar Pradesh represent a disproportionate impact on women and marginalized communities, highlighting critical gaps in equitable service delivery. The field assessment indicates that women remain the primary collectors of water across most households, especially in areas where piped water supply is either absent or unreliable. This results in a significant time and physical burden, often requiring women to travel long distances to access water from alternative sources such as open wells, hand pumps and rivers. Such practices not only reduce productive time but also adversely affect health and well-being.

The issue is further exacerbated in geographically challenging and socially vulnerable regions. In the tribal villages of Bali block (Pali district), particularly those in hilly and undulating terrain, access to household water supply remains severely limited. In three such villages—where more than 90 per cent of the population belongs to tribal communities—piped water infrastructure has not yet reached households. As a result, women are compelled to fetch water from distant sources, often at lower elevations such as riverbeds or open wells.

Carrying water uphill to dispersed households requires intensive physical effort, increasing drudgery and long-term health risks. In villages such as Goriya, where

houses are scattered across steep hill slopes and are far from motorable roads, these challenges are particularly acute. The absence of last-mile infrastructure in such settlements reflects a spatial inequity in service delivery, with difficult terrains and dispersed habitations often left out in infrastructure planning.

These findings highlight the urgent need to incorporate gender-sensitive and equity-focused planning approaches in rural water supply programmes such as JJM. Infrastructure design and implementation must account for:

- Topographical challenges and settlement patterns,
- Inclusion of remote and tribal habitations, and
- Reduction of drudgery for women through last-mile service delivery.

iii. Increase FHTC coverage

In Pali, the JJM dashboard reports that of the total 771 villages, 425 (55 per cent) have 100 per cent tap connections. This indicates that work progress needs to be accelerated. In Banda, the JJM dashboard indicates that 643 of 648 villages have 100 per cent tap connections. However, the field study in selected villages shows a significant gap in service delivery, resulting in irregularity, inadequacy and poor quality of drinking water. This must be addressed through frequent monitoring of the infrastructure and by ensuring the work is carried out at speed. Accelerated connectivity to the last-mile household is the need of the hour, which will improve the overall status of the states.

iv. Developing water-budgeting framework for strengthening water security

Water budgeting is the key practice which categorically indicates the requirement and allocation of available water to different sectors like drinking, irrigation, livestock and industries. Both districts Pali and Banda show huge dependence of groundwater. District level water budgeting framework will boost local water security and build climate resilience in both these districts.

According to the National Aquifer Mapping and Management Programme (NAQUIM) 2020 report of Pali, the district falls in the over-exploited category as the stage of groundwater development is 125.52 per cent. This shows that this drought-prone district has heavy dependence on groundwater. Pali should thus balance the demand and supply at the village level, stressing on participatory governance, water-efficient irrigation, reuse of treated wastewater and rejuvenation of groundwater and waterbodies for sustainability of the source. This will also align with Rajasthan's vision document of 2047.

Banda district of Uttar Pradesh falls within the water-stressed Bundelkhand region. Groundwater dependence is high, resulting in the declining groundwater levels. Four of the eight blocks fall under semi-critical category. A budget framework to assess water demand and supply related to drinking water, livestock, agriculture and industry of the available groundwater and surface water sources will help to improve water governance.

v. Promoting traditional water-harvesting systems

Rajasthan has traditionally practised rainwater harvesting by constructing various structures to store rainwater and use it during the lean period. With the advancement of household water supply programmes, this traditional knowledge is slowly declining. During the field survey in Pali district, the surveyed households were not practising rainwater harvesting. Although the households construct tankas to store water, the objective is limited to storing either supplied water or water bought by tankers. Rooftop rainwater harvesting has not been integrated with tankas. Similarly, in Banda, there is no practice of rainwater harvesting either at household or community level.

The JJM operational guidelines promotes the rainwater harvesting to collect the rainwater which can be used during the lean periods. This agenda should be pushed forward through knowledge dissemination and campaigning. The traditional wisdom of the community should be mainstreamed with the water supply programme to ensure water security and equitable access. This can be done by integrating the rainwater harvesting plan in the VAPs and DAPs and ensuring that it is implemented across the villages.

vi. Improving converegence between departments

The convergence between the key departments is required to ensure the sustainability of water for all the sectors. To ensure the long-term sustainability of drinking water sources, the following step will be useful:

a. Mapping of existing and potential local drinking water sources;

b. Sharing the database of existing resources with the departments such as Rural Development, Panchayati Raj, Watershed Development and Soil Conservation and Central Groundwater Board and State Groundwater Boards;

c. Water-budgeting exercises at the district and village levels should be done with all the stakeholders and relevant departments, to map the demand, supply and solutions to meet the increasing demand;

d. Planning and implementation of groundwater recharge at specific locations to ensure the recharge of groundwater. Modern tools and technologies, such as remote sensing and GIS, should be used for planning exercises. This can be provisioned through capacity building of officials and relevant authorities.

e. Ensuring a robust monitoring system through collaboration and ensuring equitable sharing of water for all the sectors.

These steps, with the joint efforts of all relevant stakeholders, will help create a detailed framework for convergence, ensuring accountability for source sustainability.

2. Mapping the issues, effects and underlying factors

The issues, their on-the-ground effects, and the underlying factors and root causes are listed in *Table 14*.

Table 14: Issues, effects and underlying factors studied from the field in Pali district, Rajasthan, and Banda district, Uttar Pradesh

Issue	Effects	Root cause	Way forward
Source sustainability is not a priority	The existing sources are drying up/ becoming defunct and reducing the availability of per capita water in the village.	The GP/VWSC has not planned the sustainability of these sources. GP unaware about source of funds, convergence and planning for source sustainability No/rare discussion on source sustainability at any level (village, block, district, state)	All the sources in the village need to be identified and mapped. District Water and Sanitation Mission (DWSM) should facilitate the process of convergence, source sustainability and mobilize funds. All the stakeholders should come together, rather than working in silos.
		Lack of community participation and sensitization	Gram panchayat/VWSC should prioritize the sustainability of these local sources as they supplement the water supply during irregularities or inadequacy
		Lack of awareness in understanding the concept of source sustainability	Technical support from ISA and JJM/PHED/Jal Nigam to be provided at village level
		Source and catchment are under different authorities and lack of convergence between the authorities	Convergence to be planned at district and state level to ensure sufficient guidance and fund for implementation of measures for source sustainability and its monitoring
VWSC is not functional	No community participation in bringing out the issues related to rural drinking water supply	After formation of VWSC, very rare efforts have been made for their strengthening and nurturing	State/district to review to the role and functionality of VWSC

Issue	Effects	Root cause	Way forward
		VWSC meetings have not been conducted	The role of ISA to be reviewed and monitored in terms of conducting VWSC meetings and strengthening
		Passive involvement of women in community, VWSC, gram panchayat meetings	The role of women should be more active through active sensitization programmes and capacity building
		VWSC have never been made a part of planning, implementation and Operation and Maintenance of drinking water supply infrastructure	Training and capacity building of VWSC regularly
		The space for community participation needs to be defined especially when large projects are being planned, designed, implemented and monitoring, including a long O&M contract	The operational guidelines shall be strictly followed during implementation of the programme. The roles of VWSC are clearly mentioned in operational guidelines but the gap in implementation must be addressed
All the FHTCs are not 'functional'	Inadequate supply to households Regularity of water supply is still a challenge Local groundwater sources face quality issues	In some villages, the infrastructure for water supply is still being laid	The implementation needs a speedy approach so that all the households are covered
		There are leakage losses during bulk conveyance of drinking water supply from large distances under Multi Village Schemes	Local sources should be identified and should be made sustainable for long term use
		No monitoring of quantity of water received at user end	JJM operational guidelines mentions to monitor the service delivery at household level. This should be ensured at household level
		Irregularity of electricity disrupts the supply of drinking water	Alternative measures have to be arranged for such conditions to provide regular supply
		Village water sources (groundwater based) face quality issues	Regular testing of drinking water at source needs to be done. Use of FTKs must be promoted
		Due to loss of pressure during water conveyance at large distance under Multi Village Schemes, the tail end users are not getting regular and adequate supply	Priority should be given to local water sources, which can be managed by GP/VWSC
		Lack of operation and maintenance at village level	VWSCs must be strengthened to monitor the gaps in O&M and coordinate with the block/ district officials
Operation and Maintenance is not done by VWSC	Leakages in water supply at village level No O&M charges collected at village level Delay in repair of pipes and strengthening of infrastructure	VWSC not trained and strengthened for O&M	Entire O&M at village level should be the responsibility of VWSC and this should be ensured
		The O&M has been given to contractors which will take care of the entire infrastructure for duration mentioned in their contracts. VWSC has no role to play	Regular trainings of VWSC should be conducted on different issues of O&M
		Announcement by Rajasthan government on no collection of user fee or O&M charges from users	Community contribution is important to collect from households to ensure the sustainability of the water supply system

E. Action agenda

1. Dual water supply approach for functionality of tap connections

Dual water supply systems combining local (groundwater-based SVS) and distant (surface water-based MVS) sources can improve reliability in water-scarce regions like Pali and Banda. Local sources, recharged during monsoon, can serve as primary supply, while distant sources act as backup during lean periods or quality issues. This integrated approach ensures adequacy, regularity and resilience against seasonal variability. Planning should move away from single-source dependency and promote convergence of both systems. Scaling this model at the state level can enhance functionality, equity, and sustainability of rural water supply.

2. Complete unfinished work

There is a clear and unacceptable gap between official 'Har Ghar Jal' certification and actual service functionality on the ground. Infrastructure completion must be treated as a priority, particularly in remote, tribal and hilly habitations where difficult terrain and scattered settlements have slowed implementation. Villages marked as 'covered' must undergo immediate verification, and incomplete layouts, leakages, and technical failures must be rectified within defined timelines. Reporting should shift decisively from connection-based metrics to measurable service delivery standards. Flow metres at designated points are necessary to verify supply, adequacy, and regularity. Chronic disruptions caused by erratic electricity supply must be addressed through solar-powered pumps and other alternative energy solutions to ensure uninterrupted distribution. Water quality assurance cannot remain aspirational; the use of Field Testing Kits (FTKs) must be operationalized and institutionalized to enable regular testing at both source and household levels.

3. Strengthen community engagement and gram panchayat capacity

The prevailing contractor-led approach has weakened local ownership and left Village Water and Sanitation Committees (VWSCs) underprepared to manage systems. This must be corrected. Clear and enforceable role delineation at the Gram Panchayat (GP) level is essential, particularly for high-cost, high-technology Multi-Village Schemes (MVSs) where O&M responsibilities are complex. Existing mission guidelines must be implemented in spirit and practice to ensure that GPs and VWSCs assume responsibility for in-village O&M rather than functioning

as passive recipients. Village-level water budgeting must be institutionalized to address demand–supply gaps through credible Village Action Plans (VAPs). At present, gram panchayats lack adequate capacity to plan and oversee such technically intensive programmes; structured capacity building and defined accountability mechanisms are therefore imperative. While technical execution may remain with engineering departments, planning oversight, monitoring of supply networks, service regularity, and quality surveillance should be clearly assigned to gram panchayats. User charge collection, as envisaged under mission guidelines, must be operationalized to build financial discipline, create dedicated maintenance funds, and reinforce community ownership. Given that drinking water, sanitation, watershed development, and water management are constitutionally recognized Panchayat subjects under the 11th Schedule, state governments must clearly define institutional responsibilities across tiers.

4. Source sustainability

Reliance on distant surface water sources such as Jawai Dam and the Yamuna River, without parallel strengthening of local sources, poses significant long-term risks. The groundwater status in the study areas underscores this urgency: all three blocks of Pali (Bali, Rani and Sumerpur) are categorized as 'over-exploited,' while Baberu, Jaspura, and Naraini in Banda are 'semi-critical,' with only Badokhar Khurd classified as 'safe,' as per India—Groundwater Resource Estimation Centre. Short-term supply augmentation from safer zones cannot substitute for sustained groundwater management. Long-term water security requires systematic efforts to restore aquifer health and strengthen local sources. Comprehensive village-level mapping of existing and potential drinking water sources must guide recharge planning and enable a conjunctive supply model integrating local groundwater with distant surface water systems. Greywater management must be embedded within source sustainability strategies to prevent contamination of shallow aquifers and safeguard long-term water quality.

5. Collaborative action

Fragmented planning and siloed functioning across departments are undermining the effectiveness of public investments in water security. This institutional fragmentation must be addressed through structured convergence. Departments responsible for water supply (PHED/Jal Nigam), groundwater management, and rural development (MGNREGA/Watershed) must coordinate planning, financing, and implementation across gram panchayat, block, district, and state levels using shared data platforms. The State Water and Sanitation Mission (SWSM) and District Water and Sanitation Mission (DWSM) must assume a proactive coordination role to ensure that recharge structures are strategically located

within drinking water source catchments and that supply systems consistently deliver adequate quantity, assured quality, and regular service.

6. Gender-sensitive and socially inclusive planning approaches

Water supply challenges in rural Rajasthan and Uttar Pradesh disproportionately burden women and marginalized communities, exposing gaps in equitable service delivery. Women remain primary water collectors, facing significant time, physical effort, and health risks due to unreliable or absent piped supply. These challenges are more severe in remote, tribal, and hilly regions where last-mile infrastructure is lacking. Spatial inequities in service delivery leave dispersed and difficult-to-reach settlements underserved. Addressing this requires gender-sensitive, equity-focused planning that prioritizes inclusion, terrain-specific solutions, and reduction of drudgery through reliable household water access.

References

1. State Water Resource Planning Department, Rajasthan, Jaipur, February 2010, State Water Policy

2. Uttar Pradesh Water Management & Regulatory Commission. (2020). *Uttar Pradesh State Water Policy 2020*.

3. JJM dashboard (https://ejalshakti.gov.in/jjmreport/JJMState.aspx) as viewed on 10 September 2025

4. Government of Rajasthan. 1999. Rajasthan state water policy. Jaipur (India): Government of Rajasthan; (accessed on September 25, 2026) (https://www.ielrc.org/content/e9903.pdf)

5. Uttar Pradesh Jal Nigam (Rural) – (https://upjn.co.in/about-rural-jalnigam.aspx), as viewed on 12 October 2026

6. Government of Uttar Pradesh, 1975. *The Uttar Pradesh Water Supply and Sewerage Act, 1975 (U.P. Act No. 43 of 1975)*

7. Government of Uttar Pradesh. (2021). *The Uttar Pradesh Water Supply and Sewerage (Amendment) Act, 2021*

8. Jal Sansthan Chitrakoot website (https://www.jschitrakoot.com/) as viewed on October 12, 2025

9. Operational guidelines for the implementation of Jal Jeevan Mission, Har Ghar Jal, National Jal Jeevan Mission, Department of Drinking Water and Sanitation, Ministry of Jal Shakti, Government of India, December 2019

10. Operational guidelines for the implementation of Jal Jeevan Mission, Har Ghar Jal, National Jal Jeevan Mission, Department of Drinking Water and Sanitation, Ministry of Jal Shakti, Government of India, December 2019

11. Operational guidelines for the implementation of Jal Jeevan Mission, Har Ghar Jal, National Jal Jeevan Mission, Department of Drinking Water and Sanitation, Ministry of Jal Shakti, Government of India, December 2019

12. https://water.rajasthan.gov.in/wr/#/home/dptHome, as viewed on 10 February 2026

13. https://www.pib.gov.in/PressReleasePage.aspx?PRID=2198882&reg=3&lang=1 as viewed on 26 December 2025

14. https://jjm.up.gov.in/site/DistrictWiseNalJalMitra as viewed on 26 December 2025

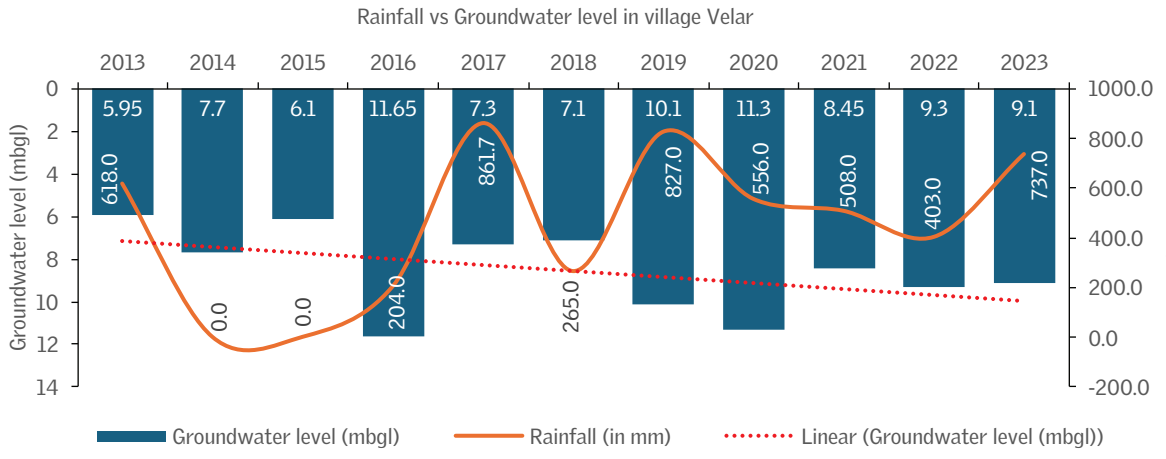
15. JJM Dashboard (https://ejalshakti.gov.in/jjmreport/JJMState.aspx), as viewed on 10 September 2025

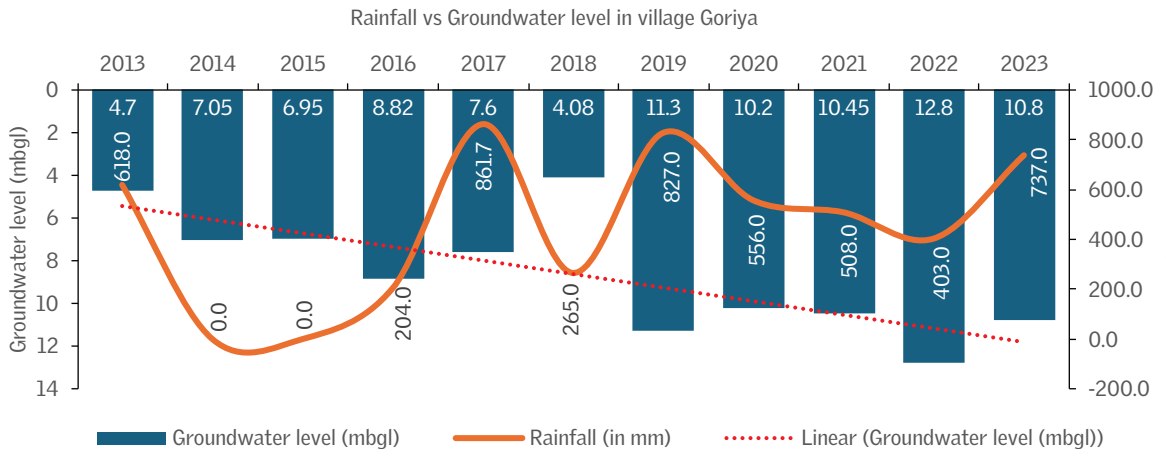
16. Press Information Bureau (https://www.pib.gov.in/PressReleasePage.aspx?PRID=1787349&reg=3&lang=2), as viewed on 18 April 2026

Annexure: Rainfall—Groundwater scenario in the study area

Pali

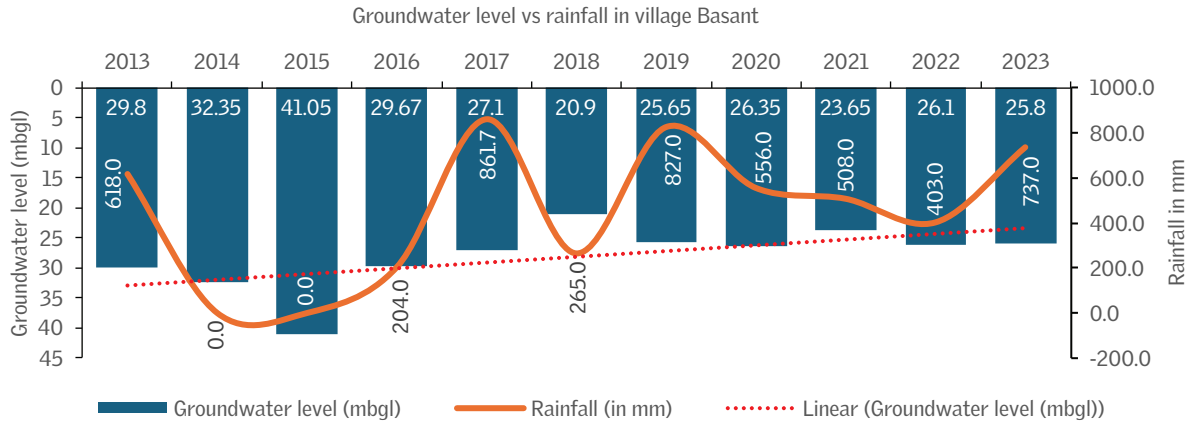
Graphs: Groundwater levels in villages of Bali block

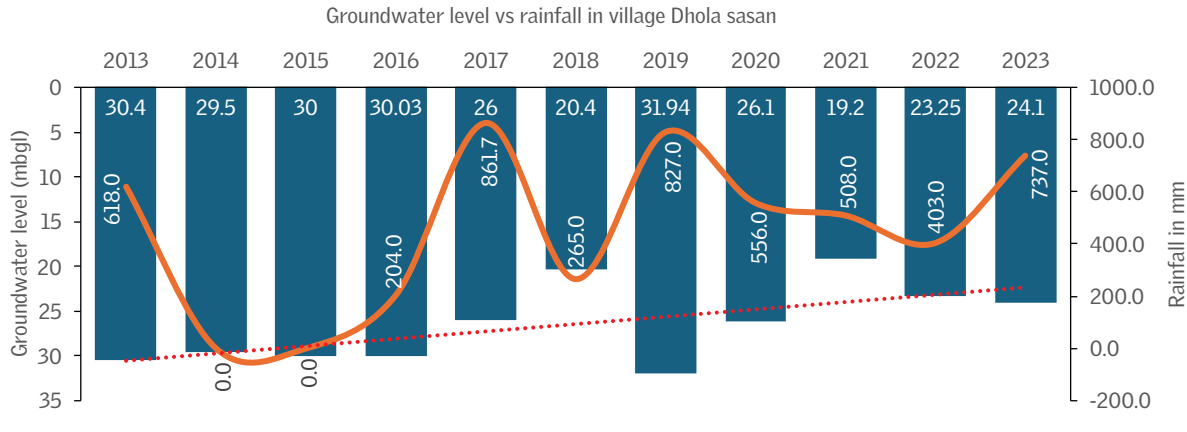


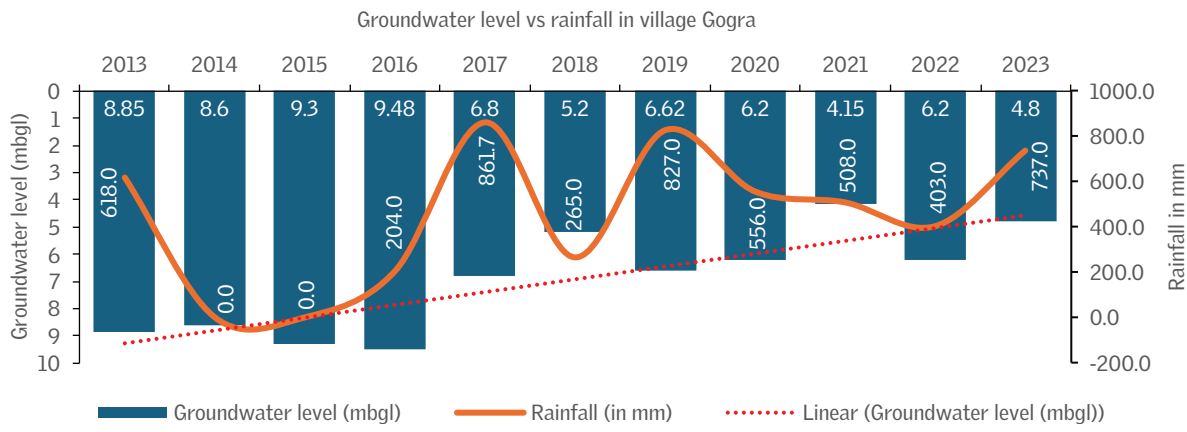


Source: Rajasthan Groundwater Department and Central Arid Zone Research Institute; compiled by CSE

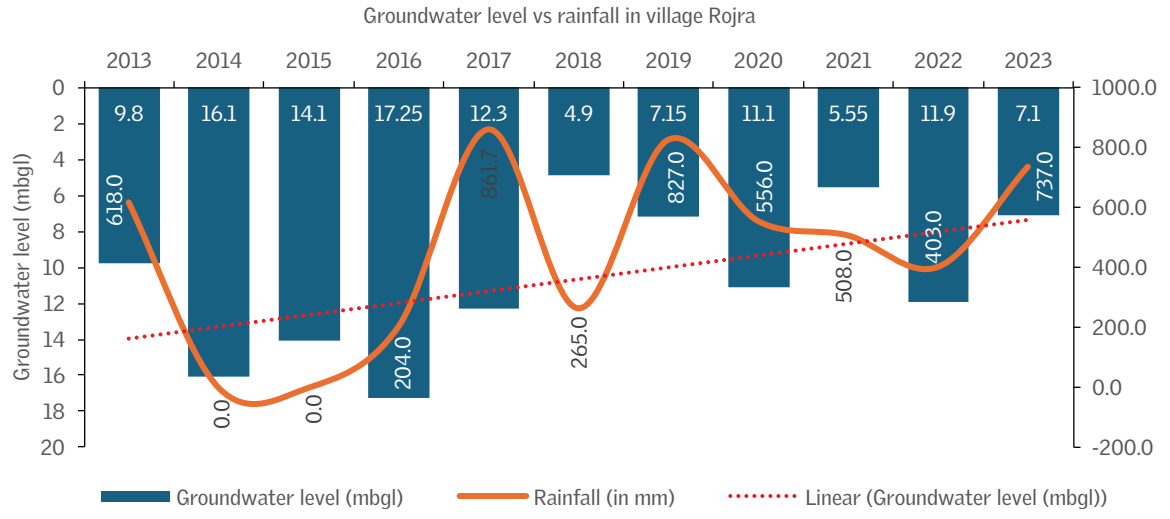
Graphs: Groundwater levels in villages of Surmerpur block



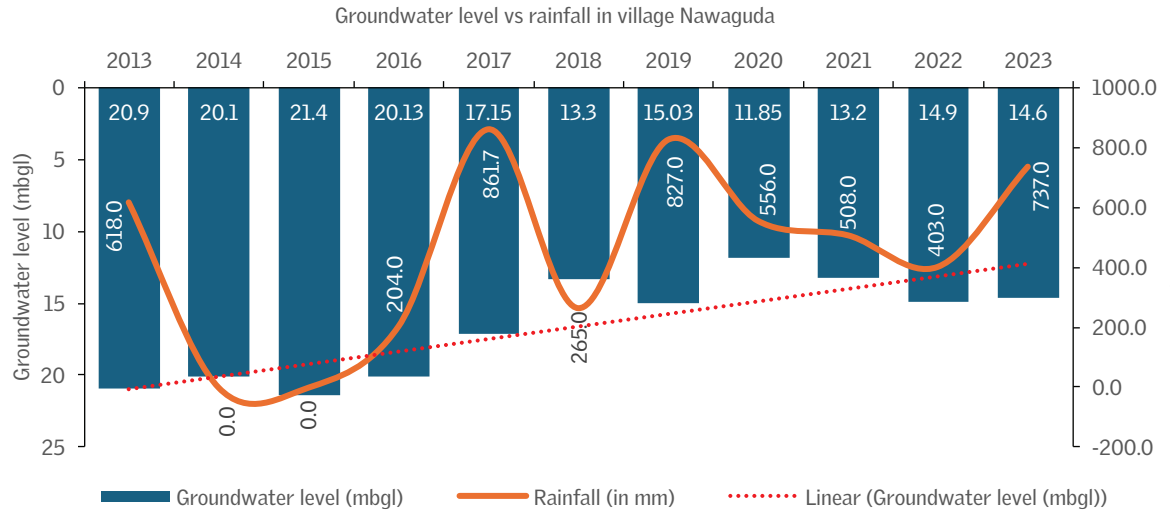


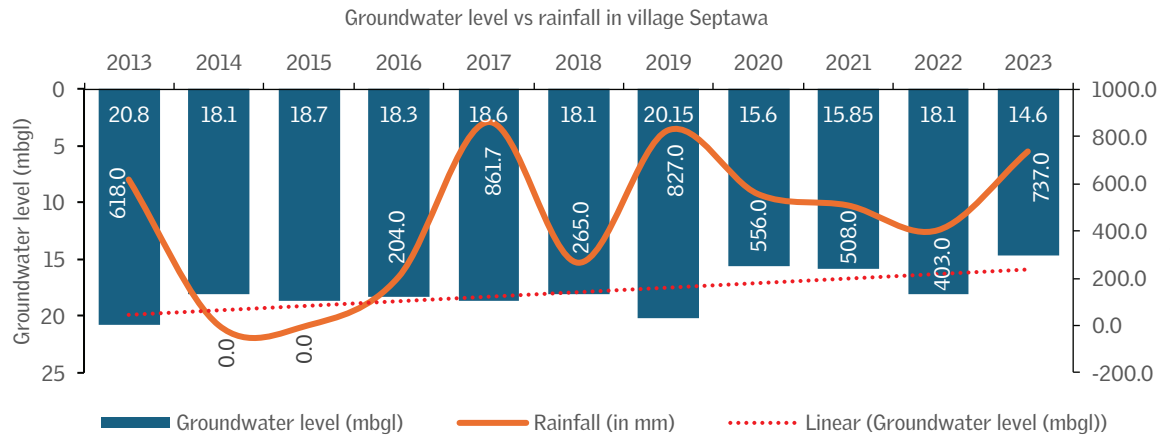


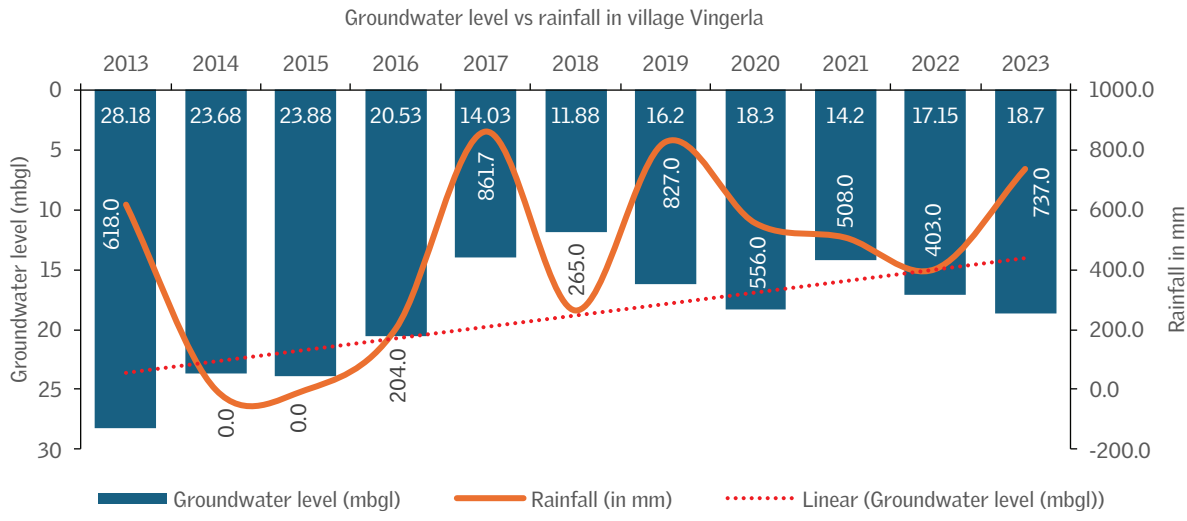
Source: Rajasthan Groundwater Department and Central Arid Zone Research Institute; compiled by CSE

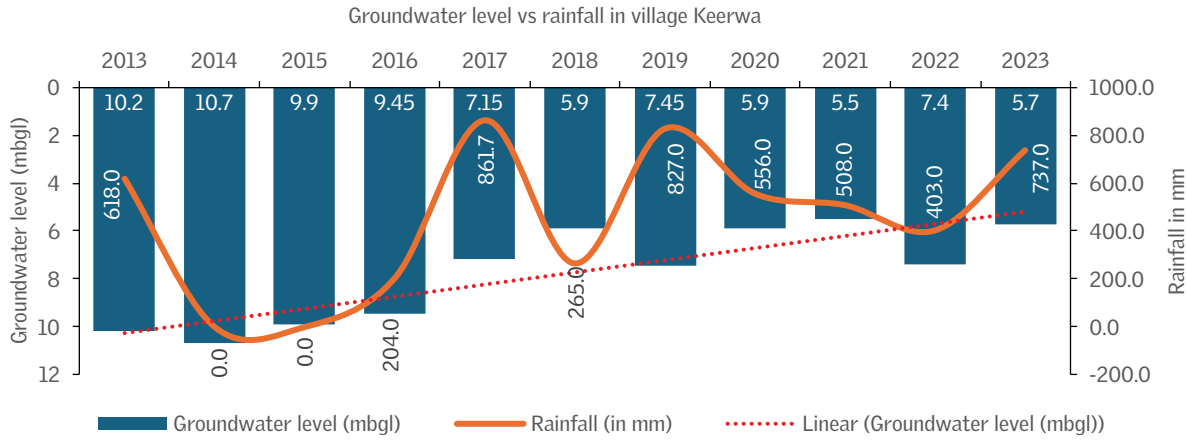


Graphs: Groundwater levels in villages of Rani block









Source: Rajasthan Groundwater Department and Central Arid Zone Research Institute; compiled by CSE

Inference from the graphs of rainfall vs groundwater

Village	Whether covered with piped water supply	Rainfall	Groundwater scenario	Inference
Bali block				
Velar	Yes	Erratic rainfall. A rise of 45 per cent between 2022 and 2023	Fluctuating groundwater condition. A rise of 0.2 metres in groundwater level between 2022 and 2023. Overall, the trend of groundwater level is decreasing	• Though therewas a rise in rainfall between 2022 and 2023, there is a negligible rise in groundwater level. • The village is still dependent on groundwater for its drinking water supply, and hence extraction of groundwater is significant in this village. • Also, there has not been enough groundwater recharge in this village.

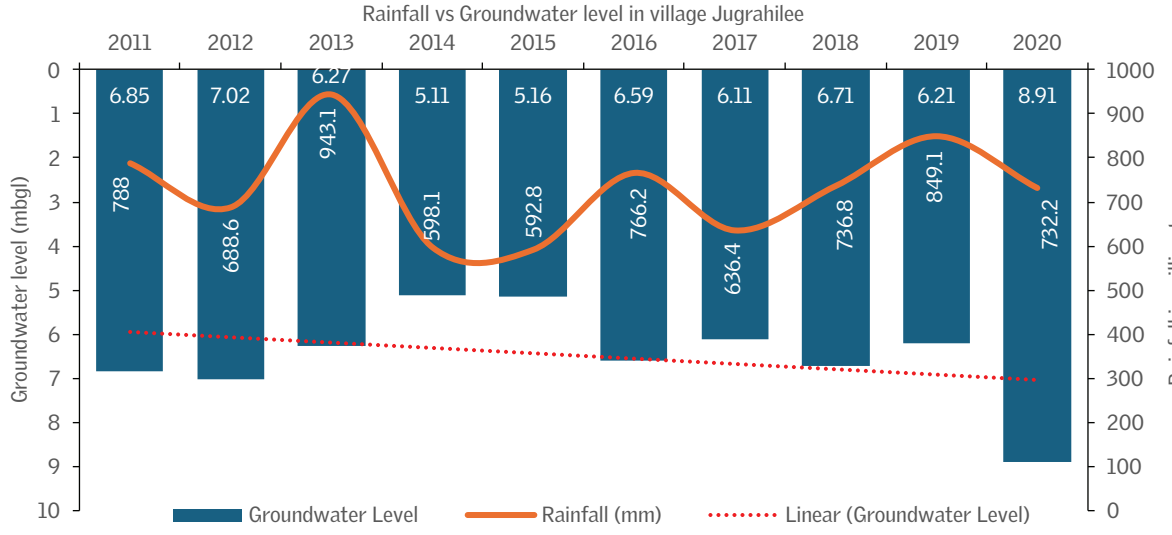
Village	Whether covered with piped water supply	Rainfall	Groundwater scenario	Inference
Goriya	No		Fluctuating groundwater condition. A rise of 2 metres in groundwater level between 2022 and 2023	• There are some water conservation measures taken in the village, which were impactful between 2022 and 2023. • Still sufficient groundwater recharge activities have not been implemented due to which the overall trend of groundwater level is declining.
Sumerpur block				
Basant	Yes		The groundwater levels are fluctuating	• The groundwater levels do not increase in Basant, despite increase in the rainfall in the year 2023. • More groundwater recharge work needs to be done in the village. • Since this is a confined aquifer, its recharge is very difficult.
Dholasasan	Yes	Erratic rainfall. A rise of 45 per cent between 2022 and 2023	The groundwater levels are fluctuating	• The groundwater levels do not increase in Dholasasan, despite the increase in rainfall in 2023. • More groundwater recharge work needs to be done in the village. • Also, since this is a confined aquifer, its recharge is very difficult.
Gogra	No		Groundwater increases and decreases with increase and decrease in rainfall	• The groundwater source in Gogra lies in an unconfined aquifer. As the rainfall decreased, groundwater levels decreased between 2019 and 2022. • When the rainfall increased between 2022 and 2023, the groundwater levels also increased. • There is a significant rise of 1.4 metres in one year, which shows that the groundwater was recharged from the rainfall.
Rojra	No		Groundwater increases and decreases with increase and decrease in rainfall	• The groundwater source in Gogra lies in an unconfined aquifer. As rainfall decreased, groundwater levels declined between 2019 and 2022. • When the rainfall increased between 2022 and 2023, the groundwater levels also increased. • There is a significant rise of 4.8 metres in one year, which shows that the groundwater was recharged from the rainfall.
Rani block				
Nawaguda	Yes	Erratic rainfall. A rise of 45 per cent between 2022 and 2023	Fluctuating groundwater level	• The groundwater level declined between 2019 and 2022. • Between 2022 and 2023, the rainfall rose from 403 to 737 mm, and the groundwater level rose by 0.3 metres.

Village	Whether covered with piped water supply	Rainfall	Groundwater scenario	Inference
Septawa	Yes		Groundwater increases and decreases with increase and decrease in rainfall	• The groundwater source in Septawa lies in an unconfined aquifer. • As the rainfall decreases, the groundwater levels decrease between 2019 and 2022. • When the rainfall increases between 2022 and 2023, the groundwater levels also increase.
Vingerla	Yes		Declining groundwater levels	• The groundwater levels are continuously declining despite a steep increase in rainfall between 2022 and 2023. The village is still dependent on groundwater for its daily domestic requirement.
Keerwa	Yes		Groundwater increases and decreases with increase and decrease in rainfall	• The groundwater source in Keerwa lies aside a pond. • This source is situated in an unconfined aquifer. • As the rainfall decreased, the groundwater levels decreased between 2019 and 2022. • When the rainfall increased between 2022 and 2023, the groundwater levels also increased.

Banda

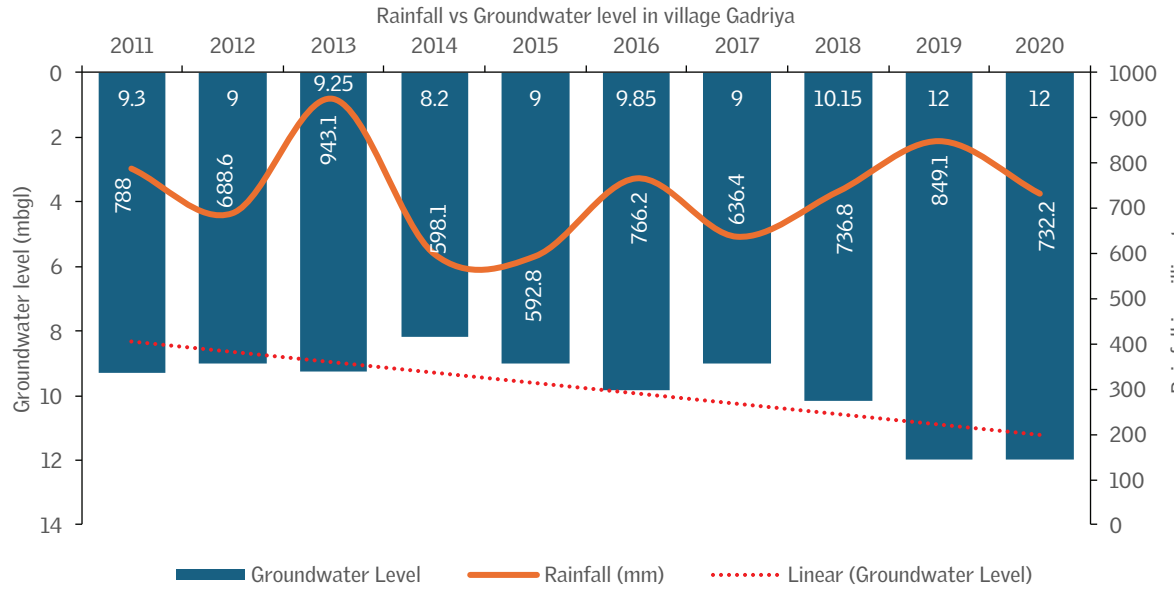
Rainfall and groundwater levels in villages of Banda district

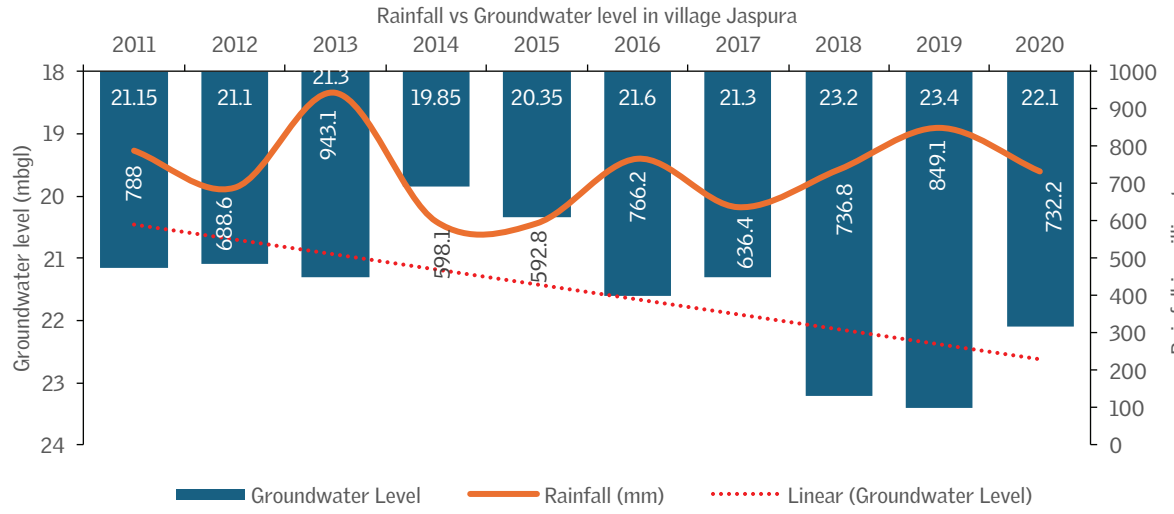
Graphs: Groundwater levels in villages of Baberu block



Source: Uttar Pradesh Climate Authority and Uttar Pradesh State Groundwater Department

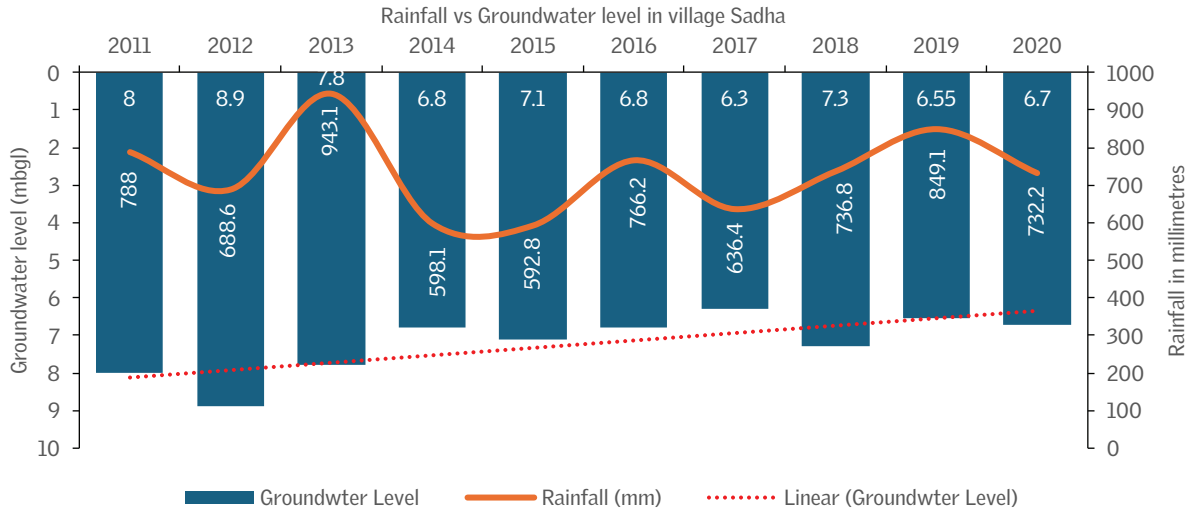
Graphs: Groundwater levels in villages of Jaspura block





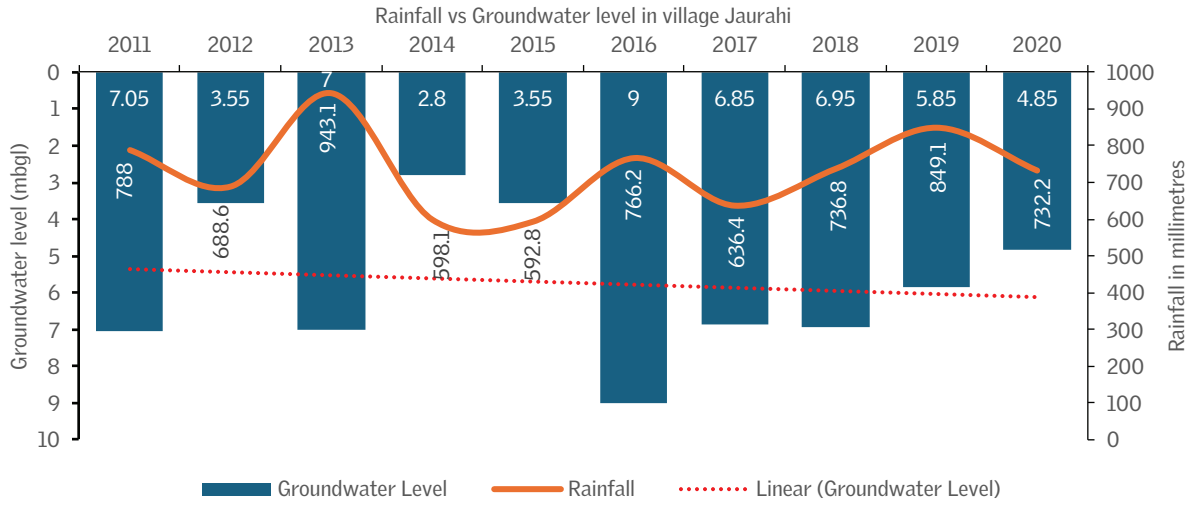
Source: Uttar Pradesh Climate Authority and Uttar Pradesh State Groundwater Department

Graphs: Groundwater levels in villages of Naraini block



Source: Uttar Pradesh Climate Authority and Uttar Pradesh State Groundwater Department

Graphs: Groundwater levels in villages of Badokhar khurd block



Source: Uttar Pradesh Climate Authority and Uttar Pradesh State Groundwater Department

Inference from the graphs of rainfall vs groundwater

Village	Rainfall	Groundwater	Inference
Jugrahilee	Erratic	Fluctuating	The groundwater is fluctuating in Jugrahilee. Since this lies in the shallow aquifer zone, the decline in rainfall has effect on the groundwater level.
Gadriya		Declining groundwater levels	The groundwater level is declining. There is insufficient groundwater recharge, and dependence on groundwater in Gadariya is high.
Jaspura		Highly fluctuating. The data between 2019 and 2020 shows a steep increase of 1.3 metres	The groundwater is declining. The groundwater levels in 2020 were affected by increased rainfall in the previous year, indicating that a significant amount of groundwater was replenished.
Sadha		Shows a decline of 0.15 metres in the last one year	Overall, the groundwater level shows a decreasing trend, but the data is fluctuating. However, since this is a shallow aquifer, groundwater levels rise with rainfall and vice versa.
Jaurahi		Shows an increase of 1 metre between 2019 and 2020	Overall, the groundwater level shows an increasing trend, but the data is fluctuating. However, since this is a shallow aquifer, groundwater levels rise with rainfall and vice versa.

Jal Jeevan Mission (JJM) aims to bring safe and sustainable drinking water to every rural household. The mission is at the last lap of implementation and is ensuring sustainability of water sources to maintain a secure water supply.

The Centre for Science and Environment conducted a survey in two districts with distinct ecologies—Pali in Rajasthan and Banda in Uttar Pradesh. In both districts, Multi-Village Supply Schemes under JJM have been proposed, where water is supplied from nearby rivers. Around 30 villages and 589 households wered surveyed in both districts.

This report suggests that a safe and secure water supply for the district will be achieved through the conjunctive use of surface and groundwater sources. Protecting and recharge of the groundwater sources are the need of the hour. The report also suggests institutional convergence, along with strengthened local governance mechanisms, to ensure long-term water security and equitable access.

Centre for Science and Environment
41, Tughlakabad Institutional Area, New Delhi 110 062
Phone: 91-11-40616000 Fax: 91-11-29955879
E-mail: cse@cseindia.org Website: www.cseindia.org