Finding Effective, Contextual Solutions for Urban Resilience: Piloting Proposed Decision Support Framework (SECURe) with emphasis on GESI in the Indian Context

Project Report

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Executive Summary

The report, Finding Effective, Contextual Solutions for Urban Resilience: Piloting the Proposed Decision Support Framework (SECURe) with an Emphasis on GESI in the Indian Context, explores the challenges of urban resilience in informal settlements of Ajmer, Rajasthan, focusing on 7 informal settlements across 5 Wards. The project, led by PRIA in collaboration with the International Institute for Environment C Development (IIED), examines issues related to Water security and the impacts of climate change through a Gender Equality and Social Inclusion (GESI) lens.

The project employed participatory methods—including Transect Walks, Social and Resource Mapping, Venn Diagrams, Focussed Group Discussions (FGDs), household surveys, spatial mapping, and water quality testing—to analyse water access, infrastructure gaps, and governance barriers. Key findings reveal severe disparities in piped water availability, with settlements like Ambedkar Colony relying entirely on distant standposts and private tankers, while others, grapple with erratic supply and low pressure. Women bear the brunt of water insecurity, spending hours collecting water and facing health risks from contaminated sources. Seasonal scarcity intensifies vulnerabilities, with majority of households in multiple settlements reporting shortages during summer. Water quality testing identified elevated fluoride, hardness, and turbidity in several areas, alongside bacteriological contamination in one settlement. Institutional inefficiencies, including delayed grievance redressal and opaque billing practices, exacerbate inequities. Recommendations emphasize community-led solutions, infrastructure upgrades, gender-responsive governance, and partnerships between SHGs, academia, and municipal authorities to foster resilient, inclusive water systems.

Community Engagement and Collaboration through the SECURe Framework

The SECURe Framework, developed by the International Institute for Environment and Development (IIED), served as a cornerstone for fostering community engagement and multi-stakeholder collaboration in Ajmer's urban resilience project. By prioritizing context-specific strategies, participatory governance, and Gender Equality and Social Inclusion (GESI), the framework ensured interventions aligned with the needs of marginalized communities while strengthening partnerships across institutions. Its five thematic pillars—community assets/services, knowledge/awareness, governance, infrastructure solutions, and financial mechanisms—provided a structured yet adaptable pathway to address water access, sanitation, and climate resilience in informal settlements.

Central to the framework's success was its emphasis on co-production and participatory research. Tools like Transect Walks, Social Mapping, and Focus Group Discussions (FGDs) enabled residents, Self-Help Groups (SHGs)[1], and local institutions to actively shape solutions. Women-led SHGs[2], for instance, became pivotal actors in designing inclusive water governance strategies, ensuring marginalized voices directly influenced decision-making. This approach not

[1] *Community-based groups, primarily composed of women, that focus on financial inclusion, entrepreneurship, and social empowerment through collective savings and lending mechanisms*

[2] *Under Deendayal Antyodaya Yojana- National Urban Livelihoods Mission (DAY-NULM), urban Self-Help Groups (SHGs) have emerged as powerful instruments of social and economic change. These women, through their collective efforts and shared resources, have been actively participating in various livelihood activities, fostering empowerment, and contributing significantly to the overall socio-economic fabric of urban communities. They serve as change agents, demonstrating the transformative capacity of grassroots movements to reshape the urban environment and advance empowerment and inclusivity.*

only built trust but also instilled a sense of ownership among communities, reinforcing long-term sustainability.

PRIA has played a pivotal role in advancing participatory research, community-based research (CBR), and community-university engagement (CUE) by advocating for inclusive and action-oriented methodologies. Through participatory research, PRIA has sought to demystify traditional research processes, ensuring that local communities actively contribute to knowledge creation rather than being passive subjects of study. This approach bridges the gap between theory and practice, fostering intellectual capacities within communities and enabling co-production of knowledge that directly informs policy and academic discourse (PRIA, 2015). Additionally, PRIA has been instrumental in mainstreaming CBR within higher education institutions (HEIs) by developing participatory training methodologies, capacity-building workshops, and community-led research projects. A key example is its collaboration with Kurukshetra University, where marginalized students conducted research on primary education in scheduled caste communities, highlighting the transformative potential of community-university partnerships (PRIA, 2015).

Strengthening Multi-Stakeholder Collaboration

The SECURe Framework systematically addressed institutional fragmentation by fostering partnerships between municipal bodies (Ajmer Municipal Corporation [AMC], Public Health Engineering Department [PHED]), academic institutions (MDS University), and community organizations. Through stakeholder mapping and governance assessments, the framework identified power asymmetries and jurisdictional overlaps, such as conflicts between AMC and Ajmer Development Authority (ADA). These insights informed targeted interventions to streamline coordination, such as joint workshops and policy dialogues, ensuring alignment across sectors.

PRIA's CBR (Community based research) initiatives focus on strengthening citizen participation in governance. The Engaged Citizens, Responsive City (ECRC) project, for instance, utilized participatory settlement enumeration (PSE) to document infrastructure gaps, sanitation services, and social security entitlements in informal settlements across Ajmer, Jhansi, and Muzaffarpur. This process empowered urban poor communities by equipping them with community-owned data for engaging with government agencies and advocating for improved services (Nagpal C Bandyopadhyay, 2020). PRIA's model of CBR highlights the importance of decentralization, participatory planning, and grassroots-led monitoring, ensuring that research outcomes translate into concrete improvements in service delivery.

Contextual Analysis for Inclusive Engagement

Phase 1 of the project employed the SECURe Framework to conduct a comprehensive contextual analysis of Ajmer's informal settlements. Institutional mapping revealed bureaucratic inefficiencies, while cultural analysis highlighted how caste, gender, and migration status exacerbated vulnerabilities. For example, women from marginalized groups faced systemic barriers in accessing water services, despite their central role in household water management. By centering these findings, the framework ensured interventions addressed intersectional inequities, paving the way for inclusive governance reforms.

The biophysical assessment underscored climate risks like flooding and water scarcity, emphasizing the need for infrastructure upgrades. Crucially, the framework linked these challenges to governance gaps, advocating for community-led solutions such as nature-based drainage systems. This holistic approach ensured technical interventions were rooted in local knowledge and priorities.

Institutionalising Community-Led Governance

Phase 2 focused on institutionalizing partnerships and scaling interventions. The SECURe Framework facilitated the formal recognition of SHGs (Self-Help Groups) as key stakeholders in municipal planning, enabling their participation in AMC-led decision-making forums. Capacity-building initiatives, co-designed with MDS University, empowered SHGs to monitor water quality, map resources, and advocate for policy reforms. These efforts were bolstered by policy dialogues that translated community insights into actionable recommendations, such as Community led Water management and service delivery models.

PRIA's community-university partnerships are deeply embedded in its participatory research framework, which seeks to empower communities by integrating their lived experiences into research and policy processes. This approach not only challenges traditional hierarchies of knowledge production but also fosters equitable collaborations between higher education institutions and civil society organizations. One example of PRIA's work is its role in engaging universities in the Global South to incorporate CBR into curricula, ensuring that students and researchers actively participate in community-driven inquiries (Tandon C Hall, 2015).

In this context, partnerships were fostered between MDS University's Department of Environmental Science C Remote Sensing and women's Self-Help Groups (SHGs) and community members in informal settlements. The SECURe Framework played a critical role in strengthening collaborations with AMC, PHED, and academic institutions. Training sessions and policy dialogues were conducted to bridge institutional gaps, ensuring more effective engagement. Data and insights from Phase 1 informed concrete recommendations for improving Water Quality C services and institutionalizing community participation in decision-making processes.

Sustaining Impact through Ownership and Equity

The SECURe Framework's enduring legacy lies in its ability to foster community ownership and equitable partnerships. By positioning SHGs as leaders in water governance, the project dismantled traditional power hierarchies, enabling marginalized groups to hold institutions accountable. The 'Amrut Mitra'[3] initiative, for instance, institutionalized community monitoring, ensuring transparency in service delivery.

Local communities possess invaluable knowledge that can be leveraged to improve their own lives and contribute to broader societal change. As demonstrated in the Tanzanian experience, *"ordinary people used their knowledge and leadership to transform their lives"* (Tandon C Hall, 2014). When communities have a sense of ownership in the co-production process, it fosters trust and creates more space for meaningful collaboration.

Learning was also integral to capacity-building efforts. Reflecting Tandon's (1998) assertion that *"Learning is an integral component of organizing, and capacity building is essential for fostering a just and egalitarian society"* (p. 190), PRIA trained enumerators and SHG members in research and data collection, ensuring community-led evidence generation became a sustainable practice.

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[3] *AMRUT Mitra is a centrally sponsored program by the Ministry of Housing and Urban Affairs where urban Self-Help Group (SHG) women serve as water management professionals. As AMRUT Mitras, they handle water demand management, quality testing, infrastructure operations, and other water sector projects. This initiative aims to improve their socioeconomic status and quality of life.*

By championing community-based participatory research, engaged scholarship, and policy advocacy, PRIA has contributed to the institutionalization of CUE globally. Its work reinforces the importance of universities as sites of democratic knowledge production, emphasizing that knowledge should serve societal transformation rather than remain confined to academic institutions (Tandon C Hall, 2015). PRIA's participatory research model aligns with the University Grants Commission (UGC) Guidelines for Fostering Social Responsibility and Community Engagement in Higher Education Institutions in India 2.0, advocating for the integration of community engagement into teaching, research, and service as a core function of universities (UGC, 2022).

Key Outcomes of SECURe's Collaborative Approach:

- Empowered women-led SHGs as decision-makers in water governance.
- Strengthened institutional coordination through stakeholder mapping and joint initiatives.
- Integrated community-generated data into municipal planning.
- Bridged gaps between academia, policymakers, and grassroots actors.
- Institutionalized participatory mechanisms for sustained resilience.

Key Findings

Water Access & Infrastructure

- **Unequal piped water coverage:** Ranges from 0% in Ambedkar Colony to 99.3% in Chhoti Nagfani, yet supply remains highly erratic. For instance, 85.3% of households in Nausar Ghati report an inconsistent schedule.
- **High dependence on alternative sources:** In Ambedkar Colony, 75.8% of households rely on private tankers, while 90.5% in Banjara Basti depend on tankers during summer water shortages.
- **Severe infrastructure gaps:** Leakages, broken pipelines, and non-functional handpumps exacerbate the crisis. In Chhoti Nagfani, only 5 out of 14 handpumps are operational.

Water Quality & Health Risks

- **Chemical contamination:** Fluoride levels exceed 3 mg/L in Ambedkar Colony, Bairwa Basti, and Nausar Ghati, increasing the risk of fluorosis. Nausar Ghati also reports extreme water hardness in handpump source (1,180 ppm), affecting usability.
- **Bacteriological hazards:** Piped water in Gujjar ki Dharti has tested positive for **E. coli**, posing significant health risks.
- **Documented health impacts:** In Ambedkar Colony, 33.3% of respondents link water quality to cholera and skin allergies. In Bairwa Basti, 80% of complainants report illness due to poor water quality.

Gender & Social Inequities

- **Disproportionate burden on women:** Women are responsible for 90% of water collection, often facing physical exhaustion and safety concerns.
- **Limited community participation:** Despite advocacy by Self-Help Groups (SHGs) for WASH (Water, Sanitation, and Hygiene) improvements, women and marginalized groups remain excluded from decision-making processes.

Governance & Accountability Challenges

- **Ineffective grievance redressal:** 66.7% of respondents in Ambedkar Colony and 85.3% in Nausar Ghati report that their water-related complaints remain unaddressed.
- **Unfair billing practices:** In Bagadia Basti, 94.1% of residents are charged fixed tariffs despite non-functional water meters.

Climate Vulnerability & Seasonal Stress

- **Monsoon-related contamination:** 75.8% of households in Ambedkar Colony report increased turbidity during the rainy season, heightening health risks.
- **Summer water scarcity:** Extreme shortages force households to depend on expensive private tankers, further straining financial resources.

Intervention Rationale

Phase 1 (April- September 2024) of 'Piloting the Proposed Decision Support Framework (SECURe) with an Emphasis on GESI in the Indian Context', explored the challenges of urban resilience in informal settlements of Ajmer, Rajasthan, focusing on Wards 2 and 48.

The key findings highlight several challenges faced by informal settlements in Ajmer. WASH services are significantly deficient, with irregular water supply, poor sanitation infrastructure, and inadequate waste management systems. These shortcomings disproportionately affect women, who are primarily responsible for managing household water and sanitation. Despite their crucial roles, women's participation in governance and decision-making remains limited due to entrenched gender norms, as seen in Ward 48, where a female ward councillor's authority is undermined by patriarchal dynamics. Climate change further exacerbates these challenges, with erratic weather patterns worsening water scarcity and overwhelming the city's inadequate drainage systems, increasing the prevalence of waterborne diseases. Institutional barriers, such as jurisdictional conflicts between the Ajmer Municipal Corporation (AMC) and the Ajmer Development Authority (ADA), along with bureaucratic inefficiencies, delay WASH service delivery and leave residents vulnerable. Community-based organizations like Self-Help Groups (SHGs) play a vital role in advocating for better WASH services, yet their impact is limited due to the lack of formal recognition and integration into local governance structures.

The study employed a mixed-methods approach, utilizing participatory tools such as Transect Walks, Social and Resource Mapping, Venn Diagrams, Focus Group Discussions (FGDs), and Key Informant Interviews (KIIs). These methods enabled a comprehensive power analysis, revealing complex dynamics between formal institutions, community organizations, and marginalized groups.

The SECURe framework guided the analysis, providing valuable insights into stakeholder relationships and resource distribution. However, the study also identified areas for improvement in the framework, particularly in its adaptability to local contexts and integration of informal practices crucial for resilience-building.

Recommendations include formalizing the role of SHGs in local governance structures, addressing jurisdictional conflicts between AMC and ADA, enhancing women's participation in decision-making processes, and improving data collection methodologies. These steps are essential for developing more inclusive, effective, and sustainable WASH interventions in Ajmer's informal settlements.

Building on the implementation of phase 1 of the project during April- September 2024, phase 2 of the project from October 2024 to January 2025, emphasised on providing actionable insights through community-led research through participatory data collection and spatial mapping of water supply systems, engaging local communities through Self-Help Groups (SHGs), MDS

University, and Settlement Improvement Committees (SICs). The proposed intervention approach aims to create partnerships between SHGs and MDS University that can foster long-term engagement with AMC, ultimately improving water service delivery in informal settlements and showcase how these partnerships will help in mitigating power relations across various stakeholders.

The intervention aimed at formalising partnerships between SHGs, MDS University, and AMC, leveraging academic and community knowledge to influence policy and service delivery improvements. The MDS University, Ajmer has agreed to collaborate on this intervention and provided letter of support (Annexure 1) and similarly Ajmer Municipal Corporation (AMC) and National Urban Livelihood Mission (NULM) unit of AMC has agreed to provide all support and provided letters of support (Annexure 2 and 3).

The proposed intervention initiated with the following objectives:

Objectives

1. Data Collection on Water Access and Usage: To assess the current access to clean drinking water, usage patterns, and challenges faced by households in informal settlements of Ajmer.
2. Spatial Mapping of Water Supply Systems: To identify gaps and inefficiencies in the existing water infrastructure using participatory spatial mapping techniques.
3. Collaborative Engagement between SHGs and University: To foster collaboration between SHGs and MDS University for data collection, analysis, and advocacy.
4. Improved Service Delivery Recommendations for AMC: To provide data-driven recommendations to AMC for improved water services.

Selection of wards and informal settlements

The first phase focused on 2 informal settlements in two wards (2 and 48) of the AMC to understand the vulnerabilities related to WASH services. But in order to have more representative sample, additional 5 informal settlements were identified across another 3 wards. The selection of wards and settlements was based on a combination of criteria to ensure effective project implementation and representation of diverse urban resilience challenges. The selection process included:

- **Existing Vulnerabilities:** Areas with significant water scarcity, poor drainage, and sanitation issues were prioritized.
- **Community Willingness:** Informal settlements where residents showed interest and active participation in past community-driven initiatives.
- **Municipal Inputs:** Consultation with AMC officials (NULM, AMRUT, and SBM) to identify under-served settlements.
- **Geographical Spread:** Ensuring a mix of settlements from different zones to capture a wide range of urban challenges.
- **Previous Engagements:** Settlements where PRIA had previous collaborations with SHGs and community groups were considered for leveraging existing relationships.

Based on these criteria, 7 informal settlements across 5 wards (1, 2, 7, 18, and 48) were selected for the study. A series of meetings were conducted with government officials, academic institutions, and community representatives. The discussions focused on integrating their perspectives into the next project phase. Further FGDs were conducted in the selected informal settlements in these wards and key vulnerabilities were mapped in water supply, sanitation, and waste management. Further discussions with community members and AMC officials has further guided us to narrow down our focus on water security challenges in these informal settlements. After narrowed down on the issue of water, separate FGDs were conducted with SHG members and community representatives. Discussion's themes included water accessibility, infrastructure gaps, and governance challenges and identification of gender-specific concerns, particularly regarding water security and safety concerns for women. To ensure a data-driven approach, the project implementation involved students and faculty from the Department of Environmental Sciences and Remote Sensing of MDS University and one day orientation session was organised at the University on need for community led source mapping and water quality testing. During the session, selection of students for further engagement in field activities and survey data collection was also undertaken.

Training workshop on Household Survey and Water Quality Testing

The training workshop on household survey and water quality testing was organised from 19th - 22nd December 2024 at Department of Environmental Sciences, MDS University, Ajmer. The workshop is jointly organised by MDS University, Ajmer Municipal Corporation and PRIA. The key objectives of the workshop are:

1. To empower SHG women with technical skills in water quality testing and data collection.
2. Foster collaboration between communities, students, and municipal officials.
3. Develop actionable insights and methodologies for improving urban water services.

The workshop focused on bridging knowledge gaps between technical experts and local communities. The importance of structured fieldwork, methodological rigor, and climate resilience in water security planning was highlighted. A collaborative effort among AMC, PHED, and MDS University was introduced as a model for inclusive urban development.

Technical sessions and practical training was imparted to participants and they learned about water availability, access and infrastructure and the impact of climate change on informal settlements. Hands-on demonstrations using portable water quality testing kits helped participants assess pH, turbidity, hardness, fluoride, and nitrate levels, reinforcing the need for regular monitoring and safe drinking water practices. Field exercises were demonstrated to identifying and documenting water sources in informal settlements, highlighting gaps in access and quality. During the fieldwork participants conducted water sample collection from different piped and non-piped water sources, following proper protocols. Thereafter, household surveys were introduced to capture social and technical data, ensuring ethical data collection. Training on mobile applications for digital data collection improved participants' ability to collect data.

The workshop highlighted the mutual learning process between students and SHG women. Participants acknowledged the importance of integrating local knowledge with scientific expertise to create actionable solutions for urban WASH challenges.

Mapping of Water Sources in Informal Settlements

Using participatory spatial mapping (involving students, SHGs, and community members) mapping of water sources (both piped and non-piped) was conducted in all identified informal settlements across 7 wards.

Methodology

Remote sensing data is obtained using Google Earth Pro, Boundary .shp file (https://onlinemaps.surveyofindia.gov.in/) and Map Locus. Further, supplementary data is obtained on-ground through coordinates points plotted using the Locus map mobile app and GPS map camera. QGIS and Google Earth Pro software is used for plotting the settlement boundary and water sources.

Ward number 1 - Ambedkar colony

Ambedkar Colony is located in North-west of Ajmer city at 26°28'N latitude and 74°35'E longitude. The settlement has hilly terrain.

Image 1- Location of Ambedkar Colony settlement in Ward number 1,

In this settlement there is no piped water supply and there is only one functional hand pump and people are dependent on private water tankers for their daily water needs. Few households get drinking water from a standpost located in Nausar Ghati which is approximately 1.5 Kms from Ambedkar colony.

Image 2- Location of handpump in Ambedkar Colony, Ward number 1, Ajmer

Ward number 1 – Nausar Ghati

Nausar Ghati is located in North-West of Ajmer city at 26°29'N latitude and 74°36' E longitude. The settlement has hilly terrain.

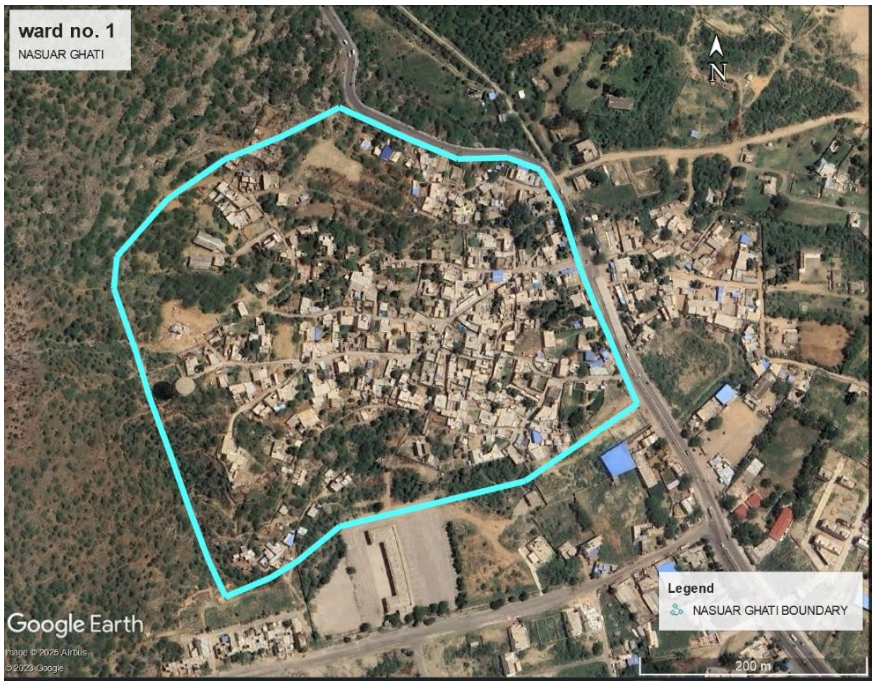

Image 3- Location of Nausar Ghati settlement in Ward number 1, Ajmer

There is a piped water supply in Nausar Ghati sourced through overhead water tank. Piped water is the major source of drinking water for the households in this settlement. Besides, there are two functional handpumps in the settlement, which are used for meeting water requirements of few households for other purposes.

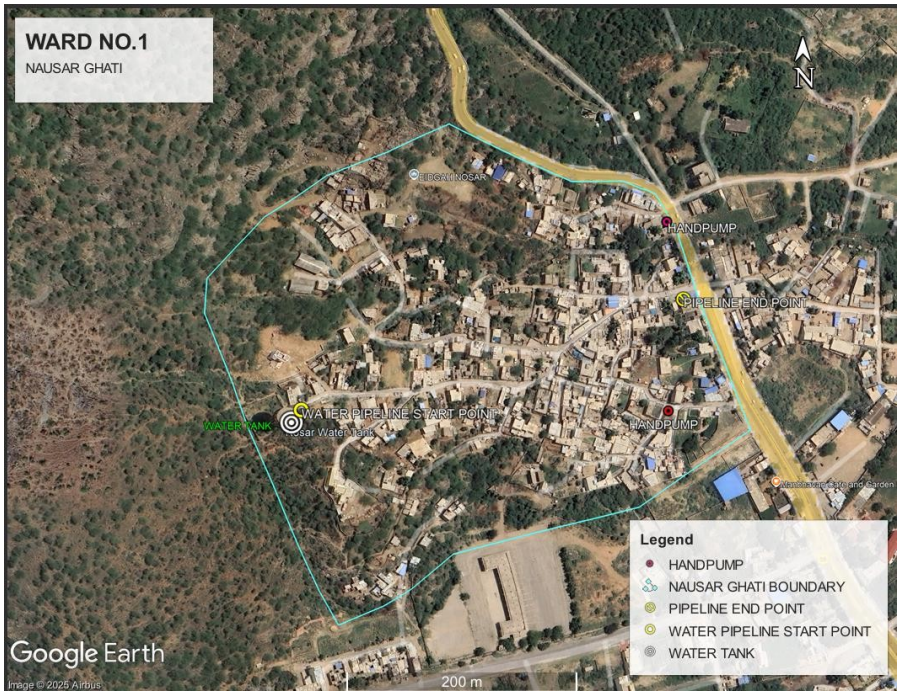

Image 4- Location of water sources in Nausar Ghati, Ward number 1, Ajmer

Ward number 2- Berwa Basti (settlement)

Bairwa Basti is located in North-East of Ajmer city at 26°477'N latitude and 74°606' E longitude.

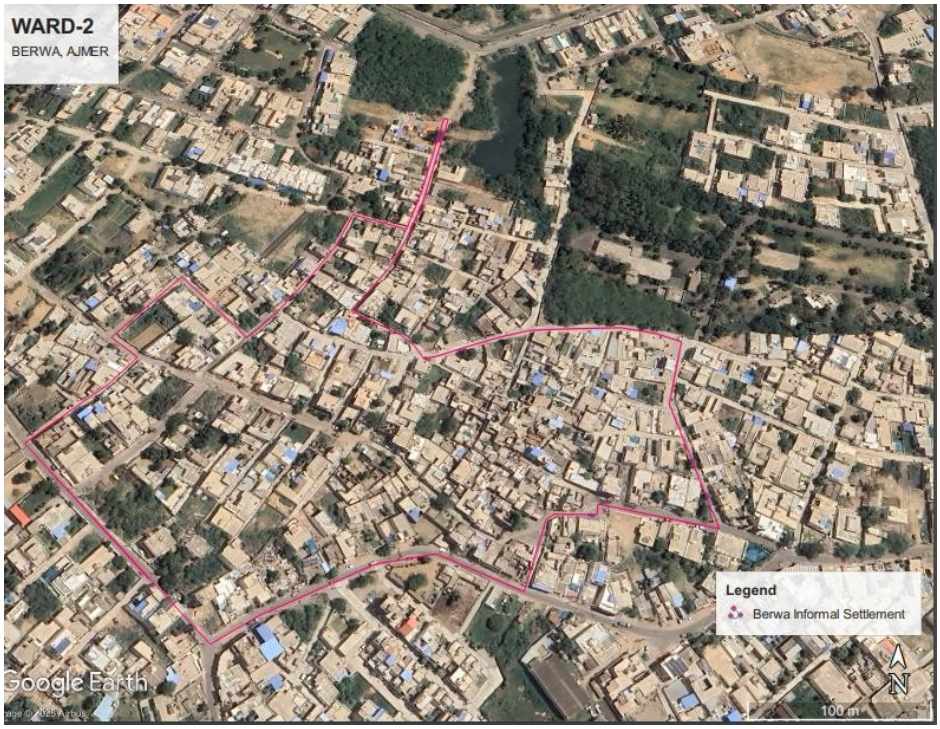

Image 5- Location of Bairwa Basti settlement in Ward number 2, Ajmer

A total of 4 types of water sources were identified in Bairwa Basti other than the piped water connections sourced through one overhead tank located in the settlement. The non- piped water sources include 10 Handpumps, out of which 8 are functional and 2 are not functional. There are 2 functional standposts, but residents reported that these are taken over by households where these are located and they do not allow other households to get water from these standposts. Besides there is one private boring in the settlement. In addition to this many households in the settlement are also dependent on private water tankers during the scarcity of water specially during summer months. But residents also reported that water supplied by private water tankers is of poor quality.

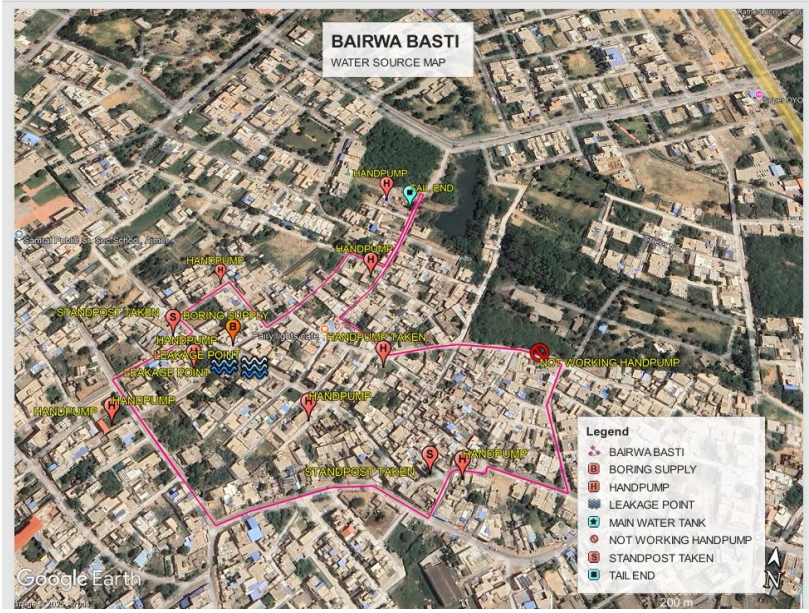

Image c- Location of water sources in Bairwa Basti, Ward number 2,

Ward number 2- Banjara Basti (settlement)

Banjara Basti is located in North-West of Ajmer city at 26°478'N latitude and 74°603' E longitude.

Image 7- Location of Banjara Basti settlement in Ward number 2 Ajmer

In Banjara Basti majority of the households have piped water connections sourced through overhead tank located near the settlement. During the mapping process it was observed that many pipelines were going through drains which affected water quality. Further, leakages were found at certain points results in wastage of water and water logging around the leakage points. Most residents complained about it. The newly developed lanes in the Banjara Basti settlement do not have pipeline connections. Besides, the settlement has 2 handpumps, out of which one is functional and one is non- functional. There is also one functional boring connection done by the municipality and many nearby households are dependent on it. But the area around the municipal boring is very slippery, and a puddle is formed, making it difficult to get water from there. There is also one well, which is privately owned but not functional. Residents reported that in the past when well is functional, many households use its water. During summer months, many residents are dependent on private water tankers because of the scarcity of water.

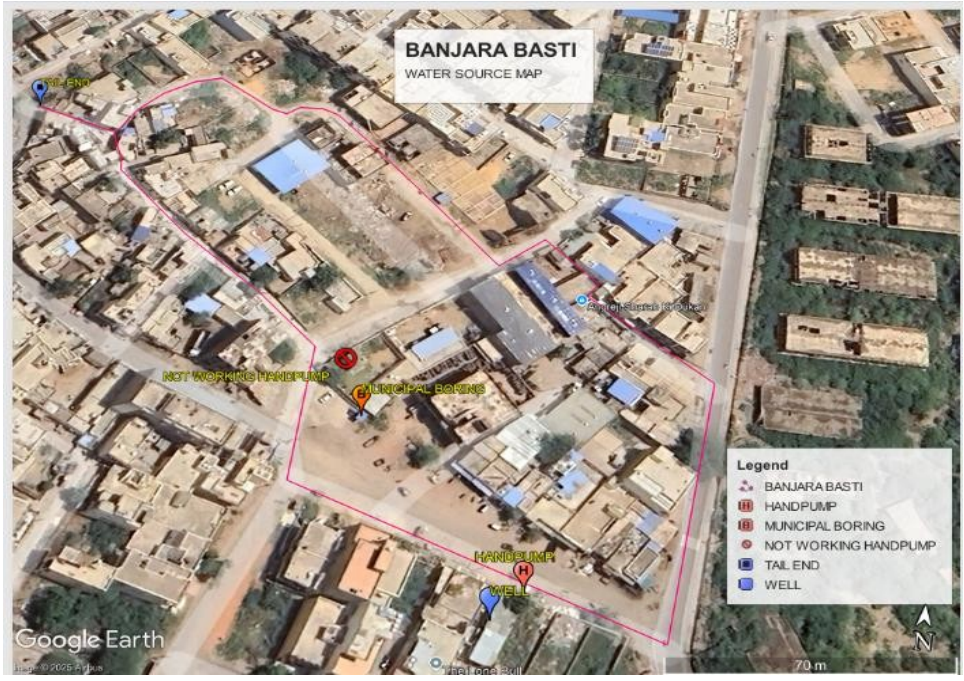

Image 8- Location of water sources in Banjara Basti, Ward number 2, Ajmer

Ward number 7- Chhoti Nagfani settlement

Chhoti Nagfani is located in North-West of Ajmer city at 26°46'N latitude and 74°61' E longitude.

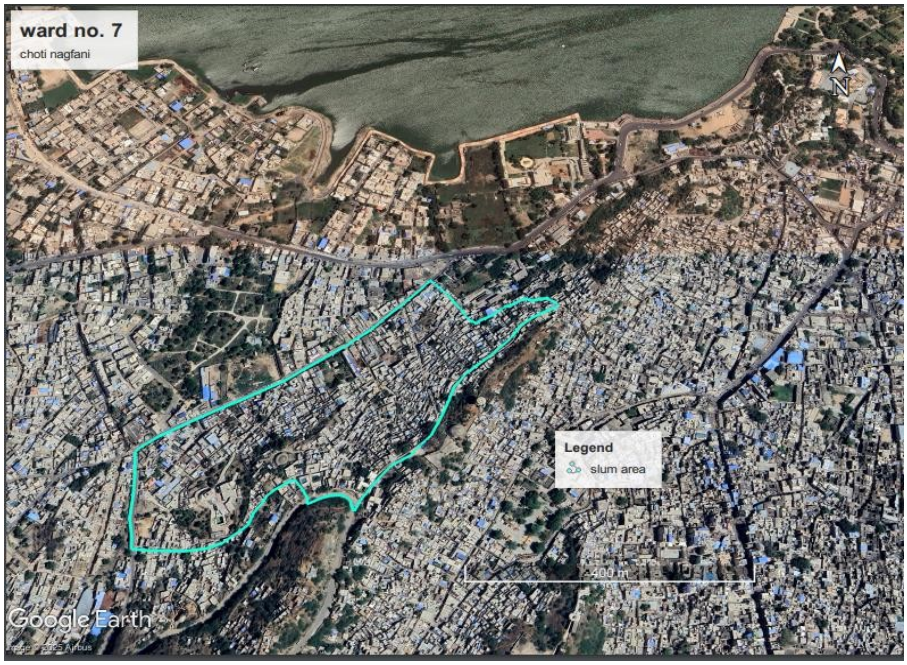

Image S- Location of Chhoti Nagfani settlement in Ward number 7, Ajmer

Chhoti Nagfani is located on the hilly area and majority of the households have piped water connections sourced through overhead tank located over the Nagfani hill. Many residents in the lower part of the settlement reported that the water pressure is very low and residents in the upper area of the settlement does not allow new pipelines from the overhead tank to lower areas of the settlement. But many households in the upper area also reported low water pressure in the taps. The settlement has 14 handpumps, out of which nine are functional and five are non-functional. Residents reported low pressure of water in the functional handpumps. There are 10 private functional boring connections. There are 4 standposts, out of these 3 are non-functional. Besides there is one functional municipal tubewell. Few households are dependent on it for

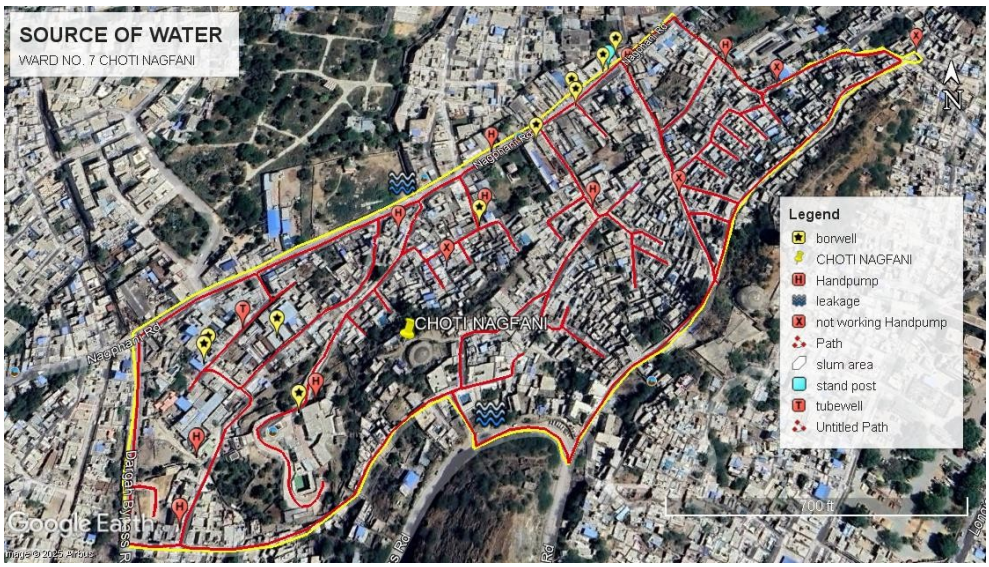

Image 10- Location of water sources in Chhoti Nagfani, Ward number 7, Ajmer

washing of clothes etc. During summer months, many residents are dependent on private water tankers because of the scarcity of water.

Ward number 18- Bagdi Basti settlement

Bagdi Basti is located in North-West of Ajmer city at 26°46'N latitude and 74°61' E longitude.

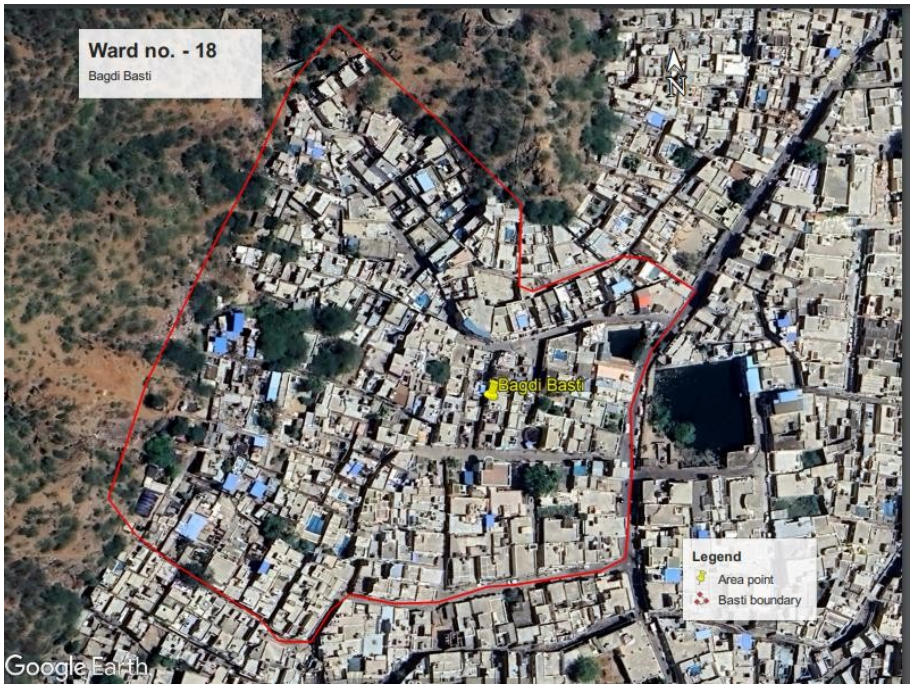

Image 11- Location of Bagadi Basti settlement in Ward number 18, Ajmer

The majority of households in Bagdi Basti have piped water connections sourced through two pipelines - one old and one new. The settlement has 8 handpumps, five of which are functional, while three are non-functional. Additionally, there are 9 private functional borewell connections. There are also five functional standposts. Furthermore, the settlement has one well and one stepwell. The well contains water but is no longer in use. However, residents reported that a few years ago, many households, especially during the summer months, relied on this well for drinking water. The stepwell also contains water but is in a dirty condition. Residents reported that the water in the stepwell has medicinal properties, attracting people with skin infections from different parts of the country who come here to bathe. During summer months, many residents are dependent on private water tankers because of the scarcity of water.

Image 12- Location of water sources in Bagdi Basti, Ward number 18, Ajmer

Ward number 48- Gujjar Ki Dharti settlement

Gujjar Ki Dharti is located in North-West of Ajmer city at 26°46'N latitude and 74°61' E longitude.

Image 13- Location of Gujjar Ki Dharti settlement in Ward number 48,

The majority of households in Gujjar Ki Dharti have piped water connections sourced from an overhead tank. Mapping of the piped water supply identified five leakage points. The settlement has 7 handpumps, all of which are functional, but residents reported issues with contaminated

water supply and very low water pressure. Additionally, there are two functional borewell connections. There are six standposts, three of which are functional and three non-functional. However, even the functional standposts are surrounded by sewage drainage and dirty water. Furthermore, the settlement has one well, which contains water, but the water level is very low, and it is no longer in use. There is also an on-site water tank installed by the Municipal Corporation, but it is in poor condition. During the summer months, many residents rely on private water tankers due to water scarcity.

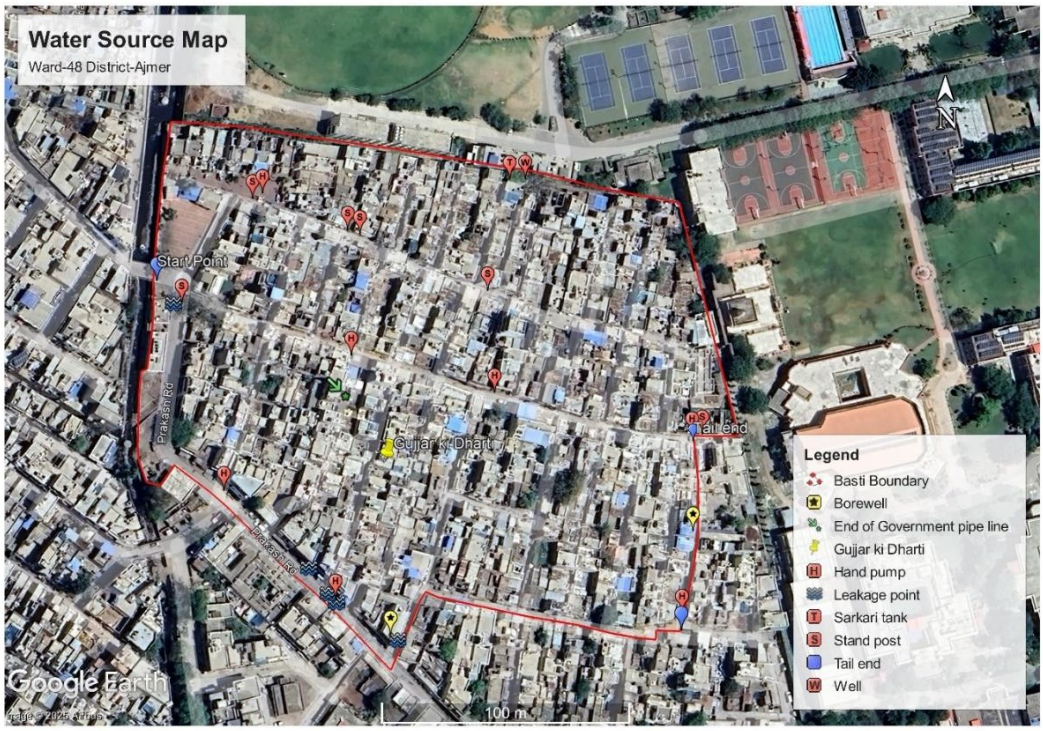

Image 14- Location of water sources in Gujjar Ki Dharti, Ward number 48, Ajmer

Household Survey and Water Quality Testing

Household Survey

To assess water access and usage patterns and quality across households (HH) receiving piped water supply and those dependent on alternative water sources (e.g., water tankers, public standposts, hand pumps) in selected informal settlements of Ajmer. Seven informal settlements, chosen for their varied socio-economic conditions, infrastructure challenges, and reliance on different water sources. Households within the study area, is divided into two main groups: i) Households with piped water supply and ii) Households without piped water connections but dependent on alternative water sources like water tankers, public standposts, hand pumps, etc. and Stratified Sampling method is used for the survey. Further, Systematic sampling is applied using a skip interval to ensure equal representation across the settlement.

For each stratum, households are surveyed at regular intervals based on the population size of the informal settlement and the desired sample size.

Sampling Procedure

Sample Size for each Informal settlement

For example, in case there are 400 HHs in a settlement the following sampling strategy is applied:

Systematic Sampling

Step 1: List of HHs in each informal settlement will be created.

Step 2: Determining the skip interval.

Household selection utilises the right-hand technique, in which the first house is selected at the pre-identified entry point of the settlement. Beginning from a first house of the sampling unit, the skip interval is followed by moving right, with every next house as per the skip interval in the direction being selected. For example, if one lane was being surveyed, then households on the right would be sampled first. Once the entire right-hand side has been completed, enumerators would start covering households from the end of the left side of the lane, which now lies on their right-hand side. In case a particular house cannot be surveyed, the next house is selected. This process is simple to follow and allows for a systematic sampling across the settlement.

Enumerators visited the households as per the above criteria to conduct survey using structured questionnaire divided into sections presented in figure 15 and collected household data using Kobo Collect Mobile application.

Figure 15: Various Sections in the Survey Questionnaire

Registration form	- Ward and Settlement Selection - Date and Time of Survey - GPS coordinates - Classification of Settlement - Consent of conducting survey
Basic Household and respondent's Information	- Basic details including name, age and gender of the respondent - Type of house - Type of ration card to identify economic status of the household - Ownership status of the house
Access and Usage of water supply for drinking and other purposes	- Source of drinking water - Source of water for other purposes - Access to the sources for drinking water - Access to the sources of water for other purposes - Scarcity of water during different seasons and alternative sources - Timing and usage of water supply through piped water
Billing of piped water supply	- Water meter - Billing cycle, water bills and payment options
Public piped water supply	- Access and timing - Time to get water from such sources - Quality of water
Other sources during scarcity of water	- Access to alternative sources - Water Storage during scarcity
Treatment of water	- Perception on water quality in terms of taste, colour, smell during different seasons - Methods of treatment used
Impact of Water logging during rainy season on sources of water	- Impact of water logging on the quality of water - Methods of treatment used
Seasonal Water usage	- Changes in consumption pattern of water during different seasons
Impact of water quality on health	- Perception about impact of water quality on health - Experience of water borne diseases
Grievance redressal	- Experience of lodging complaint related to water supply - Type and mode of complaint - Whether grievance redressed and time taken
Satisfaction level of water supply through government sources	- Whether satisfied or not? - What needs to be changed
Perception on water supply in and around respondent's HH	- Water pressure, timing etc - Water supply pipeline infrastructure
Conclusion	- Suggestions for improvement of water supply services - Whether respondents want to engage with municipal corporation in future - Photo capture

Survey Findings

Table 1- Settlement wise sample households for survey in Informal Settlements of Ajmer

Name of the informal settlement	Ward number	Total number of Households^	Sample households	Percent of total households*
Ambedkar Colony	1	200	33	17
Nausar Ghati	1	400	82	21
Bairwa Basti	2	400	90	23
Banjara Basti	2	70	21	30
Chhoti Nagfani	7	900	150	17
Bagadia Basti	18	400	76	19
Gujjar ki Dharti	48	600	102	17

**The percentage of sample households varies to cover the population using various sources of water and also due to buffer taking during survey in order to avoid incorrect responses*
^Voter list taken from the Ward councilor/ Anganwadi (ICDS)Data)

Understanding the spatial distribution of surveyed households helps identify patterns in water access and service gaps across different settlements in Ajmer. The selected areas reflect diverse infrastructural conditions, ranging from relatively well-serviced localities to those relying on informal water supply mechanisms.

In the surveyed 7 settlements across five wards, 554 households wer

e studied to ensure diverse representation:

- Banjara Basti had the highest sample representation (30%), reflecting its severe water access challenges.
- Bairwa Basti (23%) and Nausar Ghati (21%) were selected due to their dependency on alternative water sources.

- Ambedkar Colony, Chhoti Nagfani, and Gujjar ki Dharti (17% each) presented unique challenges, such as heavy reliance on standposts and tanker water.

This variation in sampling allows for a detailed understanding of localized water shortages and coping mechanisms.

Table 2- Major source of drinking water for the sample households in Informal Settlements of Ajmer

(Percentages)

Name of the informal settlement	Piped water Supply	Hand Pump	Private Tanker	Standpost	From Neighbours	On site Tank
Amberdkar Colony	0.0	9.1	39.4	42.4*	9.1	0.0
Nausar Ghati	91.5	0.0	0.0	0.0	8.5	0.0
Bairwa Basti	95.6	0.0	3.3	0.0	1.1	0.0
Banjara Basti	95.2	0.0	4.8	0.0	0.0	0.0
Chhoti Nagfani	99.3	0.0	0.0	0.0	0.0	0.7
Bagadia Basti	93.4	0.0	1.3	5.3	0.0	0.0
Gujjar ki Dharti	95.1	0.0	0.0	3.9	1.0	0.0

**These respondents get drinking water from Municipal Standpost of the Nausar Overhead water tank located around 1.5 Kms from the settlement*

While piped water connections exist in some settlements, supply remains erratic and unreliable. In many cases, households receive water only for a limited time during the day, forcing them to store water in containers. In settlements lacking household connections, residents depend on standposts, private tankers, or even borrow water from neighbours.

In the surveyed settlements across five wards, piped water supply as the primary drinking source was highly uneven:

- Chhoti Nagfani (99.3%), Bairwa Basti (95.6%), and Banjara Basti (95.2%) had almost universal piped water access.
- Ambedkar Colony had no direct piped water supply. Instead, residents relied on municipal standposts[1] (42.4%) and private tankers (39.4%).

A woman respondent from the Ambedkar colony highlighted the issue of carrying heavy buckets, stating, "Mujhe kamar dukhne lagti hai, magar paani bharna hi padta hai kyunki ghar mein pipe connection nahi hai." (My back hurts, but I have to fetch water because there is no piped connection/Tap at home.)

- Nausar Ghati (91.5%) had piped water, but 8.5% of households still borrowed water from neighbours.
- Chhoti nagfani and Bagdi Basti suffers from severe water pressure issues, particularly in higher elevations. Households on the upper floors receive little to no water.

A resident from this area stated, "Hamare yahaan chadhai par paani ki bahut samasya hai. Pani ka pressure badhaya jaye." (We have a lot of water problems in the uphill area. The water pressure should be increased.)

The unequal distribution of piped water forces residents to seek expensive and unreliable alternatives, disproportionately affecting low-income households.

Table 3- Major source of water for other than drinking purposes for the sample households in Informal Settlements of Ajmer

(Percentages)

Name of the informal settlement	Piped water Supply	Hand Pump	Private Tanker	Standpost	From Neighbours	On site Tank	Boring
Ambedkar Colony	0.0	21.2	75.8	0.0	3.0	0.0	0.0
Nausar Ghati	46.3	1.2	37.8	2.4	12.2	0.0	0.0
Bairwa Basti	40.0	18.9	35.6	0.0	1.1	0.0	4.4
Banjara Basti	28.6	14.3	47.6	0.0	4.8	0.0	4.8
Chhoti Nagfani	81.3	6.7	2.7	0.7	4.0	0.7	2.7
Bagadia Basti	73.7	10.5	2.6	7.9	2.6	0.0	2.6
Gujjar ki Dharti	63.7	27.5	2.0	2.9	0.0	1.0	2.0

Apart from drinking, households require water for bathing, cooking, and washing. However, due to irregular piped supply, many families must rely on additional sources such as hand pumps and private tankers. This dependence increases household expenditure and exposes families to waterborne diseases due to variable water quality.

In the surveyed settlements across 5 wards (1,2,7,18 C 48), multiple sources were used for non-drinking water needs:

- Ambedkar Colony (75.8%) and Nausar Ghati (37.8%) were heavily dependent on private tankers.
- Bairwa Basti (35.6%) and Gujjar ki Dharti (27.5%) still used hand pumps as a supplementary source.
- Despite piped water availability, households continued to seek additional sources, indicating insufficient supply and storage capacity.
- In numerous settlements, women respondents highlighted significant challenges with their water supply. They reported struggling with both irregular service and insufficient water pressure. The situation is particularly dire for some residents who only receive water every third day, severely impacting their ability to carry out essential household tasks.

One resident expressed her frustration, saying "Paani itna kam aata hai ki sabhi gharon mein poori supply nahi hoti. Hamein doosre ilake se paani bharna padta hai" (Water comes in such low quantity that not all houses get enough supply. We have to fetch water from another locality).

Another woman shared her concerns about seasonal variations in water availability, noting "Garmi me to paani ki jyada jarurat hoti hai, par usi samay paani ki supply kam hoti hai. Hume thand ke mausam ke jayad jarurat nhi hai, kaam chal jata hai par garmi ke mausam me jab jarurta jyada hoti hai to wahan supply sahi se nahi hoti hai" (In summer there is more need of water, but at the same time the supply of water is less. We don't need as much in the cold season and can manage, but during summer when the need is greater, the supply isn't adequate).

The high reliance on private tankers makes residents vulnerable to price hikes and service delays, exacerbating their water insecurity.

Table 4- Sample households' facing water shortage during summer months and Major source of drinking water in Informal Settlements of Ajmer

(Percentages)

Name of the informal settlement	Yes	No	Main source of water during scarcity							
			Piped water Supply	Hand Pump	Private Tanker	Standpost	From Neighbours	On site Tank	Bottled Water	Boring
Ambedkar Colony	100.0	0.0	0.0	18.2	45.5	0.0	33.3	0.0	3.0	0.0
Nausar Ghati	100.0	0.0	34.1	2.4	28.0	2.4	31.7	1.2	0.0	0.0
Bairwa Basti	95.6	4.4	23.3	9.3	48.8	1.2	4.7	0.0	8.1	4.7
Banjara Basti	100.0	0.0	33.3	4.8	52.4	0.0	4.8	4.8	0.0	0.0
Chhoti Nagfani	92.7	7.3	46.0	23.7	8.6	3.6	13.7	0.7	1.4	2.2
Bagadia Basti	89.5	10.5	26.5	52.9	8.8	2.9	4.4	0.0	1.5	2.9
Gujjar ki Dharti	95.1	4.9	61.9	24.7	2.1	6.2	3.1	1.0	1.0	0.0

Water scarcity intensifies in the summer months, with many households struggling to secure adequate drinking water. This seasonal challenge forces residents to depend on multiple sources, including private tankers, hand pumps, and neighbours.

In the surveyed settlements across seven informal settlements:

- 100% of households in Ambedkar Colony, Nausar Ghati, and Banjara Basti reported facing water shortages during summer.
- Gujjar ki Dharti (61.9%) and Chhoti Nagfani (46.0%) relied on piped water during scarcity.
- Private tankers played a significant role in water supply in Bairwa Basti (48.8%) and Ambedkar Colony (45.5%).

The widespread summer water shortages highlight the precariousness of existing water infrastructure, leaving residents in a constant struggle for basic needs.

Table 5- Availability of water through piped water supply in Informal Settlements of Ajmer

(Percentages)

Informal settlement	HHs	Frequency (days/ week)				Duration of water supply/ day				
		Once	Twice	Thrice	Four times	Less than 30 mins	30 mins	45 mins	60 mins	More than 60 mins
Nausar Ghati	75	0.0	53.3	41.3	5.3	6.7	42.7	29.3	14.7	6.7
Bairwa Basti	86	2.3	41.9	51.2	4.7	2.3	25.6	25.6	44.2	2.3
Banjara Basti	20	5.0	40.0	55.0	0.0	5.0	10.0	25.0	55.0	5.0
Chhoti Nagfani	149	1.3	19.5	75.2	4.0	0.0	8.1	4.7	87.2	0.0
Bagadia Basti	71	0.0	1.4	97.2	1.4	0.0	4.2	12.7	80.3	2.8
Gujjar ki Dharti	97	0.0	6.2	61.9	32.0	2.1	5.2	24.7	68.0	0.0

Access to piped water varies not only across settlements but also in terms of frequency and duration. Households receiving piped water often face irregular supply, making it difficult to manage daily water needs.

In the surveyed settlements:

- Bagadia Basti (97.2%) and Chhoti Nagfani (75.2%) had the most frequent supply, receiving water thrice a week.
- Bairwa Basti (44.2%) and Banjara Basti (55.0%) had longer durations of water supply, exceeding 60 minutes per day.
- Nausar Ghati had the most inconsistent supply, with 53.3% receiving water only twice a week and 42.7% receiving it for only 30 minutes.

The limited and inconsistent supply of piped water forces households to store water, increasing risks of contamination and waterborne diseases.

Table 6- Sufficiency of supplied water as per the requirements of the households in information settlements of Ajmer

(Percentages)

Informal settlement	Yes	No
Nausar Ghati	38.7	61.3
Bairwa Basti	15.1	84.9
Banjara Basti	40.0	60.0
Chhoti Nagfani	65.8	34.2
Bagadia Basti	60.6	39.4
Gujjar ki Dharti	53.6	46.4

Despite access to piped water, many households do not receive a sufficient amount to meet their daily needs. This inadequacy is compounded by erratic supply schedules and increasing demand. In the surveyed informal settlements:

- Chhoti Nagfani (65.8%), Bagadia Basti (60.6%), and Gujjar ki Dharti (53.6%) had the highest percentage of households reporting sufficient supply.
- Bairwa Basti (84.9%) and Nausar Ghati (61.3%) reported significant dissatisfaction with supply sufficiency.

These disparities underscore the inefficiencies in water distribution, with certain settlements struggling to secure enough water despite having piped connections.

Table 7- Water supply as per the timetable and convenience of water supply in Informal Settlements of Ajmer

(Percentages)

Informal settlement	HHs	Water supply as per timetable			Timing of water supply		
		Always	Occasionally	Never	Very convenient	Somewhat convenient	Not at all Convenient
Nausar Ghati	75	1.3	13.3	85.3	1.3	49.3	49.3
Bairwa Basti	86	3.5	46.5	50.0	3.5	72.1	24.4
Banjara Basti	20	0.0	70.0	30.0	0.0	90.0	10.0
Chhoti Nagfani	149	16.1	45.6	38.3	11.4	56.4	32,2
Bagadia Basti	71	18.3	70.4	11.3	22.5	63.4	14.1
Gujjar ki Dharti	97	49.5	50.5	0.0	52.6	44.3	3.1

Timely and reliable water supply is critical for household routines, yet many settlements experience unpredictable access, disrupting daily life. In the surveyed informal settlements:

- Gujjar ki Dharti (49.5%) was the only settlement where nearly half the households received water as per the timetable.
- Nausar Ghati (85.3%) and Bairwa Basti (50.0%) reported that water supply never followed a schedule.
- Banjara Basti (90.0%) and Bairwa Basti (72.1%) found their water supply timing inconvenient.

Unpredictable supply patterns force households to adjust their routines, disproportionately affecting women, who bear the responsibility of water collection.

Table 8: Metering and billing of piped water supply in informal settlements of Ajmer

(Percentages)

Parameters	Informal Settlement					
	Nausar Ghati	Bairwa Basti	Banjara Basti	Chhoti Nagfani	Bagadia Basti	Gujjar ki Dharti
Water Meter						
a) Yes, Functional	80.0	70.9	70.0	83.2	43.7	77.3
b) Yes, Not functional	2.7	7.0	25.0	4.0	25.4	9.3
c) No meter	13.3	18.6	5.0	10.1	31.0	13.4
d) Don't know	4.0	3.5	0.0	2.7	0.0	0.0
Water Bill						
a) Yes, receiving	86.7	93.0	95.0	86.6	95.8	94.8
b) Not receiving	9.3	4.7	0.0	10.1	1.4	5.2
c) Don't know	4.0	2.3	5.0	3.4	2.8	0.0
Billing frequency						

a) Monthly	24.6	33.8	57.9	40.3	25.0	35.9
b) Once in 2 months	69.2	62.5	42.1	46.5	70.6	64.1
c) Once in 3 months	1.5	2.5	0.0	3.9	1.5	0.0
d) Half yearly	1.5	0.0	0.0	7.0	1.5	0.0
e) Yearly	3.1	1.3	0.0	2.3	1.5	0.0
Billing Interval convenience						
a) Yes, Convenient	86.2	90.0	78.9	78.3	92.6	100.0
b) Not convenient	13.8	10.0	21.1	21.7	7.4	0.0
Bill calculation						
a) As per meter reading	3.1	45.0	47.4	4.7	4.4	19.6
b) Fixed amount	86.2	50.0	52.6	89.1	94.1	71.7
c) Don't know	10.8	5.0	0.0	6.2	1.5	8.7

Water metering and billing practices play a crucial role in water conservation and equitable access, yet inconsistencies exist across settlements.

- Functional water meters were most common in Chhoti Nagfani (83.2%) and Nausar Ghati (80.0%), while Bagadia Basti had the lowest (43.7%).
- Water bills were widely received, with over 90% of households in most settlements paying regularly.
- Billing frequency varied, with most households receiving bills every two months, though some settlements had fixed annual charges.
- Bairwa Basti (45.0%) and Banjara Basti (47.4%) had higher reliance on meter-based billing, while Bagadia Basti (94.1%) followed a fixed rate system.

These variations indicate the need for better transparency in water billing, ensuring fair pricing and reducing financial burdens on low-income households.

Table G: Frequency of dirty water supplied during last 3 months in informal settlements of Ajmer

Percentages

Informal settlement	Always	Less than 3 times	More than 3 times	Never
Ambedkar colony	18.2	30.3	12.1	39.4
Nausar Ghati	3.7	47.6	13.4	35.4
Bairwa Basti	0.0	33.3	52.2	14.4
Banjara Basti	4.8	66.7	23.8	4.8
Chhoti Nagfani	4.0	37.3	16.0	42.7
Bagadia Basti	2.6	42.1	18.4	36.8
Gujjar ki Dharti	1.0	62.7	18.6	17.6

Water quality remains a significant concern, with many households receiving dirty water multiple times within a three-month period. Contaminated water increases health risks, particularly for children and elderly residents.

- Ambedkar Colony (18.2%) and Bairwa Basti (52.2%) reported frequent instances of dirty water.
- Gujjar ki Dharti (62.7%) and Banjara Basti (66.7%) reported receiving dirty water at least three times in the past three months.
- Chhoti Nagfani (42.7%) and Nausar Ghati (35.4%) had a relatively lower frequency of contamination.

The recurring supply of contaminated water highlights systemic infrastructure failures, requiring urgent interventions to ensure safe drinking water access.

Table 10: Alternative sources of drinking water during scarcity in informal settlements of Ajmer

(Percentages)

Name of the informal settlement	Handpump	Private tanker	Standpost	Neighbours	Bottled water	On site tank	Boring water
Ambedkar Colony	36.4	75.8	21.2*	12.1	6.1	0.0	0.0
Nausar Ghati	3.7	41.5	13.4	59.8	1.2	0.0	0.0
Bairwa Basti	23.3	68.9	0.0	36.7	36.7	0.0	8.9
Banjara Basti	9.5	90.5	0.0	42.9	33.3	0.0	4.8
Chhoti Nagfani	40.7	20.0	13.3	38.0	4.7	4.0	12.0
Bagadia Basti	75.0	21.1	21.1	25.0	6.6	0.0	6.6
Gujjar ki Dharti	49.0	3.9	19.6	19.6	19.6	2.0	3.9

**These respondents get drinking water from Municipal Standpost of the Nausar Overhead water tank located around 1.5 Kms from the settlement*

In the surveyed seven informal settlements of Ajmer, access to water remains a persistent challenge, forcing households to rely on multiple alternative sources. The data reveal a significant dependence on private water tankers, particularly in Banjara Basti (90.5%), Ambedkar Colony (75.8%), and Bairwa Basti (68.9%). This reliance reflects the inadequacy of piped water supply and the financial burden imposed on low-income households. In contrast, Gujjar ki Dharti shows minimal use of private tankers (3.9%), likely due to the availability of alternative groundwater sources. Handpumps and municipal standposts also play a crucial role, with Bagadia Basti (75.0%) and Chhoti Nagfani (40.7%) reporting high usage of handpumps, while standposts are a key source in Ambedkar Colony (21.2%) and Gujjar ki Dharti (19.6%).

As one resident aptly stated, "Humaare paas koi option nahi hai paani ka, aur paani jaruri hai, to jo bhi kamaate hai usme se jyada paani par hi kharch kar dete hai." ("We have no option when it comes to water, and since it is essential, we end up spending most of our earnings on it.")

Another striking trend is the dependence on neighbours for drinking water, particularly in Nausar Ghati, where 59.8% of households borrow water. In many cases, families are compelled to purchase bottled water, with its usage being most notable in Bairwa Basti (36.7%) and Banjara Basti (33.3%), reflecting concerns over water quality. On-site tanks are rare, with only Chhoti Nagfani (4.0%) reporting their presence, and boring water is used sparingly in Bairwa Basti (8.9%) and Chhoti Nagfani (12.0%). These findings underscore the inequities in water access and highlight the precarious situation of many households, who are forced to spend a significant portion of their earnings on water.

Table 11: Water storage practices during scarcity in informal settlements of Ajmer

(Percentages)

Name of the informal settlement	Underground water tank	Roof top Water tank	Pots or pitchers	Plastic bottles	Large Containers
Amberdkar Colony	33.3	13.3	60.6	10.3	75.8
Nausar Ghati	63.4	78.0	69.5	29.3	76.8
Bairwa Basti	31.1	56.7	41.1	22.2	66.7
Banjara Basti	33.3	85.7	42.9	42.9	71.4
Chhoti Nagfani	29.3	78.0	68.0	34.0	63.3
Bagadia Basti	23.7	92.1	51.3	34.2	63.2
Gujjar ki Dharti	17.6	71.6	88.2	26.5	45.1

Households using multiple methods to store water during shortage

In the surveyed seven informal settlements of Ajmer, water storage practices vary significantly based on access to supply, household infrastructure, and financial capacity. Many households are forced to store water due to erratic supply, relying on different methods to ensure availability during periods of scarcity.

The above data highlights the diverse water storage practices in informal settlements of Ajmer, revealing how communities adapt to water scarcity. Nausar Ghati has the highest reliance on underground water tanks (63.4%), while Gujjar ki Dharti reports the lowest (17.6%), indicating variations in infrastructure access. Rooftop water tanks are widely used in Bagadia Basti (92.1%) and Banjara Basti (85.7%), suggesting a preference for elevated storage in certain settlements. Traditional methods like pots and pitchers remain prevalent, especially in Gujjar ki Dharti (88.2%) and Nausar Ghati (69.5%), showing cultural continuity in water storage. The use of plastic bottles is relatively lower across settlements, with the highest usage in Banjara Basti (42.9%). Large containers are the most common storage option overall, with high usage across settlements, particularly in Nausar Ghati (76.8%) and Ambedkar Colony (75.8%). These storage trends reflect both resource availability and coping strategies shaped by settlement conditions.

A resident from Banjara Basti stated, "Humaare paas paani ka koi bharosa nahi hai, kabhi aata hai kabhi nahi, isliye jitna ho sake, ikattha karna padta hai." ("We cannot rely on water availability; sometimes it comes, sometimes it doesn't, so we have to store as much as possible.").

These findings underscore the urgent need for more reliable water supply systems and better storage infrastructure, particularly for low-income households struggling to secure their daily water needs.

Table 12- Respondents experience changes in water taste, colour and smell during different seasons in informal settlements of Ajmer

Percentages

Settlement	Taste			Colour			Odor		
	Summer	Rainy	Winter	Summer	Rainy	Winter	Summer	Rainy	Winter
Ambedkar Colony	0.0	75.8	0.0	0.0	66.7	0.0	0.0	72.7	0.0
Bagadia Basti	9.2	28.9	1.3	9.2	26.3	1.3	7.9	28.9	0.0
Bairwa Basti	15.6	57.8	2.2	16.7	54.4	0.0	11.1	60.0	0.0
Banjara Basti	33.3	57.1	0.0	28.6	57.1	0.0	38.1	47.6	0.0
Choti Nagfani	14.0	29.3	4.0	8.7	25.3	2.7	11.3	26.7	2.0
Gujjar Ki Dharti	29.4	46.1	3.9	18.6	40.2	1.0	16.7	51.0	1.0
Nausar	18.3	57.3	1.2	14.6	53.7	1.2	14.6	62.2	0.0

Survey data highlights significant seasonal variations in water quality perceptions, with the monsoon bringing the highest complaints about taste, colour, and odour, indicating potential contamination. This is likely due to surface runoff, overflowing drains, and compromised storage, leading to increased turbidity and microbial growth.

Taste changes are most reported in Ambedkar Colony (75.8%) and Bairwa Basti (57.8%), while colour variations are frequent in Ambedkar Colony (66.7%) and Nausar Ghati (53.7%). Odor complaints are widespread, particularly in Nausar Ghati (62.2%) and Bairwa Basti (60.0%), suggesting bacterial contamination and stagnant water issues. These concerns are minimal in summer and winter, highlighting the direct impact of monsoon-related water contamination.

The findings underscore the need for improved water management, including better filtration, regular quality monitoring, and community awareness on safe storage practices to mitigate seasonal health risks in Ajmer's informal settlements.

Table 13- Methods used by households for cleaning drinking water in Informal settlements of Ajmer

Percentages

Settlement	Method					
	Boiling	Use of water filters	Filtering leaving the water still	Use of alum	Using water without cleaning	Filtering it through straining
Ambedkar Colony	3.0	6.1	18.2	48.5	0.0	84.8
Bagadia Basti	42.1	3.9	10.5	30.3	1.3	81.6
Bairwa Basti	38.9	11.1	37.8	32.2	11.1	52.2
Banjara Basti	57.1	9.5	57.1	23.8	4.8	42.9
Choti Nagfani	29.3	3.3	23.3	14.7	6.0	82.0
Gujjar Ki Dharti	31.4	0.0	23.5	34.3	5.9	68.6
Nausar	2.4	0.0	9.8	6.1	2.4	97.6

Most of the households use combination of different methods. Most common combination is first strain the water and then use alum. Households use boiling method mostly during the rainy season

In the seven surveyed informal settlements of Ajmer, data on household water purification practices highlights a preference for multiple methods. Straining is the most widely used, with nearly all households in Nausar (97.6%) and a majority in Ambedkar Colony (84.8%) relying on it. The use of alum is also common, particularly in Ambedkar Colony (48.5%) and Bagadia Basti (30.3%), reflecting a local adaptation for improving water clarity.

Boiling is more frequently practiced in Banjara Basti (57.1%) and Bairwa Basti (38.9%), though overall usage remains low, likely due to fuel constraints. Water filters see limited adoption, with the highest usage in Bairwa Basti (11.1%), suggesting affordability and accessibility barriers. Alarmingly, some households in Nausar (2.4%) and Banjara Basti (4.8%) consume untreated water, posing significant health risks. While the widespread use of straining and alum indicates awareness of water contamination, the reliance on basic methods underscores the need for improved access to safer purification technologies.

Table 14: Health problems faced by respondents in Informal settlements of Ajmer

Percentages

Settlement	No	Yes	Major health problems respondents linked to water quality		
			Cholera	Kidney Stones	Skin Allergy
Ambedkar Colony	66.67	33.3	45.5	0.0	54.5
Bagadia Basti	86.84	13.2	80.0	0.0	20.0
Bairwa Basti	83.33	16.7	66.7	0.0	33.3
Banjara Basti	90.48	9.5	50.0	0.0	50.0
Choti Nagfani	87.33	12.7	36.8	26.3	36.8
Gujjar Ki Dharti	75.49	24.5	80.0	0.0	44.0
Nausar	90.24	9.8	25.0	12.5	87.5

Percentages of respondents facing health issues are calculated on the basis of respondents reported Yes. Some of the respondents are facing multiple health issues

Table 14 highlights the prevalence of health issues linked to water quality, which varies across informal settlements in Ajmer. In **Ambedkar Colony**, 33.3% of respondents reported experiencing health problems, with 45.5% of these cases linked to cholera and 54.5% to skin allergies. **Bagadi Basti** had a lower percentage of affected individuals (13.2%), but among them, 80% reported cholera and 20% skin allergies.

A community health worker noted, "During monsoon, cholera cases spike. Families here store water in open containers, which become breeding grounds for bacteria."

Similarly, in **Bairwa Basti**, 16.7% of respondents experienced health issues, with 66.7% of them linking their illness to cholera and 33.3% to skin allergies. **Banjara Basti** had the lowest reporting rate (9.5%), with equal occurrences of cholera and skin allergies (50% each).

A women resident remarked, "Everyone here has skin problems."

In **Choti Nagfani**, 12.7% of respondents reported health issues, with 36.8% attributing their conditions to cholera, 26.3% to kidney stones, and 36.8% to skin allergies. A local doctor speculated that the high prevalence of kidney stones in the area could be due to the mineral content of groundwater, which remains largely untested. **Gujjar Ki Dharti** had a relatively higher percentage (24.5%) of affected respondents, with 80% linking their health problems to cholera and 44% to skin allergies.

One resident lamented, "hamare pani se ajeeb gandh aati hai, aur isaka upayog karane ke baad hamen chakatte pad jaate hain. lekin hamaare paas koee vikalp nahin hai."(Our water smells strange, and we get rashes after using it. But we have no choice.)

In **Nausar**, only 9.8% of respondents reported health problems, but among them, 87.5% associated their condition with skin allergies, 25% with cholera, and 12.5% with kidney stones.

A mother from Nausar expressed her frustration, "mere bachche nahaane ke baad lagataar apane haath aur pair khujaate hain. hamane kapade dhone ke lie nal ke pani ka upayog karana band kar diya hai, lekin ham aur kya pee sakate hain?"(My children scratch their arms and legs constantly after bathing. We've stopped using tap water for washing, but what else can we drink?" These findings highlight significant health risks associated with poor water quality, particularly skin-related ailments, cholera outbreaks, and, in some cases, kidney stones due to groundwater contamination.)

Table 15: Complaints related to water supply lodged with Municipal Corporation during last 1 year by the respondents of informal settlements in Ajmer

Percentages

Parameters	Informal Settlements						
	Ambedkar Colony	Nausar Ghati	Bairwa Basti	Banjara Basti	Chhoti Nagfani	Bagadia Basti	Gujjar ki Dharti
Whether Complaint is lodged							
Yes	21.2	3.7	16.7	4.8	6.0	21.1	13.7
No	66.7	80.5	76.7	95.2	86.7	77.6	82.4
Don't know	12.1	15.9	6.7	0.0	7.3	1.3	3.9
Type of complaint*							
Irregular water supply	0.0	66.7	80.0	100.0	88.9	81.3	35.7
Poor quality of water	0.0	0.0	73.3	100.0	33.3	31.3	50.0
Billing issues	0.0	0.0	0.0	0.0	0.0	18.8	0.0
Stand post not working	0.0	0.0	0.0	0.0	0.0	0.0	14.3
Handpump not working	14.3	33.3	13.3	0.0	11.1	25.0	14.3
Non- availability of pipeline	100.0	0.0	0.0	0.0	0.0	18.8	0.0
Pipeline broken	0.0	0.0	0.0	0.0	0.0	18.8	50.0

**Percentages of type of complaints are calculated from the number of respondents lodged the complaint. Few respondents lodged more than one type of complaint*

Table no. 15, the data on complaints lodged with the Municipal Corporation indicates a widespread reluctance or inability among residents to report water supply issues. In **Ambedkar Colony**, 21.2% of respondents reported filing complaints, while 66.7% had not done so, and 12.1% were unaware of the process. In **Nausar Ghati**, only 3.7% had lodged complaints, while 80.5% had not, and 15.9% were unsure. Similarly, in **Bairwa Basti**, 16.7% had reported issues, while 76.7% had not, and 6.7% were unaware. Complaint rates were even lower in **Banjara Basti** (4.8%) and **Chhoti Nagfani** (6%), with the majority of residents not reporting issues. **Bagadia Basti** (21.1%) and **Gujjar Ki Dharti** (13.7%) had relatively higher complaint rates, but non-reporting remained dominant.

Among those who did complain, the most commonly reported issue was **irregular water supply**, affecting 100% of complainants in Banjara Basti, 88.9% in Chhoti Nagfani, 80% in Bairwa Basti and Bagadia Basti, and 66.7% in Nausar. A daily wage worker from Bairwa Basti explained, *"We queue for hours at the handpump. If it's dry, we skip work to find water elsewhere."* **Poor water quality** was another major concern, particularly in **Bairwa Basti**, where 73.3% of complainants cited it as a problem. However, only 16.7% of its residents linked health issues to water, suggesting a disconnect between poor water quality and health awareness.

Infrastructure-related complaints, such as **non-functional handpumps**, were recorded in **Nausar (33.3%)**, **Gujjar Ki Dharti (14.3%)**, and **Bagadia Basti (25%)**. **Broken pipelines** were reported by **50% of complainants in Gujjar Ki Dharti** and **18.8% in Bagadia Basti**. **In Ambedkar Colony, all complainants (100%) reported the complete absence of pipelines**, forcing residents to depend on alternative, often unsafe, water sources.

A community leader from Bagadia Basti pointed out the inefficacy of the complaint system, stating, "People don't trust the municipality. They fix pipes for a day, and the problem returns next week."

Furthermore, many respondents were unaware of how to file complaints, as indicated by the high percentage of "Don't know" responses, such as **15.G% in Nausar**. A resident of Gujjar Ki Dharti

stated, *"Even if we complain, no one listens. They say there's no budget or it will take months to fix."* This trend underscores significant barriers in grievance redressal mechanisms, whether due to lack of awareness, bureaucratic hurdles, or a general distrust in municipal response systems.

These findings highlight the urgent need for improved municipal interventions, including better infrastructure maintenance, increased public awareness of grievance mechanisms, and proactive efforts to ensure equitable water access in Ajmer's informal settlements.

Table 16: Method of lodging complaints related to water supply and infrastructure

Percentages

Method of lodging complaint	Informal Settlements						
	Ambedkar Colony	Nausar Ghati	Bairwa Basti	Banjara Basti	Chhoti Nagfani	Bagadia Basti	Gujjar ki Dharti
At helpdesk/ Helpline (181)	100.0	66.7	20.0	100.0	11.1	0.0	28.6
Through Engineer/ Plumber	0.0	0.0	0.0	0.0	22.2	0.0	7.1
Personally visited Municipal office	0.0	0.0	33.3	0.0	0.0	37.5	28.6
Through ward councillor	0.0	33.3	46.7	0.0	66.7	62.5	35.7

Table no. 16 shows the methods residents use to lodge complaints regarding water supply and infrastructure. The findings indicate a strong reliance on the helpline **(181)** in certain settlements, with **Ambedkar Colony** and **Banjara Basti** reporting full usage (100%). However, its effectiveness varies, as some settlements, such as **Bagadi Basti**, show no engagement with this method. Instead, residents in **Bagadi Basti** (37.5%) and **Gujjar ki Dharti** (28.6%) prefer visiting the municipal office in person, suggesting a perception that direct engagement yields better responses. The role of ward councillors in complaint lodging is significant, particularly in **Chhoti Nagfani** (66.7%) and **Bagadi Basti** (62.5%), while **Bairwa Basti** (46.7%) also relies heavily on councillors. Notably, the use of engineers or plumbers for addressing water supply issues is minimal, indicating limited technical intervention at the community level. The variation in complaint channels highlights differences in awareness, accessibility, and trust in institutional mechanisms across settlements.

Table 17: Complaints resolution and time taken

Percentages

Settlement	Whether complaint is redressed		Time taken for the redressal of complaint			
	Yes	No	Within 1 day	2-3 days	4-7 days	More than 1 week
Ambedkar Colony	0.0	100.0	-	-	-	-
Bagadia Basti	56.3	43.8	0.0	33.3	11.1	55.6
Bairwa Basti	53.3	46.7	12.5	25.0	0.0	62.5
Banjara Basti	0.0	100.0	-	-	-	-
Choti Nagfani	0.0	100.0	-	-	-	-
Gujjar Ki Dharti	100.0	0.0	0.0	50.0	28.6	21.4
Nausar	33.3	66.7	0.0	0.0	0.0	100.0

The data above examines the resolution of complaints and the time taken for redressal, revealing stark disparities in responsiveness. In **Ambedkar Colony, Banjara Basti,** and **Chhoti Nagfani,** none of the complaints were resolved, raising concerns about institutional neglect in these areas. Conversely, **Gujjar ki Dharti** reports a 100% redressal rate, with most issues being resolved within a week. Settlements such as **Bagadi Basti** (56.3%) and **Bairwa Basti** (53.3%) show mixed outcomes, with nearly half of the complaints remaining unaddressed. In **Nausar**, only 33.3% of complaints were resolved, and all redressals took more than a week, indicating significant delays. The varied response rates suggest systemic inefficiencies, with some settlements receiving

quicker interventions while others face prolonged inaction. This underscores the need for improved grievance mechanisms, greater accountability in service delivery, and increased awareness among residents about the most effective channels for lodging complaints.

Table 18: Irregularities related to water supply reported by informal settlement dwellers

Percentages

Settlement	No piped water supply	Functional handpump covered	Low water pressure	People installed high pressure water motor	Non cleaning of overhead water tank	Encroachment of public standpost
Ambedkar Colony	100.0	100.0	0.0	0.0	0.0	0.0
Bagadia Basti	0.0	0.0	79.5	23.1	20.5	5.1
Bairwa Basti	0.0	0.0	52.9	62.7	11.8	3.9
Banjara Basti	0.0	0.0	100.0	62.5	0.0	0.0
Choti Nagfani	0.0	0.0	65.2	34.8	0.0	0.0
Gujjar Ki Dharti	0.0	0.0	68.6	20.0	8.6	5.7
Nausar	0.0	0.0	91.9	45.2	24.2	0.0

Table no 18 highlights key issues in water supply across informal settlements in Ajmer. **Ambedkar Colony** faces the most severe water insecurity, with no piped supply (100%) and non-functional handpumps (100%). Other settlements primarily report low water pressure, most notably in **Banjara Basti** (100%), **Nausar** (91.9%), and **Bagadi Basti** (79.5%), likely due to high demand and infrastructure limitations.

The use of high-pressure water motors is widespread, particularly in **Bairwa Basti** (62.7%) and **Banjara Basti** (62.5%), exacerbating inequitable access. Poor maintenance of overhead water tanks is another concern, especially in **Nausar** (24.2%) and **Bagadi Basti** (20.5%), posing health risks. Additionally, minor cases of public standpost encroachment are reported in **Bagadi Basti** (5.1%) and **Gujjar Ki Dharti** (5.7%).

These findings reveal significant disparities in water access, with some settlements facing acute shortages while others struggle with unfair distribution. Addressing these issues requires infrastructure improvements, stricter enforcement of regulations, and community initiatives to promote equitable access and hygiene.

Key Insights from Household Survey Data: Trends, Challenges, and Implications

The findings from the household survey and water quality assessment across informal settlements in Ajmer highlight severe infrastructure disparities, unreliable water access, health risks, and governance gaps. Settlements such as Ambedkar Colony, which entirely lacks piped water **(Table 2)**, face extreme vulnerability, with 100% of households reporting water shortages during summer **(Table 4)**. The reliance on private tankers (75.8% for non-drinking purposes) in such settlements underscores the financial burden placed on low-income households. Meanwhile, even settlements with widespread piped connections, such as Chhoti Nagfani (99.3% piped supply), continue to suffer from low water pressure and seasonal scarcity **(Tables 5 and 12)**. The erratic and inadequate water supply results in increased dependency on expensive and often contaminated alternative sources, disproportionately affecting women, who are responsible for fetching water.

A resident from Chhoti Nagfani expressed, "We have water problems uphill. Increase the pressure."

Water quality issues pose serious health risks, particularly in settlements like Bairwa Basti, where 52.2% of households reported receiving dirty water more than three times in three months **(Table G)**. Contaminated supply directly correlates with rising cases of waterborne diseases, as seen in Ambedkar Colony, where cholera (45.5%) and skin allergies (54.5%) were among the most reported health problems **(Table 14)**. Seasonal fluctuations exacerbate these concerns, with the monsoon season triggering widespread complaints of changes in *taste*, colour, and odor **(Table 12)**. Many households rely on rudimentary purification techniques, with 84.8% in Ambedkar Colony resorting to simple straining instead of more effective boiling or filtration methods **(Table 13)**, further increasing their exposure to unsafe drinking water. The absence of regular water quality monitoring, particularly for groundwater sources, has resulted in chronic health conditions such as kidney stones in areas like Chhoti Nagfani, where groundwater minerals remain untested.

A resident from Gujjar Ki Dharti lamented, "Our water smells strange, causing rashes. We have no choice."

The burden of water scarcity falls disproportionately on women, particularly in settlements like Ambedkar Colony, where 42.4% of households rely on distant standposts. Women spend hours collecting water, often carrying heavy containers (75.8% store water in large drums, **Table 11)**, leading to chronic health issues. The erratic and unpredictable timing of supply **(Table 7)** further complicates household water management, disrupting daily routines and increasing stress.

A woman from Ambedkar Colony described her plight, saying, "My back hurts, but I must fetch water."

These findings emphasize the urgent need for gender-responsive governance that acknowledges the specific challenges faced by women in managing household water needs.

Institutional gaps further exacerbate these issues, with low complaint rates indicating widespread distrust in municipal governance. In Nausar Ghati, only 3.7% of respondents lodged a formal complaint regarding water supply issues **(Table 15)**, and settlements like Ambedkar Colony, Banjara Basti, and Chhoti Nagfani reported a 0% resolution rate for complaints **(Table 17).** The reliance on ward councillors (66.7% in Chhoti Nagfani, **Table 16)** rather than official helplines suggests that formal grievance mechanisms are either inaccessible or ineffective. Additionally, financial transparency remains a concern, with settlements like Bagadia Basti relying on fixed billing (94.1%) despite the presence of non-functional meters (25.4%, **Table 8),** creating inequities in water pricing.

A resident from Bagadi Basti pointed out, "Complaints lead to no change. Pipes are fixed temporarily."

The lack of responsive governance mechanisms leaves many communities without recourse, further entrenching their vulnerabilities.

Seasonal variations intensify water insecurity, with summer scarcity forcing reliance on costly alternatives. In Banjara Basti, 90.5% of households depend on private tankers during water shortages **(Table 10),** straining already fragile household finances. The need for more storage capacity has led many to adopt rooftop tanks (92.1% in Bagadi Basti, **Table 11),** but these storage systems remain vulnerable to contamination, particularly during monsoon months. Households expressed frustration over the paradox of greater water demand in summer coinciding with reduced supply,

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A woman from Nausar Ghati shared, "We need more water in summer, but supply drops."

Addressing these challenges requires a multi-pronged approach that integrates infrastructure upgrades, improved quality monitoring, and community participation in governance. Expanding piped water networks in under-served settlements like Ambedkar Colony, repairing leakages in Gujjar Ki Dharti, and installing pressure pumps in Chhoti Nagfani can alleviate access issues. Regular water quality testing, particularly for groundwater and tanker water, should be institutionalized, with community-led purification workshops promoting safer household-level filtration techniques. Given the disproportionate burden on women, strengthening the role of Self-Help Groups in water governance and incorporating them into municipal planning as "AMRUT Mitras" would enhance community ownership. Transparent billing practices should replace fixed tariffs with meter-based systems, as seen in Bairwa Basti, while subsidies can ensure affordability for low-income households. Additionally, pre-monsoon preparedness efforts, including drainage maintenance and subsidized distribution of safe storage containers, would mitigate contamination risks.

Ultimately, the interplay of infrastructural neglect, gendered burdens, and institutional apathy perpetuates water insecurity in Ajmer's informal settlements. Strengthening community-led partnerships between Self-Help Groups, MDS University, and municipal authorities can create sustainable, participatory models for climate-resilient water governance. Addressing these systemic issues requires a shift toward decentralized, inclusive decision-making that prioritizes the voices of the most vulnerable residents, ensuring that water access is recognized as a fundamental right rather than a privilege dictated by economic or social status.

Water Quality Testing

Sampling Strategy for Water Quality Testing

The sampling strategy for water quality testing in the selected informal settlements focused on both piped water and alternative water sources such as tankers, stand posts, hand pumps, and boring. For households with piped water, testing includes examining the integrity of the water infrastructure, particularly identifying any broken pipes or sections where pipes pass through drains, which may lead to contamination. Additionally, the possibility of piped water being mixed with borewell water in the main storage tanks is assessed, as this could affect water quality. Households relying on water supplied by private water tankers also examined to evaluate the cleanliness and safety of this source. Stand posts and hand pumps, which often serve as key alternative water sources also included in the testing to ensure comprehensive coverage of all water options in use. The skip interval method is used for systematic sampling, ensuring representation from both piped and non-piped water users, providing a holistic understanding of water quality issues across different supply modes.

Key findings of Water Quality testing

The selection of water quality testing samples was based on a combination of reported issues, systematic sampling methods, and external factors affecting water sources. The approach included:

1. **Diversity of Water Sources**: Samples were collected from multiple water sources, including piped water, hand pumps, standposts, and stored water, to capture variations in water quality across different supply systems. This ensures a holistic understanding of contamination risks and source reliability.
2. **Targeting Households with Reported Quality Issues**: Households that reported water quality concerns during the source mapping and household survey were prioritized for sample collection. This ensured that the testing addressed community-identified challenges.
3. **Systematic Sampling Using Skip Interval Method**: To ensure a representative sample, a skip interval method was used to select households with both piped and non-piped water sources. This method provided a structured and unbiased approach to sample selection.

Key Parameters Tested

pH levels, Turbidity, Total Hardness, Chloride, Alkalinity, Residual Chlorine, Iron, Nitrate, Fluoride, Bacteriological Characteristics (E. coli, coliforms, pathogens). The detailed note on key water quality testing parameters is provided in Annexure 5.

Source of Water tested (Piped s non-Piped)

Piped water	Piped home supply and Public Standpost
Non- piped water	Handpump, private water Tanker, Boring, On- site tank, Water stored at house (water tank, other storage)

***** *Some variations in test results were observed, particularly in hand pump samples (Ambedkar colony). One sample was collected during rainfall, which may have inffuenced contamination levels, while another was taken from a hand pump before the rain and included stored water. These variations highlight the impact of weather conditions on water quality and emphasize the need for contextual analysis when interpreting results.*

Summary of Key findings - Settlement Wise

1. Ambedkar Colony

- **pH:** Within optimal range (7-9).
- **Turbidity:** Handpump sample 2 exceeds limits (10-25 NTU).
- **Hardness:** Handpump samples 1, 2, and 3 exceed optimal levels (440-720 ppm).

- **Chloride:** Handpump sample 2 exceeds limits (720 mg/L).
- **Alkalinity:** Handpump and water tanker sources exceed recommended levels (300-720 mg/L).
- **Iron:** Handpumps sample 2 and 3 reach the threshold (0.3 ppm).
- **Fluoride:** Elevated in Handpump samples 1, 2, 3, and Private water tankers 1, 2 (2-3 mg/L).
- **Bacteriological:** No contamination detected.

2. Nausar Ghati

- **pH:** Within safe range (7-8).
- **Turbidity:** Handpump sample 2 exceeds limits (>25 NTU).
- **Hardness:** Handpump sample 2 extremely high (1180 ppm).
- **Chloride:** Handpump sample 2 and Boring exceed limits (500 mg/L and 360 mg/L).
- **Alkalinity:** Handpump sample 1 and Water Tanker exceed limits (500 mg/L and 480 mg/L).
- **Iron:** Handpump sample 2 exceeds limits (3.0 ppm).
- **Fluoride:** Boring and Water Tanker exceed limits (3.0 mg/L).
- **Bacteriological:** No contamination detected.

3. Bairwa Basti

- **pH:** Within safe range (7-8).
- **Turbidity:** All samples within limits.
- **Hardness:** Sample P1(pipeline) exceeds limits (760 ppm).
- **Chloride:** Within limits (80-400 mg/L).
- **Alkalinity:** Within limits (80-600 mg/L).
- **Iron:** Within limits (0-0.2 ppm).
- **Fluoride:** Sample P4(Pipeline), H2 (Handpump), B1 (Boring), B2 (Boring), B3 (Boring) exceed limits (3.0 ppm).
- **Bacteriological:** No contamination detected.

4. Banjara Basti

- **pH:** Within safe range (7-8).
- **Turbidity:** All samples within limits.
- **Hardness:** Sample P1(Pipeline), H2 (Handpump), B1(Boring) exceed limits (120-500 ppm).
- **Chloride:** Sample B1 (boring) exceeds limits (400 mg/L).
- **Alkalinity:** Within limits (80-600 mg/L).
- **Iron:** Within limits (0-0.2 ppm).
- **Fluoride:** Sample B1(Boring) exceeds limits (3.0 ppm).
- **Bacteriological:** No contamination detected.

5. Choti Nagafani

- **pH:** All samples neutral (7).
- **Turbidity:** Sample 1(pipeline) exceeds limits (50 NTU).
- **Hardness:** Within limits (160-400 ppm).
- **Chloride:** Within limits (110-340 mg/L).
- **Alkalinity:** Samples 14 and 18 (pipeline) exceed limits (600 mg/L).
- **Iron:** Sample 1 within limits (0.2 ppm).

- **Fluoride:** Sample 8 (Pipeline) exceeds limits (3.0 ppm).
- **Bacteriological:** No contamination detected.

6. **Gujjar ki Dharti**
   - **pH:** Mostly neutral, some variations in handpumps and borings.
   - **Turbidity:** All samples within limits.
   - **Hardness:** Handpumps exceed limits (460-600 ppm).
   - **Chloride:** Within limits (100-300 mg/L).
   - **Alkalinity:** Within limits.
   - **Iron:** Within limits.
   - **Nitrate:** All sample within limits.
   - **Fluoride:** Within limits.
   - **Bacteriological:** The bacteriological analysis confirmed contamination in several samples, specifically piped water samples P2, P3, P4, P5, P8, P9, S2, and well sample W1. As a result, these water sources were deemed unsafe for drinking and domestic use. Some residents, in an attempt to validate the test results, reported that during the initial 5–10 minutes of water supply, they receive dirty water, which may contribute to contamination. Additionally, further testing and regular monitoring of Standpost 2 and Well 1 are necessary to assess their water quality. Therefore, routine monitoring, proper maintenance, and timely interventions for water sources are strongly recommended.

7. **Bagdi Basti**

- **pH Levels:** Most samples were within acceptable limits, except for **Sample B4**, which had a pH of 9, indicating alkalinity. This could lead to taste issues and lime-like deposits in pipelines.
- **Turbidity:** All samples showed **0 turbidity**, indicating clear water free from suspended particles.
- **Chloride:** Chloride levels in all samples were **below 250 mg/l**, within permissible limits.
- **Alkalinity:** Sample B4 had an alkalinity level of **1600 mg/l**, far exceeding the permissible limit, which could cause unpleasant taste.
- **Total Hardness:** All samples were within the permissible limit for hardness.
- **Fluoride:** Fluoride levels in all samples were within the prescribed limits.
- **Nitrate:** Nitrate levels in all samples were within the prescribed limits.
- **Iron:** Most samples had zero iron content, except for handpump Samples H3 and H4, which had 0.2 mg/l and 0.3 mg/l respectively, still within permissible limits.
- **Bacteriological Indicators:** No contamination detected.

Analysis

Overall Water Quality

- Most settlements have pH levels within the safe range, but **Ambedkar Colony** and **Nausar Ghati** show elevated hardness, chloride, and fluoride levels.
- **Turbidity** is a concern in **Ambedkar Colony** (Handpump 2) and **Choti Nagafani** (Sample 1).
- **Hardness** is a widespread issue, particularly in **Nausar Ghati** (Handpump 2) and **Bairwa Basti** (P1-pipeline).
- **Fluoride** levels are elevated in multiple settlements, especially in **Ambedkar Colony**, **Nausar Ghati**, **Bairwa Basti**, and **Banjara Basti**.
- **Iron** levels are generally within limits, except in **Ambedkar Colony** and **Nausar Ghati**.

- **Bacteriological** contamination (**P2, P3, P4, P5, P8, PG, S2, and W1**) is only detected in **Gujjar ki Dharti** settlement.

Common Contaminants

- **Hardness** and **fluoride** are the most common issues across settlements.
- **Chloride** levels are elevated in **Ambedkar Colony** and **Nausar Ghati**.
- **Turbidity** is a localized issue in **Ambedkar Colony** and **Choti Nagafani**.
- **Bagdi Basti** observed **high alkalinity and elevated pH in Sample B4(Boring)**, which could affect taste and pipeline integrity.

Variability Across Settlements

- **Nausar Ghati** has the most severe water quality issues, with high hardness, chloride, and fluoride levels.
- **Ambedkar Colony** and **Bairwa Basti** also show significant contamination, particularly in hardness and fluoride.
- **Choti Nagafani** and **Gujjar ki Dharti** have fewer issues, with only localized problems in turbidity and alkalinity.
- While most samples were within acceptable limits, **Sample B4 (Boring)** stood out as an outlier with high alkalinity and pH levels in **Bagdi Basti**

General Trends

- Most settlements have acceptable pH levels, but hardness and fluoride are widespread issues.
- Turbidity is a localized problem, but it can lead to microbial contamination if not addressed.
- Bacteriological contamination is not a major concern for other settlement except Gujjar ki Dharti, but regular monitoring is essential.

Areas of Concern

- **Hardness:** High levels in multiple settlements can lead to scaling and health issues.
- **Fluoride:** Elevated levels in several settlements pose risks of dental and skeletal fluorosis.
- **Chloride:** Elevated in some areas, leading to salty taste and plumbing corrosion.
- **Turbidity:** Localized but can indicate potential contamination.
- **High alkalinity and pH :** potentially indicating localized contamination or pipeline issues.

Potential Sources of Contamination

- **Natural Sources:** Contaminants from the environment, such as fluoride-rich soil and naturally hard water sources.
- **Human Activities:** Improper waste disposal, sewage leakage, and other anthropogenic factors that contribute to water contamination.
- **Infrastructure Issues:** Leaking pipelines, inadequate purification, and lack of regular cleaning and maintenance of water supply systems.
- **Household Water Storage Practices:** Many community members are unaware of proper water storage and handling practices, increasing the risk of secondary contamination. Awareness and training on safe water storage are essential to ensuring water safety at the household level.

The findings from the water quality tests in selected 7 informal settlements reveal critical challenges, particularly concerning high hardness levels, elevated fluoride concentrations, and localized turbidity. While bacteriological contamination is not a widespread concern, the presence of chemical contaminants raises serious public health risks, especially for communities with prolonged exposure. High fluoride levels can contribute to dental and skeletal fluorosis, while excessive hardness affects the palatability and usability of water, leading residents to seek alternative, often unregulated, water sources.

Addressing these issues requires a two-pronged approach. In the short term as recommended, immediate interventions such as affordable Community-Led Water Management Solution and awareness campaigns on safe water usage can help mitigate risks. However, sustainable solutions necessitate long-term strategies, including periodic water quality monitoring, robust data-sharing mechanisms between local authorities and communities, and policy-driven efforts to integrate water safety planning into urban development initiatives.

Moreover, community participation is crucial in ensuring the effectiveness of these interventions. Strengthening local governance structures, training more SHGs members C community volunteers in water quality testing, and establishing grievance redressal mechanisms can empower residents to advocate for better services. These findings reinforce the need for multi-stakeholder collaboration, with municipal authorities, public health agencies, and civil society organizations working together to ensure safe and equitable access to drinking water. Ultimately, targeted policy interventions that prioritize infrastructure improvement, equitable distribution, and adaptive water management are essential to safeguarding public health and resilience in Ajmer’s informal settlements.

Community Voices: Analysis of Suggestions and Feedback

The participatory activities and community engagement in Ajmer's urban informal settlements have provided invaluable insights into the lived realities of residents facing persistent water challenges. Through focused group discussions, informal dialogues, and structured sharing and validations, community members have articulated their concerns and proposed solutions, reflecting a deep understanding of local issues and resilience mechanisms. Their feedback underscores the need for systemic improvements in water supply infrastructure, billing processes, and quality monitoring, with strong emphasis on community-led solutions.

1. Water Supply Timing and Pressure: A Source of Everyday Hardship

Residents across settlements, particularly in Chhoti Nagfani, Gujjar ki Dharti, and Banjara Basti, repeatedly highlighted the irregularity in water supply timings and inadequate pressure. A community member from Chhoti Nagfani shared,

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"Water comes at odd hours—sometimes at midnight, sometimes early morning. We wake up and wait, but the pressure is too low to fill our containers. By the time we collect enough, it's already time to start our daily work." (Pani ka samay koi nischit nahi hota hai- kabhi aadhi raat ko, kabhi subah jaldei aa jata hai . ham jaagate hain aur intejar karte hain, lekin hamaare kantenar ya bartan ko bharne ke lie dabaav bahut kam hai. jab tak ham jarurat ke hisab se pani Bharte hain, tab tak hamara daily ka kaam shuru karane ka samay ho chuka hota hai."

This inconsistency creates daily stress, disproportionately affecting women and elderly members who are primarily responsible for fetching and storing water. Residents in Banjara Basti added that the limited number of functioning water sources further exacerbates the problem, forcing them to rely on distant hand pumps.

2. Water Billing and Payment Struggles: A System in Disarray

Billing irregularities emerged as a major grievance across settlements. In Bagdi Basti and Gujjar ki Dharti, residents reported erratic meter readings and unexplained fluctuations in bill amounts. One resident from Bagdi Basti recounted,

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"I got a bill of ₹1,500 one month, but the next month it was ₹300. Some people don't even get bills for months, and then suddenly receive a huge backlog to pay at once." (mujhe ek mahine mein ₹1,500 ka bil mila, lekin agale mahine yah ₹300 ho gaya. kuchh logon ko to mahinon tak bil nahin milta hai, aur phir achaanak jama karne ke lie ek bada pending amount aa jaata hai.)

Additionally, concerns about monthly bill payments accumulating interest were raised in Gujjar ki Dharti and Banjara Basti. Many suggested reinstating E-Mitra counters, which previously provided accessible payment options without interest accumulation.

3. Dysfunctional Water Infrastructure: Repairs Needed Urgently

A common theme across settlements was the poor condition of water sources, particularly non-functional hand pumps and stand posts. In Chhoti Nagfani, out of 14 hand pumps, 5 are broken, and 3 out of 4 stand posts do not function. Similar concerns were voiced in Bagdi Basti and Nausar, where several hand pumps remain unusable, leaving households with limited options.

A woman from Ambedkar Colony explained the struggle

"The hand pump near my house has too much iron and ffuoride. Even if we boil the water, the taste doesn't change. But we have no choice—clean water is a luxury for us." (humare yahan to ek hi source hai baki me paise lagte hai, usme bhi paani bahut khara aata hai, aur koi upaay nhi hai)

Communities requested regular maintenance of wells, hand pumps, and pipelines to ensure uninterrupted water access.

4. Water Quality Concerns: Awareness and Treatment Needed

While bacteriological contamination was not found to be widespread, concerns about fluoride, turbidity, and iron dominated community feedback, especially in Ambedkar Colony and Nausar. A resident from Nausar remarked,

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"Water testing was done, but we still don't know what's safe. We need regular updates and solutions."(pani ka test to hua lekin hume ye pata nhi ki kya sahih ai nahi , jaanch niyamit rup se ho aur samadhan bhi mile)

The community members suggested increased awareness campaigns, community led water management solution and local/affordable purification systems to address these issues. In Bagdi Basti, residents requested cleaning and treating stepwells and settlement wells to make them viable alternative water sources.

5. Collective Recommendations: A Community-Driven Approach

Despite these hardships, community members were not passive recipients of challenges; they provided concrete solutions. Across all settlements, there was a collective push for:

- Regular water quality testing with transparent communication of results.
- community led water management solution C Community-led awareness programs on water conservation and cleanliness.
- Localized storage solutions such as community water tanks to manage shortages.
- A structured grievance redressal mechanism for reporting and fixing infrastructure issues efficiently.

These insights demonstrate the strength of co-production, where local knowledge and lived experiences shape the path toward sustainable solutions. The integration of community feedback into policy and infrastructure planning will be critical in ensuring water security for Ajmer's informal settlements.

Recommendations

A) Community-Led Water Management Solution

1. **Low-Cost Filtration Methods**
    a. **Sand and Charcoal Filters:** Use locally available materials to remove turbidity and impurities.
    b. **Cloth Filtration:** Simple method to strain out sediments before boiling or treating water.
2. **Affordable Water Purification Techniques**
    a. **Alum Treatment:** Cost-effective way to settle impurities and improve water clarity.
    b. **Solar Disinfection (SODIS):** Place water-filled plastic bottles in sunlight for 6-8 hours to kill bacteria.
    c. **Boiling Water:** Effective but can be combined with solar cookers or shared fuel-efficient stoves.

3. **Community-Managed Water Storage and Conservation**
    a. **Rainwater Harvesting:** Collect rainwater in household or shared tanks for non-drinking use.
    b. **Shared Storage Tanks:** Community-managed tanks ensure equitable distribution.
    c. **Water-Saving Practices:** Use bucket baths and recycle water for cleaning or other purpose.

4. **Collective Advocacy and Engagement**
    a. **Strengthening SHGs:** Advocate for better services, monitor infrastructure, and report leakages.
    b. **Water Monitoring Groups:** Train residents to test water quality and address contamination issues.
    c. **Water User Committees:** Bridge the gap between the community and municipal authorities.

5. **Reducing Fluoride and Hardness in Water**
    a. **Earthen Pots:** Naturally reduce fluoride and improve water taste.
    b. **Crushed Moringa Seeds:** Low-cost method to reduce turbidity and fluoride content.
    c. **Lime Treatment:** Community-led use of lime can soften water and make it safer.

6. **Infrastructure Maintenance and Repair**
    a. **Fixing Leaks:** Volunteer groups can identify and report pipeline leakages.
    b. **Reviving Handpumps:** Small repair drives can restore defunct handpumps and borewells.
    c. **Protecting Standposts:** Ensure fair access, prevent encroachment, and maintain cleanliness.

B) Long-term Monitoring Strategies

a) **Regular Testing:** Establish a routine water quality monitoring program to track changes and ensure compliance with standards.

b) **Community Awareness:** Educate residents on water quality issues and the importance of proper water treatment.

c) **Infrastructure Maintenance:** Regularly clean and maintain water storage tanks, pipelines, and areas near handpumps to prevent contamination.

d) **Source Protection:** Identify and eliminate sources of contamination, particularly in areas with high nitrate and fluoride levels.

Conclusion

The study highlights the systemic water insecurity prevalent in Ajmer's informal settlements, stemming from infrastructural neglect, gendered burdens, and institutional inefficiencies. Although piped water networks exist, issues such as erratic supply, contamination, and financial constraints continue to perpetuate inequities, disproportionately affecting women and low-income households. The participatory approach adopted for piloting the SECURe framework underscores the critical need to integrate community voices into governance and decision-making processes.

Key recommendations—such as decentralizing water management through Self-Help Groups (SHGs), installing pressure pumps to stabilize supply, and institutionalizing robust water quality monitoring mechanisms—offer viable pathways toward resilience. Strengthening collaborations between the Ajmer Municipal Corporation (AMC), MDS University, and SHGs can bridge the gap between technical expertise and local knowledge, fostering inclusive and climate-adaptive solutions.

Furthermore, prioritizing gender-responsive policies, ensuring transparent water billing systems, and upgrading infrastructure will not only address immediate challenges but also contribute to achieving Sustainable Development Goal 6 (clean water and sanitation for all) in urban India. This phase lays the foundation for scaling community-led models, paving the way for equitable and sustainable water security in the region.

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Annexure 1- Letter of Support from Maharishi Dayanand Saraswati University (MDSU), Ajmer

299/EnvSci
26/9/24

MAHARSHI DAYANAND SARASWATI UNIVERSITY
AJMER – 305 009 (RAJ.) INDIA
Department of Environmental Science

Prof. Subroto Dutta
HEAD

E-mail: drsubrotodutta@gmail.com
Mobile: 9414006839

To,
Dr, Rabi Raj
Senior Programme Officer
PRIA- Participatory Research in Asia

Subject: Response to Collaboration Request for SECURe Project on Urban Resilience and Water Access in Ajmer

Dear Dr. Rabi Raj,

I hope this letter finds you in good health. On behalf of the Department of Environmental Science at Maharshi Dayanand Saraswati University, Ajmer. I would like to express our sincere appreciation for reaching out to us regarding your project, *"Finding Effective Contextual Solutions for Urban Resilience: Piloting Proposed Decision Support Framework (SECURe)."* We appreciate it that you regard our department as a valuable partner in this significant initiative, particularly in the context of addressing critical issues such as gender equality, social inclusion, and access to safe drinking water in informal settlements.

Given our department's focus on environmental sustainability, We are positive about the prospect of collaborating, particularly in the critical areas you identified— spatial mapping, household surveys, and collaborative engagements with Self-Help Groups (SHGs). Our faculty and students would be keen to contribute their technical expertise, as well as to gain valuable insights through active participation in this initiative.

To formalize this collaboration, we are happy to provide a letter of support and to work closely with PRIA in ensuring the success of the proposed activities over the coming months.

Warm regards,

Prof. Subroto Dutta
Head, Department of Environmental Science
(Centre for Excellence)
Maharshi Dayanand Saraswati University
Ajmer, Rajasthan

Annexure 2- Letter of support from National Urban Livelihood Mission (NULM) Department of Ajmer Municipal Corporation

Office Municipal Corporation Ajmer

Prithvi Raj Marg,Ajmer

दूरभाष–0145–2429953, फैक्स–0145–2433813,Email - ajmermc@gmail.com, ajmermc@rajasthan.gov.in

Letter No./2024–25/ ५०५१ Date:-18/11/2024

To,
The Project Director,
Participatory Research in Asia (PRIA),
New Delhi, India.

Subject: Support for Climate-Resilient WASH Services Project in Informal Settlements of Ajmer.

Dear,

On behalf of the National Urban Livelihoods Mission (NULM), Ajmer, I am pleased to express our support for PRIA India's initiative to improve water, sanitation, and hygiene (WASH) services in the informal settlements of Ajmer. Recognizing the need for targeted, community-led interventions in these areas, NULM is committed to assisting PRIA in fostering resilience and sustainable development among the city's most vulnerable populations.

In line with our mission to enhance urban livelihoods, NULM will actively contribute to this project by identifying key informal settlements and Self-Help Groups (SHGs) for engagement. Additionally, we will support the training and mobilization of SHGs for conducting household surveys and community assessments, ensuring that local voices are central to data collection and decision-making processes. By collaborating with PRIA and other stakeholders, NULM aims to empower communities to advocate for and secure essential WASH services.

We look forward to working closely with PRIA to develop an inclusive framework for WASH service delivery in Ajmer's informal settlements. Together, we can achieve a meaningful impact, advancing both climate resilience and community well-being.

18-11-2024

Sincerely,

Kannupriya Tak
District Project Officer(NULM)
Municipal Corporation Ajmer,
Rajasthan

Annexure 3- Letter of support from Ajmer Municipal Corporation

Office of Municipal Corporation Ajmer

PR Marg, Ajmer (Rajasthan) Phone No.- 0145-2429971,2429920
Email– ajmermc@gmail.com, web- ajmermc.org.

Letter No. AMC/MEW/SWM/2024-25/174 Date :- 13/11/24

To

Participatory Research in Asia (PRIA),
New Delhi, India.

Subject: Support and Collaboration for Climates-Resilient WASH Services Settlements of Ajmer

In regarding to the requesting letter submitted by your organization, dated 08/11/2024, you are hereby given consent to conduct survey regarding Water and sanitation (Wat-san) and climate resilience sector with the help of Self-Help Groups (SHGs) National Urban Livelihoods Mission (NULM) and Atal Mission for Rejuvenation and Urban Transformation (AMRUT) divisions to identifying and addressing the specific needs of Ajmer's informal settlements. The insights gained will guide our action plans and policies to improve water service delivery and climate resilience across the city's most vulnerable areas.

Deputy Commissioner (A)
Ajmer Municipal Corporation

RajKaj Ref
11759857

Signature valid
Digitally signed by Anita Chaudhary
Designation : Deputy Commissioner
Date: 2024.11.13 17:58:21 IST
Reason: Approved

Annexure 4- Program design of the training workshop organised from 1G-23 December 2024

Session	Duration	Facilitator
Day 1		
Inaugural Session	10.00- 11.00 am	PRIA C MDSU team
Tea break		
Opening Session: Introduction to the training	11.15-11:30 am	PRIA C MDSU team
Getting to Know Each Other	11:30-11:40 am	PRIA
Understanding Basics of Urban WASH Services	11:45-12:15 pm	Ms Rita Chaturvedi, CCDO, PHED
Introduction to Water Quality Concepts	12:15-01:00 pm	MDSU
Lunch Break		
Understanding Equipment and Sample Collection	02:00- 03:15 pm	MDSU
Tea Break	03.15- 03.45 pm	
Understanding Water Quality Testing	03:45- 05:00 pm	Dr. Archana Mathur, Superintendent Chemist, PHED
Instructions for Field Work	05.00- 05.30 pm	MDSU and PRIA team
Day 2		
Field Practice: Sample Collection and Testing	10:00- 01:00 pm	MDSU and PRIA team
Lunch break	01:00- 02:00 pm	
Field Experience Sharing and Learning Insights	02:00- 03:30 pm	MDSU and PRIA team
Tea Break	03.30- 04.00 pm	
How to Use a Smartphone	04:00-05:00 pm	PRIA
Day 3		
Understanding the Survey Questionnaire	09:30-11:00 am	PRIA
Tea Break	11.00- 11.30 am	
Introduction to Mobile App	11:30- 01:00 pm	PRIA
Lunch break	01:00- 02:00 pm	
Practice Session for Using Mobile App	02:00- 03:30 pm	PRIA
Tea Break	03.30- 04.00 pm	
Understanding Survey Methods and Survey Etiquettes	04:00- 05:00 pm	PRIA
Instructions for Field Work	05.00 – 05.30 pm	PRIA
Day 4		
practice session for Mobile App-Based Surveys	10:00- 01:00 pm	PRIA and MDSU team
Lunch break	01:00- 02:00 pm	
Discussion on Field Work Experiences and Survey Planning	02:00-3:30 pm	SHGs Member C Students
Tea Break	03:30- 04:00 pm	
Certificate Distribution C Closing Session	04:00- 05:30 pm	PRIA and MDSU team
High Tea	05.30 pm	

Annexure 5

WATER QUALITY TESTING PARAMETERS

Water samples were tested on the following parameters: pH, turbidity, hardness, chloride, alkalinity, residual chlorine, iron, nitrate, fluoride and bacteriological characteristics.

pH:

pH is a unit used to measure the nature of water such as its acidity and alkalinity. pH is the negative logarithm of Hydrogen ion concentration.

The pH scale ranges from 0 to 14. Neutral water has a pH of 7. Acidic water has a pH below 7 and alkaline water has a pH above 7.

Raw water has a pH between 6.5 and 8.5.

Turbidity

Turbidity is a measure of the transparency of water. It indicates the presence of mud, silt, organic matter, vegetation, micro-organisms or other insoluble substances in water, which makes the water appear non-transparent. The admissible limit is 0-5 NTU.

Hardness

Hardness is the ability of water to produce lather with soap. Water having hardness between the range of 0-75 is soft, 75- 150 is moderately hard, 150- 200 is hard and above 300 is very hard. Drinking water ought to be moderately hard.

Chloride

Water dissolves when it comes into contact with soil and rocks that contain chloride containing minerals. Excess chloride makes the water taste salty, when present with sodium. While the BIS prescribes 250 mg/L as the desirable limit, the maximum allowable dosage is 1000 mg/L.

Alkalinity

It is the measure of the ability of water to donate OH ions or accept H ions or destroy acids. The required alkalinity of water is 200 mg/L while the permissible limit is 600 mg/L.

Residual Chlorine

Chlorine is added to water to sterilise drinking water. The chlorine remaining after complete sterilisation of water is residual chlorine. Residual chlorine in drinking water should generally not exceed 1.0 mg/liter.

Iron

Iron ranks as the second most abundant metal found on the earth. Iron is unstable in water supply and precipitates as iron hydroxide. The maximum permissible limit for iron content in water is 1.0 mg/L.

High iron values can lead staining of clothes and utensils as well as a metallic taste and bad smell. Unwanted iron can also cause bacterial growth.

Nitrate

Nitrate can be present in water due to natural sources such as nitrate-rich soil and rocks or nitrogen-fixing bacteria or due to man-made sources such as fertilisers or manure used in

agriculture as well as from domestic sewerage. The maximum permissible limit according to BIS is 45 mg/L.

Fluoride

Presence of Fluoride can be both beneficial and harmful, based on the levels on which it is present. The maximum acceptable dose in water is 1.5 mg/L.

Prolonged consumption high fluoride water can lead to dental and skeletal fluorosis.

Bacteriological Sampling

Bacteriological examination is a process used to detect and quantify microorganisms, such as bacteria, in various types of samples like water, food, or biological specimens. It is crucial for monitoring public health, ensuring water and food safety, and diagnosing infections.

It determines the presence of pathogens such as Escherichia coli (E. coli), coliform bacteria, or other harmful microbes in drinking water.

The results of a bacteriological examination for water samples collected in sterile bottles typically focus on detecting bacterial contamination and determining whether the water is safe for consumption.