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Perceptions of Potable Water in Rajasthan's Jodhpur and Barmer Districts

Melissa Spross
SIT Study Abroad

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Perceptions of Potable Water in Rajasthan's Jodhpur and Barmer Districts

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Abstract

This paper looks at differences and similarities in various populations' perceptions of safe drinking water (SDW) within Rajasthan (RJ), India, developing suggestions for future initiatives addressing the movement for safe drinking water for all. For this study, surveys were used; the survey was conducted in RJ, India, both in urban Jodhpur and in surrounding rural villages. To analyze the data, all the responses were entered into Excel format to discover patterns, themes and trends within four subtopics: access, storage, quality and cultural significance. The responses indicate that while a distinct water culture spans the geographic area, each different population retains perspectives and reports experiences unique to their specific socio-economic and geographic groupings. Greatest variance was seen in access between groups. Many reported being unsatisfied with their current water situation. Suggestions for addressing these inequities are discussed in the last section of the paper; Further action is needed on a larger scale to support target populations (TPs) and prevent further degradation of the environment, which is exacerbating issues surrounding SDW. It is necessary for governments to empower grass-roots intervention involving SDW as well as better address macro environmental concerns in order to be successful in this endeavor.

Keywords: safe drinking water, India, perceptions

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- I. United Nations (UN) Map of Global Water Stress and Scarcity, 2011
- II. Map of Jal Bhagirathi (JBF) Project Area within the Marwar Region of Rajasthan,
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Abbreviations

BHR: Basic Human Right

HDI: Human Development Index

INR: Indian Rupee

JBF: Jal Bhagirathi

LIG: Low Income Group

MDGs: Millennium Development Goals

MIG: Middle Income Group

MR: Marwar Region

NGO: Non-Governmental Organization

RJ: Rajasthan

SDW: Safe Drinking Water

TP: Target population

UDHR: Universal Declaration of Human Rights

UIG: Upper Income Group

UN: United Nations

UNICEF: United Nations Children's Fund

WHO: World Health Organization

Perceptions of Potable Water in Rajasthan's
Jodhpur and Barmer Districts

The declaration of safe drinking water as a human right is the establishment of a global standard. However, implications of this standard are both far reaching and may vary widely in practice between populations. In this paper, I will present and examine the various perceptions of safe drinking water (SDW) within Rajasthan's (RJ) Marwar Region (MR) in Northern India.

Water transcends mere physical definitions. Perhaps from its necessity to life has sprung great dread and respect of water. Revered and feared in history, even today it holds great significance in many religions and cultural traditions. It finds its way into symbolic rituals like Baptisms in Christianity and the washing of one's feet and hands before entering a temple.

As medicine and technology have advanced, the capacity to better monitor this life-giving and culturally meaningful substance has also grown. Additionally, international bodies have begun to look at Human Development Indexes (HDIs) as markers of the development of nations. Water, being a large determining factor in health of all kinds, whether mental, physical, emotional, spiritual, and that of identity, has thus come to the forefront of international attention in many regards. Accordingly, broad-scale investments for the improvement of health through access to SDW have increased.

Further, the global supply of SDW is dwindling. Decline in availability has been seen especially in nations bordering the equator, seen in Appendix I. Issues of inequitable water distribution and sanitation previously present in these nations is being exacerbated by dwindling water resources. Communities previously managing to subsist on meager

amounts of water now face a barren reality, settling for unsafe drinking water or none at all.

As these realizations were made and interventions begun, United Nations (UN) legislation established the access to safe drinking water as a BHR (United Nations, 2010). Even so, the situation continued to degrade. In efforts to galvanize participating nations into awareness and action, the Millennium Development Goals (MDGs) were set at the UN Geneva, Switzerland Conference of 2000. In all eight of the goals, the access to SDW was identified as a precondition for success.

The UN initiated supplementary campaigns to guide progress, including the international establishment of a "World Water Day", accompanied by various initiatives, such as "dedesertification". These small steps forward, as well as the post-2015 reiteration of the MDGs, report great success in not only bringing awareness to global SDW issues, but also in facilitating progress towards SDW for all.

To better guide the initiatives stemming from these goals, international standards for access and quality have been established. According to current joint World Health Organization (WHO)/United Nations International Children's Emergency Fund (UNICEF) reports, SDW is defined as "any water with microbial, chemical and physical characteristics that meet WHO guidelines or national standards on drinking water quality" (WHO/UNICEF 2014). The WHO guidelines mentioned give descriptions and suggested ranges of solute concentrations and composition, including pH and fluoride content (WHO, 2011).

Though these suggested standards create a foundation for a global expectation, nations participating in the above-mentioned initiatives take their own stances regarding SDW quality standards. The implementation of SDW programs remains a national affair.

The concept and issues surrounding water have always been central to the identity of the Indian subcontinent. The name "India" itself is derived from the presence of the Indus River. A large percentage of the Indian population, 80.5% according to the 2011 census, self-identify as Hindu and revere the Ganga River as a goddess. Technological innovations involving water began in India's first years as an independent nation, as Prime Minister Nehru attempted to modernize India through the use of hydroelectric dams.

Water scarcity in India, too, has consistently been a central issue. India has not escaped the global trend of increased water scarcity. According to recent studies, a trend in decreasing rainfall has been documented throughout the entirety of Northern India (Meena, 2015).

With this scarcity has come greater issue with water quality. Even with the Indian Government's setting national standards for quality of drinking water, the burden of water borne diseases in water-scarce areas remains of great concern. The UN reports that every year over one lakh people die from water-borne diseases in India. Cases of Typhoid and Malaria continue to flare up in rural villages, with little to no access to safe, government-monitored water supply (Anand, 2010).

In the 70s, UNICEF partnered with the Indian Government to increase SDW. Bore wells were used to increase access to upper level aquifers, a relatively quick answer

that seemingly improved the situation. National dependence on this method was thereby established, unsustainable as it was.

In time, the role of these wells in lowering the water table became apparent. Previously water-secure areas' traditional wells and ponds began to dry up. Even so, 80% of the India's water supply to this day comes from bore wells, and as of yet, the Indian government has placed no regulations on their drilling. Ongoing water security remains a great concern for millions of citizens who currently have no immediately viable alternative to quickly transition into more sustainable options.

Next to the issue of access is that of quality. Even the groundwater pumped out by these bore wells is sometimes not fit for drinking, in India. Issues of Fluoride contamination are growing concerns, as over time ingestion of high concentrations can degrade and damage the bones. Issues of Arsenic contamination of ground water are also prevalent. These are naturally occurring phenomenon, caused by the acidic pH of these water sources' leaching these solutes out of surrounding rock, the concentration increasing to dangerous levels over time (Modi 2012).

Additionally, contamination of water sources with pathogens persists, especially in rural areas with limited access to purification technologies. Throughout India and other areas of the world categorized as "developing nations", open defecation is commonplace. This unsanitary practice leads to further contamination of ground water and is a major contributor to water-borne disease. Latrines in these areas are neither easy to come by nor well maintained when they are present. Much of the Indian Government's funding towards SDW development now goes towards water quality testing labs, instead of measures of prevention.

While provision of better waste management technology is necessary, improvements in sanitation education have been used to approach this issue from a different angle. This has seen substantial success in combatting the spread of water borne-diseases in previously affected areas. The decentralizing of information into the villages through the use of Accredited Health Workers (ASHAs) and other Non-Government organization (NGO) equivalents makes a different kind of prevention accessible, while empowering these communities.

These more local outreaches align with modern, restructured Indian stances on water management, departing from the previous technology centered attempts. A more decentralized and educational approach, with equal monetary investment and maintenance commitment of the central government and involved communities, is being used to manage resources more effectively (Government of India, 2010)

The duties assigned to the government in this approach are allocated to ten different agencies directly involved in the maintenance of water. Each agency deals specifically with one topic, such as surface water depletion, river water quality, agriculturally related, rural, urban, etc. (WaterAid, 2015). Though this approach ensures many perspectives are taken and multiple approaches are accounted for, it also makes communication, consistency and cooperation difficult. The focus required to address the urgent Indian water issues is not optimally addressed with the current amount of decentralization.

What is more, private control of water rights on a national and international level is a growing obstacle to success in access to SDW for all. With the government's slow

progress, communities are left vulnerable and without suitable access to water. In this vulnerability, they turn to privatized sources.

Water distribution by private sources is most often through the use of water tanker trucks. Though the Indian government retains the right to monitor the quality of the water these trucks provide to paying customer, little else is regulated. The water is treated as a commodity and market product and prices fluctuate accordingly, putting farmers and low-income groups (LIGs) at risk. Additional issues of violence have been linked to these circles of water tanker hubs, referred to as the Water Mafia.

Mass produced packaged water, from companies such as Bisleri and Aquafina, also pose a problem. While these names are trusted to uphold quality standards, their success further monopolizes global SDW resources. The drain this has on water sources, as well as the creation of plastic waste, negatively impacts the environment, threatening future supply further (Shiva, 2002). While these market-based sources may serve to mitigate acute water scarcity, they are not a long-term sustainable solution for the Indian continent. Instead they serve to perpetuate and even exacerbate many of the SDW issues.

In the western Indian state of RJ, water quality and scarcity are a particular challenge. The most densely populated arid region in the world, much of the state is especially water scarce and drought prone. The title "Marwar Region" translates to "Land of Death", a derivative of the harsh, water-strained area's history. Now, with global and national scarcity growing, residents of RJ are further pressed for SDW.

The water distributed by the government, namely to cities such as Jodhpur and Udaipur, is typically supplemented from out of state sources. Beginning at the Ganges River, the Indira Gandhi Canal, constructed in 1988, brings water in from Punjab to

reservoirs such as Jodhpur's Lake Kilana. From here, the local government water works distribute the water via mainlines to the people. In no city in RJ is water abundant enough for daily provision, instead coming every two or three days for a few hours at a time.

While all major urban neighborhoods have mainline access to government-supplied water, urban LIGs and rural communities are more difficult to reach. Even those pipelines extending to rural villages are often in disrepair. The harsh environment and dispersed nature of the population make centralized government difficult, even with RJ's comparatively impressive highway system and infrastructure.

In the absence of a consistent, dependable supply from the government, citizens are turning to NGOs for assistance. Organizations, such as the Jal Bhagirathi Foundation (JBF), partner with the government as well as national and international agencies, to enhance traditional rainwater harvesting methods and provide communities with the resources necessary to improve their decentralized water provision sources. This is both in line with the government's own decentralization stances as well as an empowerment and affirmation of these areas' traditional water practices and wisdom.

JBF, in particular, works with funding from corporations such as WaterAid, to fund SDW and sanitation projects in partnering project villages. Both bodies pay half of the total cost. In this way, the community has stake in the project and reason to maintain and guard it. This empowerment of the community addresses challenges of community involvement, thereby ensuring upkeep of water projects, as seen in the JBF SDW Problem Tree in Appendix III.

This mimics traditional water source management of Sacred Groves, areas of cultural and religious significance to rural Indian communities. Though this practice

has been lost in many areas due to decades of dependency on UNICEF and centralized sources, these were once common source of biodiversity as well as SDW, communally maintained and guarded. The purity of the water was carefully monitored, as it was used for drinking, religious festivals and for the washing of village deities.

In the degradation of traditional practices, the absence of government supply, and diminished rainfall, access to SDW is the primary issue facing this region's populations. The subsequent daily consideration and ever-present thought of SDW has created a unique water culture in this area. Water is venerated in rural folk songs and holy days, such as Dev Jhulni Gyaras, Gyaras, Amavasya, and Poornima. A total of seven different names are given to rain, with the title given to the one first drop, 'hari', as an appeal to the gods. These practices and more have been documented by JBF on their website, at http://www.jalbhagirathi.org/water_culture.html.

In regards to the individual perspectives of the people of the MR themselves and their experiences with SDW, little is documented. The depth of its meaning to these target populations (TPs), as well as how this may differ between TPs, remains to be documented.

Purpose of Study

This study promises a better understanding of SDW within this region, as perceived by different people groups. Collecting and documenting the different perceptions of SDW within different TPs serves to document similarities and differences between these groups. This may serve as communication between the different parties living in this area. Awareness of issues and successes relating to, or affecting, findings should draw attention to disparities in the success of previous initiatives and inform

future legislation and initiatives in this area. Additionally, this study has the potential to generate information valuable to epidemiological, nutritional and sociological studies as well as tertiary care studies, pertaining to prevention of water-borne communicable diseases.

Research Questions

Issues of scarcity of drinking water globally and nationally are well known, as are those of water quality. Even so, previous studies have failed to record the individual perceptions and experiences relative to SDW. This study endeavors to fill this literature gap, specifically in Western RJ, by asking the question:

Do experiences with, perceptions of and standards for SDW differ among different populations in Rajasthan's Jodhpur and Barmer Districts?

The question follows: If so, how do they differ?

Within these questions, the following themes will also be investigated:

- How does the accessibility of SDW differ between the TPs?
- How do methods of and beliefs about SDW storage differ between the TPs?
- How do methods of and beliefs about SDW treatment differ between the TPs?
- How do personal, religious, and cultural significance of SDW differ between the TPs?

Logic for Chosen Location

Located within the MR of RJ's Thar Desert, the city of Jodhpur is an ideal location for studies relating to water scarcity and culture. Being the second largest city in

RJ, with a population of 3,687,165, according to the 2011 census, Jodhpur is home to a wide variety of different population groups of interest to this study. Within the city are various neighborhoods of varying populations: Chopasni Housing Board and the Old City as a mixed and middle income group (MIG) areas, Shastri Nagar as an UIG area, and various slums for lower income groups (LIGs).

The stationing of JBF's headquarters and governmental water plants in and nearby Jodhpur also provide incentive to conduct the study in this location, as much of RJ's water legislation and regulation take place here.

JBF itself continues to positively influence accessibility of water to rural communities in the MR. As such, this organization provides valuable insight into local water knowledge and practices as well as connections to this region that will greatly benefit this study. Similarly, infrastructure surrounding the city provides easy access to near-by rural communities of interest to the study. JBF's presence and connections in the rural Barmer villages of Champa Beri and Goliya Vidha make these rural locations both accessible and open to participation. JBF's program area encompasses both the Jodhpur and Barmer Districts, as seen in Appendix II.

Methodology

In this paper, data collected through surveys and observations will serve as the primary methodology. The survey will be conducted with both urban and rural populations, including subpopulations of class, caste, religion, age, and gender. Additional information will be obtained through observations of the above settings and will be used as complementary data to the findings of this survey.

Review of Literature

The inquiry *Perceptions of Potable Water in Rajasthan's Jodhpur and Barmer Districts* has been divided into three sections: first, International SDW, second, The Indian Government and SDW and third, RJ and SDW. Each section is further subdivided in related categories.

International Perspectives on SDW

In Shiva's book, *Water Wars: Privatization, Pollution, and Profit*, the issue of water scarcity and its implications for the health and the future of India and the world are explored. This work explores the inherent sacredness of water and its importance to all life while posing arguments against the privatization of water sources. Shiva argues for a decentralized approach for SDW access, reversing the current privatization trend.

A 2013 progress report on the MDGs stated:

“The prolonged global economic downturn and violent conflicts in recent years have exacerbated poverty, inequality and exclusion. Biodiversity loss, the degradation of water, dry lands and forests and the intensifying risks of climate change threaten to reverse our achievements to date and undermine any future gains” This report also commended nations for increasing access of SDW and sanitation to slum dwellers, but urged the need to increase efforts as both rapid urbanization and environmental degradation continue. It identified the cyclical nature of water issue in human and environmental health, and highlighted the need for improvement in this area. The environmental role of privatization and SDW is also reiterated here.

In 2013, the WHO and UNICEF Joint Monitoring Programme for Water Supply and Sanitation released the global update “Progress on Sanitation and Drinking Water” with all released statistics dating from 2011. Though a reported 89 % of the world's

population used improved-drinking water sources by this time, around 750 million did not, with 185 million still relying on surface water for daily drinking needs. The report defined an improved drinking-water source as “one that by the nature of its construction adequately protects the source from outside contamination, in particular from fecal matter.” This study gives context to India’s status of SDW and its relationship to sanitation in comparison with that of the world, again, drawing attention to barriers to SDW for all.

This goal itself was originated in Agenda number 48 in the UN’s 64th session, in July of 2010, determining safe and clean drinking water and sanitation as a basic human right. This was stated to be: “essential for the full enjoyment of life and all human rights;” further, this legislation calls on governments to provide funding and assistance to countries working towards this access for all and calls for an annual report on the topic to be filed. This signifies action must be taken in regards to the world status of SDW.

Ms. Catarina de Albuquerque, in her 2014 annual report on the state of the UN’s commitment to the HR to SDW and sanitation, urged the need for improved approaches. This report pointed out that all efforts for long-standing change would be futile should the underlying causes remain unaddressed. It was indicated that focus should be shifted to social and political inequalities, developing indicators to effectively measure improvement in these areas, in order for the HR to SDW and sanitation to be realized by all.

In 2013, WHO also published a paper, Water Quality and Health Strategy, taking five stances on the next generation of SDW initiatives. This document pledges to: “1. Obtain the most rigorous and relevant evidence on water quality and health 2. Provide up-to-date, harmonized water quality management guidelines and supporting resources 3.

Strengthen the capacity of Member States to most effectively manage water quality to protect public health 4. Facilitate implementation of water quality and health activities through partnerships and support to Member States and 5. Monitor the impact of these activities on policies and practice to more effectively inform decision making” It is an expression of WHO’s commitment to partnership between WHO and member nations such as India in continuing to address issues in SDW.

The fourth edition of the WHO guidelines for Drinking-water Quality offer both microbial and disinfection suggestions for the actual quality and treatment of water, as well as a framework for implementation. Additionally, the significance of each endeavor and of each microbial is explained and quantified. This is a concrete guideline available to member nations, setting a standards for what “SDW” quantifiably is.

Sanitation

In Wright, Gundry and Conroy’s 2004 Report, “Household drinking water in developing countries”, issues of water contamination between source and use were investigated. The findings, though varied in magnitude, showed that initiatives in improving sources of drinking water might be useless if transportation and storage methods are not also improved. Every sample out of the 57 studies done either remained the same or decreased in quality after storage. In half of the studies used in this comparative analysis, the fecal coliform concentration was significantly higher at the point of use than at the time of collection. A possible association with this is the practice of covering the water source and the cleanliness of vessels or hands being dipped into this water. In these findings, that more than access must be achieved for SDW to be a reality is apparent. Storage, as an aspect of SDW, must also be addressed, through education and awareness.

Indian Perspectives on SDW

As stated by the Indian government in the 2010 publication of the National Rural Drinking Water Programme:

“To increase economic productivity and improve public health, there is an urgent need to immediately enhance access to safe and adequate drinking water and Government should give highest priority to the meeting of this basic need for the most vulnerable and deprived sections of society.” This publication lays out detailed objectives and goals for this intervention, ultimately striving to “To provide every rural person with adequate safe water for drinking, cooking and other domestic basic needs on a sustainable basis. This basic requirement should meet minimum water quality standards and be readily and conveniently accessible at all times and in all situations.” To accomplish this, conjunctive use of water as well as a decentralized approach are to be used at both the state and federal levels of government. This is the current arrangement of the Indian Government in regards to SDW.

With the 2013 implementation of the *National Urban Health Mission Scheme*, detailed at the website: nrhm.gov.in, the health needs of the urban LIG were established as a special point of focus for future health legislation. This scheme took steps towards making primary health care services more available, as well as affordable, to these populations. This government scheme seeks to focus on the urban poor in ensuring access to health and health determinants, such as drinking water and sanitation. In order to do this, expansion of health care systems, partnerships with local NGOs and communities, public-private healthcare partnership, as well as adaptation of institutional management

are vehicles to this end. Improved access to SDW for the urban poor is included in this scheme, a target population (TP) of this study.

Within these Government stances and schemes, the need for specific standards is evident. The Indian Standard Specifications for Drinking Water, established in 1993, sets parameters for both Essential and Desirable Characteristics of SDW. Each aspect is identified with an associated acceptable range. A basis for this range is provided, and a top limit number is established for those cases when the recommended range cannot be met in the available water source. pH, color, odor, taste, turbidity, hardness, and content of iron and chlorides are categorized as essential measures, while others, such as fluoride and pesticide content, are considered desirable.

WaterAid has published a comprehensive background paper on SDW in India, detailing the progression of government stances as well as current organizational structure. The roles expected of the government and those expected of the communities are listed and explained in depth, providing insight into India's approach to SDW for all. Issues, approaches and solutions are posed and suggestions, such as the further integration of sanitation and education sectors, are made. This document gives an outside perspective on the Indian Government's organization and actions and is highly informative in the history of India and SDW. The value placed on SDW as a human right and as a goal for India is evident.

The 2015 study, "Long term trend analysis of mega cities in northern India using rainfall data" indicates unfavorable change for the Northern Indian climate. States, RJ included, were found to have substantially decreased rainfall magnitudes positively associated with the high land chance rate. As a traditional source of SDW for the villages

included in this study, rainwater is essential to the sustenance of rural villages in the MR.

A decrease in access to this source can be detrimental to their health, income and way of life. Even with reformed Government organization, this poses a new problem.

Sustainable interventions to prevent further environmental degradation are needed.

Author Syed Shabudeen, in a 2011 publication in the *Indian Journal of Science and Technology*, draws attention to the importance of climate change in India's future. The article points out the socio-economic implications climate change will have and calls for the adoption of preventative strategies. It was found that the average temperature in India is increasing. The impact further environmental degradation will have on water availability and subsequently human health and food availability are warned against, as well as an increase in unpredictable weather along the Coast of the Indian Ocean and flooding during monsoon seasons. This identifies a greater issue misuse of water sources has in perpetuating its own scarcity within the Indian subcontinent.

Even so, progress in SDW access in India has been seen in the past decade. The 2011 report, *India's Progress Towards Achieving the MDGs*, indicated that a low percentage of the country using basic sanitation, 28% in 2006, posed the greatest barrier towards SDW for all. It also suggested a great and growing challenge to both of these aspects of the MDGs lay in the current trend of rapid urbanization. Special attention is needed on the urban poor.

An article by Nerkar (2014), details the perceptions of Indian villagers as to the cause of their frequent sicknesses. Here, water scarcity is cited as the main reason for their physical, as well as mental and social, health. Association was seen not only with physical diseases, but also with migration, alcoholism and partner violence. These

findings allow personal experiences with SDW to reveal possible associations with societal and psychological issues, showing the importance of SDW in all areas of life. A significant source of stress associated with access to SDW in the MR highlights the needs to consider all implications of intervention, as well as the need to consider individual experiences and their validity in informing interventions. These issues, though still pertaining to access to SDW in TPs in India, differs markedly from the findings of the 2011 Report on MDG progress, showing how different TP require different interventions.

Rajasthan Perspectives on SDW

The RJ State Government's water supply, initiatives and organization are detailed on their website, <http://waterresources.rajasthan.gov.in>. Information is provided regarding cost of water per liter, as well as ways in which the government is attempting to conserve water. Explanations, in Hindi, and illustrations of various issues and solutions for RJ residents are also provided, such as irrigation techniques. In addition, the website provides an estimate of the minimum amount of water required for families of sizes 6, 7, 8, 9 and 10 for one day. This is split into cooking/drinking water, and an "other" category. No account is given for livestock. This serves as the baseline for Rajasthan SDW information as provided by the Government.

In the 2008 *Rajasthan Human Development Report*, a goal of halving the proportion of the population without access to SDW was established within the state of RJ. It was pointed out that accomplishing this goal would involve finding solutions to issues with extension of services across difficult terrain, a tight budget and discriminatory attitudes within Rajasthani society itself. The harsh environment of RJ makes this especially challenging in monitoring and providing water to rural villages.

Quality

Accordingly, disease outbreaks resulting from unsafe water in rural RJ villages are not rare. In response to a 2010 outbreak of typhoid in a rural village in western RJ, an investigation was conducted. The study found association between the outbreak and a local government water source's contamination with fecal material. Even when the government manage to supply water to the villages, quality is challenging to maintain. The people are put at risk in this way.

An article by Modi and Kumar, published in 2012, looks at characteristics of water sources contaminated with fluoride in Jodhpur, RJ. It was found that a basic pH was positively associated with the presence of fluoride, possibly due to his range of pH's effects on the rocks enclosing these aquifers.

Similarly, a 2006 article analyzing the quality of groundwater in Jodhpur, RJ, identified chemical influences on water quality. Sharma and Jain report the influence of pH, potassium, nitrate, and fluoride in determining this. Quality within the city limits of Jodhpur is just as much an issue as in rural areas, in different ways. The water is saline and dangerous in many areas. Provision of SDW is still easier accessed in this area than in villages, due to the proximity of water treatment plants and alternate sources of government supplied water.

In Nerkar's 2013 study, "Improvement in health and empowerment of families as a result of watershed management in a tribal area in India", antibiotic resistance in bacteria in rural water sources was investigated. A difference was seen in contamination of water and in resistance between those villages with and without watershed programs, with the former seeing less in both categories. This shows that different approaches must

be taken to provide SDW to villages than to urban areas. While out-of-state water provision and treatment plants seem to work for most urban residents with established access, watershed programs seem to have a more positive impact on rural areas. These TPs require different approaches to their similar, yet different SDW issues.

Results and Discussion

The questions used in the survey, available in Appendix IV, were designed to identify trends, themes, and patterns as well as to examine the similarities and differences found in different populations' perceptions of SDW. The compilation of the data from the survey contained both objective and subjective information with sufficient information to pull out themes and trends. The focus of this research was aimed towards discovering differences in perception of SDW and the extent to which these exist. To reinforce the objectives of this study, special emphasis in the survey questions was placed on four broad categories. The resulting data was then entered into Excel format to methodically present the patterns and themes for this qualitative approach. The following variances and similarities were found within these four categories:

Access

In this section of the survey, questions were asked regarding sources of SDW both in house and in public, frequency of access, cost, and satisfaction with access. Even agreeing on the magnitude of this issue, actual access varied greatly with geography and socioeconomic class. This section of the survey yielded the greatest variance in answers between the TPs.

Opening each survey with a series of questions directed at access to SDW was met, several times, with affirmations of the importance of this topic to this area. "Yes,

this is the main issue of this area,” remarked an elderly participant in the MIG, Chopasni area. Similar verbalizations were made by survey participants in a slum, an upper-class area and in the village, by men and women, young and old, alike.

MIG and UIG, from Chopasni, Shastri and the Old City, were most similar in their reported access to SDW. Government control ensured water provision on alternate days, during the winter. Summer months may delay access to every three days, at times. On these days, the water typically runs in the morning for 2-4 hours, at which time all storage vessels are cleaned and filled.

The source of water for both of these income groups is the mainline, connecting these neighborhoods to the Filter House, next to Lake Kilana. The lake itself is replenished by the Indira Gandhi Canal.

Both Shastri and Chopasni residents reported the use of water tanker trucks should government supply run out, but affirmed that this rarely happens. Over all, the upper castes and classes reported higher satisfaction with their current situation. Residents in the MIG area, Chopasni, brought up issues with water pressure and inconvenient timing of water such as at nighttime instead of the morning. Residents of the Shastri and Old City areas generally reported satisfaction with their current SDW situations.

In the Old City, a unique source of access is also available. While Chopasni and Shastri wholly depend on the government supply and supplementary tankers, Old City residents often partially rely on private wells.

Additionally, an unforeseen issue with water supply was discovered in the Old City neighborhoods of Jodhpur. Though receiving the same alternate day, approximately

3 hour supply year round, this area, and reportedly additional areas near the city center, actually struggle with excess water during monsoon season. During this time, nearby rainwater reserve lake, Ronni Sagar, overflows its walls and sweeps through the streets, damaging houses and shops.

It was reported that the government has made no provisions for this. Lacking pipelines to capture or direct the flow of the lake water rushing down the incline of the Old City area, the water remains on the streets. This yearly occurrence is a hazard for women and children out at the time and is a great expense for the people of these areas, often overlooked in the issues of water in Jodhpur.

Also interesting was the variance in cost of government-supplied water to each area, though frequency and access were the same. Monthly prices for water in Shastri Nagar averaged around 400 Indian Rupee (INR). Prices in Chopasni averaged around 100 INR. Prices in the Old City were around 75 INR. This is associated with the number of people living in the house, but even accounting for this; Shastri Nagar's high prices are far greater than would be expected. This difference may be due to larger houses and thus larger amounts of water needed to clean, or the ownership and maintenance of multiple cars, often washed in the driveways, as well as the presence of lawns and gardens requiring watering.

Additionally, the supplementing of private well water for government provided water in the Old City area could account for the lower bills in these families.

In surveying the urban LIG in one of Jodhpur's slums, the difference in access was most pronounced. These families had no concept of their ultimate SDW source, as they had no government supply connections and no income to purchase the water.

Instead, on the days water was supplied to nearby MIG homes, these families report going door-to-door and begging for water.

It was also mentioned by one survey participant that the water tankers used to supplement government provided water to MIG and UIG residents are typically driven by members of the working class often living in slums. This being so, the little water remaining in the tankers after depositing the majority to the paying customer is given to these communities.

Access in the rural villages of the BD, Champa Beri and Goliya Vidha, was also strikingly different. In these two villages, the government water tanks are not in working condition. All access to water for these areas comes from stored monsoon water, tankers, and wells.

The villagers surveyed reported that SDW from monsoon rainwater lasts their households 3-4 months out of the year. In the case of one survey participant, as many as 4 separate tanks are being used to collect and store as much rainwater as possible during this season. Still, issues exist with insufficient storage space. During monsoon, tanks often overflow with the rain for lack of sufficient space. In the summer, water is lost through evaporation, especially in uncovered structures.

Once the supply of rainwater has been depleted in these rural villages, tankers are brought from nearby villages, Koduka and Bharkarbar, priced at 1000 INR a tank, 2-3 times a month. This can amount to more than a third of the household income.

In addition to these sources, the women of one survey participant's household still walk 2.5 Km to the school well, free of cost, twice a day, once in the morning and once in

the evening. Here they water their sheep and goatherds, bringing back a pot of the water for the household via head loading¹.

Both villages included in this study are current project areas for JBF. Collaboration over improved size and design of these tankers, in order to hold and retain more rainwater, are ongoing.

Also of interest in these villages were the elder family members perceptions of declining SDW access via rainwater, over all. It was reported that, in the span of their lifetimes, they have seen less and less rain during the monsoon each year. One farmer insisted that the issue of access to SDW, now the foremost issue in these villages, was virtually a given. He stated that previously, monsoon rainwater lasted them much longer. When asked why he thought rainfall has decreased, he cited "man" as the physical cause. Whether or not this was aimed at man's degrading of the environment or of the increase in population and thus the lesser supply for individuals was unclear, but the spiritual was specifically excluded.

In addition to less rainfall, it was also suggested that the rain itself was becoming more and more unpredictable in its timing, causing issues with crops and with cleaning the tankers in time.

The issue of access to SDW in public spaces was also addressed in all TPs. All those surveyed indicated they had access to what they felt was adequate SDW at weddings and in restaurants. Several explained the modern trend in weddings to provide

¹ Head loading refers to a method of carrying water in a pot atop one's head, usually on top off a round cushion. This method is common in parts of India and Africa

bottled water, typically the brand Bisleri, to guests to ensure water safety and guest comfort. In both spaces, it was indicated that SDW was usually readily accessible.

The opinions on access to SDW within public spaces like markets and shopping centers varied more between individuals and TP. MIG survey participants mainly brought their own reusable bottles from home, otherwise buying plastic bottles while out.

The urban LIGs, instead, depended on “pay-as-you-can” water stations and temple supplies while out. Interestingly enough, the UIGs also professed to use the “pay-as-you-can” stations. These typically consist of a woman sitting along the road with a series of matkas and lotas, giving out water for donations.

In the Old City, as well as in passing temples during rickshaw rides, it was observed that some residents use temple hand-washing stations as quick drinking water sources while out and about, as well.

For rural villagers, the concept of bringing water when going out was foreign. One survey participant laughed and said the only time any house member brought water out with them was when they went to use the restroom outside: one liter for washing themselves, another for washing their hands.

Storage

For this section of the survey, questions were asked regarding methods of storage, place of storage, significance of these methods, and sanitation habits accompanying SDW storage. Storage methods for SDW across the different TPs was seen to be more continuous.

Within all MIG and UIG areas of Jodhpur surveyed, drinking water was kept in round clay pots, called a matka, covered by a plate of some sort and kept on a table or

counter in or near the kitchen. Water is most often retrieved from these matkas with a small silver or brass pot-like vessel, more often silver, referred to as a lota. Additional SDW, stored from the alternate days of government supply and used to fill the matkas once water runs out, is typically kept in large plastic or metal covered buckets on the floor.

Reasons cited for primarily using matkas to store SDW were their porous nature and ability to keep the water cool. The inherent cleanliness of keeping the SDW off of the floor and covered from particles that might fall in was also cited as significant in their storage habits. Some survey participants also stated the importance of washing one's hands before dipping the lota into the pot, to avoid unintentional contamination of the source.

The urban LIG also use matkas to store their water, though these were often seen outside of the house and on the ground. Most were covered with plates, these plates kept from blowing off via a weight or stone on top. In addition, some families covered their matkas with thick blankets.

When asked the significance behind their chosen location for their SDW, most of the LIG survey participants indicated they would prefer to keep their matkas in the house and off the ground, but did not have enough room to do so. They stated that keeping the matkas inside would keep the water cooler and cleaner, but settled for keeping them outside in the shade, as this is their only viable option. A few houses kept their matkas on tables and mentioned the importance of keeping them out of the reach of small children with dirty hands.

It was also observed that the LIG tend to have more matkas than the MIGs or UIGs, 2-5 in comparison with the middle and UIG 1-2. This could be a result of MIG and UIG ownership of large tanks to store water for those purposes aside from drinking, while many of the urban LIG made no distinction between SDW and water used for other purposes, and have no large tanks to store the water separately.

In the rural areas, matkas and lotas were also used for storage and retrieval of SDW. In the houses visited, the matkas were observed to be kept on the floor, often just outside of the house. Here they were kept on top of the small, round head cushions used by women during head load. Mixed responses were received as to whether or not SDW and water for other purposes were kept separate. One respondent drew very clear distinctions as to the tankers each was pulled from and the utensils used to retrieve the water from the tankers, while another made no distinction whatsoever.

Rural areas, too, tended to have more matkas than did MIG and upper income group (UIG) urban residents, possibly associated with the number of people in the household. This, too, could have been the equivalent of urban MIG residents keeping excess drinking water in metal buckets, simply different vessels. More MIGs and UIGs also appear to use buckets to store excess drinking water, whereas rural and urban LIGs do not.

In the time of cleaning the matkas themselves, each TP responded similarly: simply, once all the water in the matka had been used up. At this time, fresh water is used to rinse and wash before the pot is refilled. Some participants went even further, using a cloth and soap to scrub the inside before rinsing. Others specifically warned against any

scrubbing method, saying the aggravation could potentially close the pores in the clay pot, compromising the effectiveness of its cooling properties and taste benefits.

Quality

In this section of the survey, questions were asked regarding methods for cleaning SDW, concerns with quality of SDW, sources of this knowledge, and difference between SDW and water used for other tasks.

Methods used for the actual cleaning water for drinking varied, but did not appear to be associated with geography, class or caste. A variety of methods were used across the board.

One such method was the use of a filter; either hand-held and plastic or attached to the tap from which the government supplied water is supplied. In some instances, both methods were used. This was seen in Chopasni, Shastri and the Old City, as well as in the Jal Bhagirathi main office itself. Another method seen in all but the slum areas was the use of small white stone-like objects, called Fitkari. In swirling this around in the drinking water, larger dust and debris settles to the bottom of the pot and the top water is reportedly good for drinking. Perhaps most common is the use of a thick cotton cloth to filter the water. This is placed on top of the matka and the water is strained through. In UIG and MIG, Aquaguard, electronic filter machines kept in the kitchen, were used. Other, less widely used methods included bleach powder and boiling. Additionally, a few respondents did nothing at all to their water in terms of treatment before drinking.

In addition, when asked where these methods were learned, most respondents cited their parents or "tradition". Many even chuckled at the question itself, assuming it a given. In contrast, when the urban LIGs were asked, many cited very different sources of

knowledge. Most stated the techniques used for cleaning their drinking water were learned by observing how women in the nearby UIG and MIG houses cleaned their own water. Similar answers were reported regarding storage methods as well as religious practices involving water.

The more significant associations were found between the number of different methods used in a single household and income. Urban LIGs and rural used 0-1, MIG used 1-2, and the UIG respondents used 3. UIG households described a three-filter process of cleaning their drinking water, involving Purits and Aquaguards. In contrast, rural and LIGs reported using a cotton cloth, or simply a plastic filter similar to those used for straining chai seeds from their tea.

Along these same lines was worry over whether or not ingestion of bad water would make one sick. UIG and MIG respondents generally had the most worry over these issues, even with their increased standards and methods for cleaning their drinking water. Often included in response to this question was the addition of phrases such as, "we see it all the time in the paper" or "we saw on the news..." It is possible that a greater exposure to media coverage of the dangers of unsafe drinking water was more closely associated with worry about SDW.

A few MIG houses reported not usually worrying. It was reported that when the government water came out of the tap discolored and smelly, they simply boiled it and drank it without any complications.

In response to this same question, urban LIGs and rural populations often said they did not worry. Their reactions to questions of poor access had markedly more visible responses than to questions of poor quality.

When asked about their knowledge of the relationship between sanitation and SDW, respondents tended to have a basic understanding of the importance of hand washing as a bare minimum. The majority mentioned washing your hands before retrieving water from the matka and keeping your utensils clean and off the ground.

In middle and UIG houses, bathrooms of both western and Indian style are typical, usually more than one. Urban LIGs and rural residents, on the other hand, practice open defecation. Even those, like one of the farmers surveyed, with otherwise good sanitation habits have no access to toilets.

Initiatives by JBF in the provision of toilets within rural communities has seen success. Interest from families in Champa Beri and Goliya Vidha has also been seen and may be in future plans. Issues are that of funding for these projects as well as maintenance of the toilets themselves. There is also the issue of psychology in the use of toilets in these areas, as many individuals accustomed to open defecation find the switch to enclosed toilets a difficult one, opting to continue their traditional practices.

Some described the transition as difficult due to the feeling of being constrained. This enclosed feeling made it difficult for some to feel comfortable using the restroom. Others attributed it to the enclosed spaces' trapping of heat and smell. In this way, it was both uncomfortable and seemingly less sanitary. Initiatives in maintaining toilets to ensure continued sanitation are being taken by both the government and NGOs. Even so, these issues should be considered in the design and implementation of future waste management.

In the rural areas, groundwater tended to be saline. The farmers surveyed listed no specific qualms with the quality, but said they were not quite satisfied with the taste,

smell and color of the tanker, well and even rainwater. One UIG woman mentioned that urban weddings provided good water, while rural one's necessitated bringing one's own bottle, as the water provided was salty.

In terms of the actual quality of the water sources in the Jodhpur and Barmer Districts, many survey participants across the board in economic classes and geography had qualms. In Jodhpur proper, individuals referred to the water as grainy and hard. Those women either married into the region or visiting after having moved away claimed the water quality damaged their hair.

Cultural Significance

In this section of the survey, questions were asked regarding health practices regarding water, religious significance of water and the continuity of these beliefs and practices across familial generations. It was observed that families in the MR of Jodhpur had specific health and religious practices regarding water that appeared to transcend all distinctions between the TP, though depth of knowledge about these practices varied.

On multiple occasions, families warned against the drinking of cold water after coming in from the heat or while sweating, lest one catch a cold. These individuals stated this as if common knowledge, some going further to analyze why this might be. Many concluded that this Rajasthani health lore stemmed from the temperature change's effects on the body, similar to how the change from one season to another makes people sick. This tradition spanned all geographic and economic differences in the area.

Additional health and beauty lore pertaining to SDW was observed in the drinking of chai with survey participants. It was said that one should not drink water immediately after drinking chai. This was the case in rural, MIG and UIG houses. Some cited the same

temperature change issue for this lore, while others attributed it to beauty. One UIG family insisted that drinking water just after drinking chai turns one's teeth yellow.

At dinner with a Jodhpur family, it was brought up that one should not drink water while eating, instead waiting 15 minutes. This was attributed to digestion. Any kind of drink at a meal was rarely seen. Only after finishing and sitting for a while would family members get up to fill their glass from the matka or from refrigerated bottles.

Though chances for this type of observation were not common, it was observed that any foreigners in the house, even those from different states in India, took water with their food. A larger investigation into these health and beauty lore would need to be conducted to establish the uniqueness of these practices to this area. These may very well extend beyond the MR, as the period and berth of my study did not allow time or resources for this.

In addition, the survey included questions regarding the religious significance of water in the Rajasthani culture. Elaboration on these questions was only found from Hindi participants. Few participants of other religions reported religious use of water at all. Even within the Hindu population, detailed answers were only given by MIG and UIG. While it was originally assumed that specific practices would vary by caste and location, much of the answers pertained to overarching themes within Hinduism.

Many made reference to the great Ganga River and its status as many goddesses in Hinduism, or otherwise descended from the gods. Other instances included the compulsory monthly participation in cleaning the temple with water, specifically within the MIG Chopasni area. It was observed that some practicing Hindus used water as an

offering in their prayers, taking a copper pot from the matka, raising it to the sky, and pouring it out onto the ground.

Besides these instances, one respondent went into detail regarding the importance of water in all Hindu rituals from birth to death. There is the significance of the first bath, the taking of water in one's marriage and the desire to hold funerals and cremations near bodies of water.

In rural villages, little was said of religion and water. The urban LIGs, too, had little to say regarding the subject. Urban LIGs responded only about the presence of sinks and tanks outside of the temples, used for washing hands and feet before entering. Many stated they got water from these sources when away from their homes. Many of the slum residents also reported never having personally been inside a temple.

Additionally, the Muslims surveyed, as well as those not included in the survey but observed, stated that Islam attributes no special significance to water. One respondent stated that the only thing necessary in Islam was to sit down when drinking, and take the water of one lota in 3 drinks. When asked the significance of this, the individual responded, "there is no significance. This is just what you do in Islam."

The Christian population of the region was markedly underrepresented in the surveys found. Significance for Indian Christians in this area included water used for baptism and the Catholic belief in holy water, but there was no opportunity to investigate these beliefs and others more fully.

Differences expected in women and men, in all four categories of questions, did not seem to be significant, as the perceptions of water were generally family-wide issues,

involving all house members. In addition, differences in caste were difficult to measure, as many LIG declined to identify with a caste.

Limitations

As with any study, there were a few limitations to my research. While 26 are a moderate number of participants in the survey, this was necessitated by the timeframe of the study. The skewed numbers of surveyed individuals per each TP poses a similar issue in underrepresenting the views of these areas. Time and limited knowledge of the city upon arrival are the cause of this. Water scarcity and the subsequent limited access to safe drinking water are issues faced throughout the entirety of RJ's MR. Accordingly; this sample size cannot truly convey the entire populations' perceptions. Surveys also proved a challenge due to the Hindi-English language barrier. Undoubtedly, some depth of meaning could have been lost even with the use of a translator and interpreter.

Conclusions and Future Study

This study revealed that TPs' perceptions regarding access, storage, quality and cultural significance surrounding SDW in RJ's Jodhpur and Barmer Districts differ in many significant ways. Geography and income played the largest roles in contributing to these outcomes. There were also similarities that carried over between TP, such as regional health lore and religious practices, though even slight variations on these were discovered between the different populations. While the MR shares many broad water issues, each TP has unique successes and failures that effect their perception of their SDW situation. Future SDW legislation should consider these differences in improving SDW access and quality.

Access for the rural and urban LIGs was especially pressing, but in different ways. While rural dealt with storage and cost issues, urban dealt with access to any supply. This reveals the need for different approaches for different populations in SDW legislation. Varied methods are needed to effectively address these different SDW realities. These findings implicate the best approach to resolving India's SDW issues lies in partnership with communities and NGOs, addressing needs from a bottom-up approach. The consolidation of water management within the government could allow more efficient cooperation between the government and external groups.

The little known and discussed about sanitation and SDW identifies an area in need of improvement in government education. That rural participants seemed to know more than many urban may have been due to the success of ASHAs, only present in rural villages, and of JBF. The urban LIG, especially, are in need of better information regarding sanitation and SDW. Efforts at addressing the urban LIG's health can be better executed through Government SDW and City Planning department collaboration. The use of ASHAs in these communities, or an equivalent, may also be beneficial in improving issues of sanitation and SDW.

Further research into this topic would be beneficial in documenting the similarities and differences in this area and other areas of India. A comparative study between issues of drought prone areas and water rich areas would yield some insight into the challenges faced by the Indian government. Additional research could be done in RJ, furthering this study and expanding the TP to include more districts and ranges. Further research could also look more closely at relationships between caste and gender and

perceptions regarding water in this region, as these issues were not fully explored in this study.

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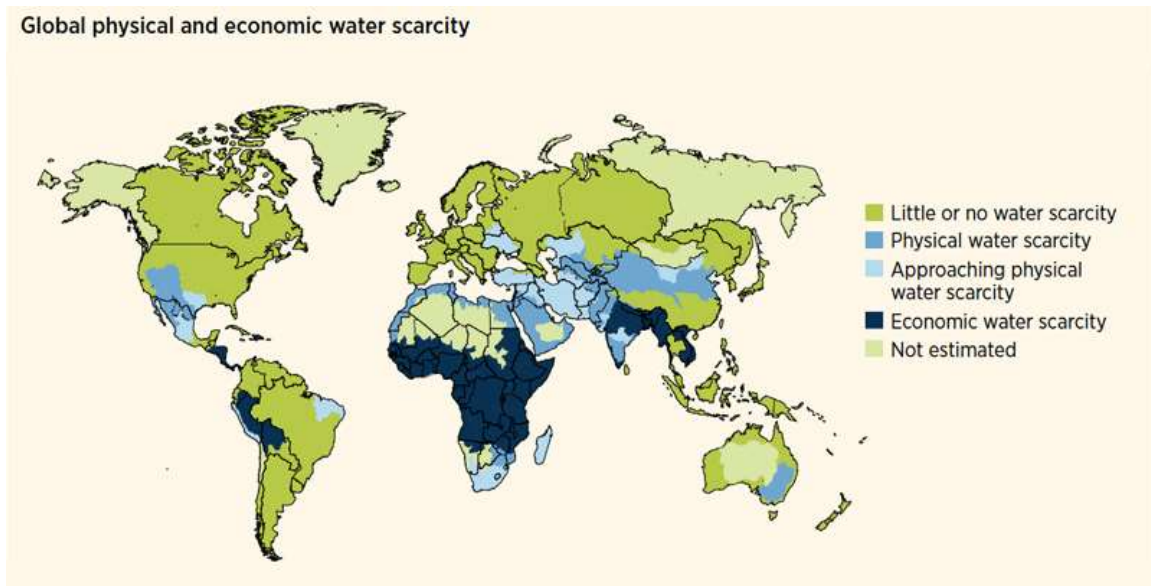
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Appendix I:

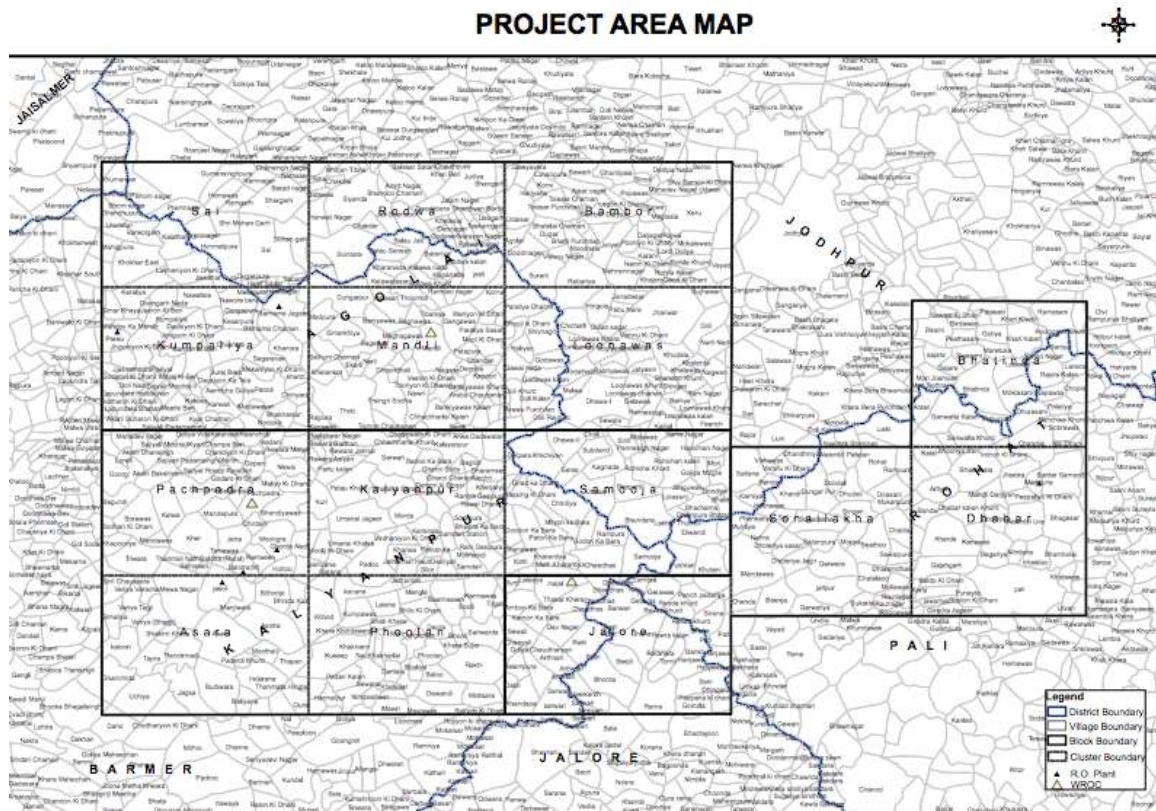
Global Water Stress and Scarcity, 2011



Note: retrieved from <http://www.un.org/waterforlifedecade/scarcity.shtml>

Appendix II:

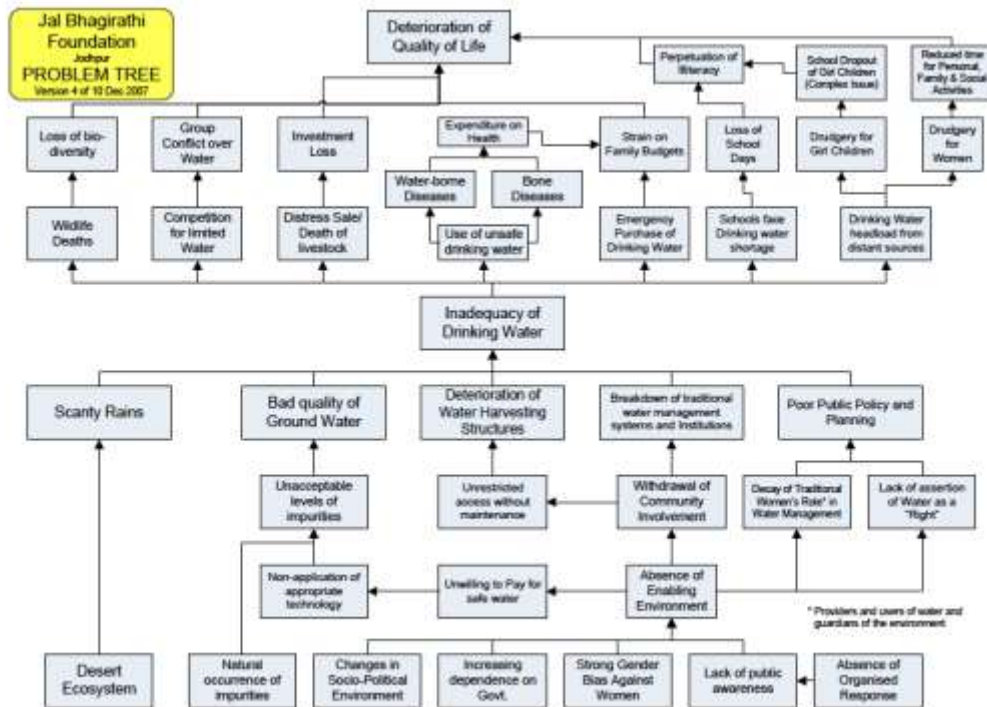
JBF Project Area within the Marwar Region of Rajasthan, India's Thar Desert



Note: retrieved from http://www.jalbhagirathi.org/project_area.html

Appendix III:

JBF Water Quality Problem Tree



Note: retrieved from http://www.jalbhagirathi.org/water_culture.html

Appendix IV:

Survey Questions

1. Name
2. Age
3. Origin
4. Caste
5. Education level
6. # Of people living in house
7. Religion

I. ACCESS

1. Where does your water come from?
2. What is the source of this water?
3. How much does water cost you per month?
4. How often do you get water?
5. How long does the water come?
6. If you run out of this water, what do you do?
7. Are you satisfied with your access to SDW? If not, what is your ideal situation?
8. When you go to market, wedding or a restaurant, where do you get your drinking water?

II. STORAGE

1. How do you store your drinking water?
2. Where do you keep this?
3. Does it matter how and where you store your drinking water? Why?
4. How do you get your drinking water out of the storage container?
5. Where did you learn these techniques?
6. How and when do you clean the container?

III. QUALITY

1. How do you clean your drinking water?
2. Where did you learn these methods?

3. What do you know about the relationship between sanitation and SDW?
4. Do you use drinking water and washing water differently? If so, how?
5. Do you worry about getting sick from drinking unsafe water? If so, what precautions do you take?

IV. CULTURAL SIGNIFICANCE

1. Do you know of any health traditions involving water? If so, what are they and why do you think they exist?
2. Do you use water in your religion? How?
3. Where did you learn this?
4. Do your parents, grandparents and children do this the same way?

PERCEPTIONS OF POTABLE WATER IN RAJASTHAN'S JODHPUR AND BARMER DISTRICTS

53

I. Chopasni Housing Board

Survey ID #	1	2	3	4	5	6	7	8	9	10
Gender	F	F	F	F	F	M	M	F	M	F
Age	49	34	24	54	50	22	52	26	37	52
Caste	Mathur	Brahmin	Jain	Mathur	Mathur	Soni	Hindu	Soni	Soni	Gurjar
Education	Masters	Masters	Some college	12th standard	Bachelors	Bachelors	Masters	Bachelors	9th standard	Masters
# In house	2	3	3	2	6	5	4	7	5	7
Religion	Hindu	Hindu	Hindu	Hindu	Hindu	Hindu	Hindu	Hindu	Hindu	Hindu
ACCESS										
Where does your water come from?	Kilana (lake)	Gov. water department	Gov. water department	Mainline	Kilana (lake)	Kilana	House filter	Filter	Tap	Kilana, jawai bandh
What is the source of this water?	The canal	Gov. water department	Indira Gandhi Canal	Lake	Kilana	Kilana	Filter	Pipes		Kilana
How much does water cost you per month?	230	230	300	200	200	250-300	188	100	100	350
How often do you get water?	Alternate days	Alternate days	The water comes every other day	Alternate days	On the one day it comes and the next it does not	Every other day	Alternate days	One day and then not the next and then it comes again the next day	Every 2 days	Alternate days
How long does the water come?	The water comes out of the pipes for 3-4 hours	3-4 hours		About 3 hours, sometimes 4	3-4 hours	I don't know	It comes for 2 hours	2-3 hours	1500 L	3 and a half hours, but in summer, the amount of water coming is low because more people want more water, the use is more.
If you run out of this water, what do you do?	We use water from the underground tank	We don't run out because we have more water stored in the tank and in vessels	We don't run out. We store enough to not run out.	If we run out we pay a water tanker to bring water	We use the water stored in our tank	Our water tank has extra water	We pay for a tanker to come	We have a tank with excess water that we use	We use a hand pump or sometimes we will have a tanker come	
Are you satisfied with your access to SDW? What is your ideal situation?	Yes	Sometimes yes and sometimes no. We want a more consistent supply.	We are satisfied with their supply, but we want better water quality. Sometimes it comes out discolored.	Yes, we are satisfied	We are very unsatisfied. We want the water to be available all day. The alternate days for a few hours is not good.	We would like more water to be available that is our ideal.	No. The water pressure here is bad. We want it to be higher.	Yes, but the timing could be better. Sometimes the water comes at night and we have to take care of that instead of doing other things.	If we get water from any other place then we keep it	
When you go to market, weddings or restaurants, where do you get your drinking water?	We take from home for market; we do not take water from home for weddings, but we do purchase Bisleri in Rest.	We bring from home when we go to market; we drink water from wedding/rest;	We bring our own bottles; in rest., we only drink water from ISI marked ones. At marriage we drink the water there	We take water with us; no, they have clean water at rest. and weddings	Yes, we bring it from home;	From home for market; we get packaged water at weddings and rest.	No; we drink water there	Yes, we take bottles; in weddings, we drink water there from bottles. For restaurant we take bottles with us		For shopping we take water with us in water bottles; water at weddings is purified and good quality so we do not take then.
Remarks										
STORAGE										
How do you store your	Matka and purit	Vessels	We keep in a water can	We have a tank and matkas	Matka	It goes in the water tank and	Matka	Its in the pot	In matkas	We have matka

drinking water?						drinking water is kept in the pots				
Where do you keep this?	It's in the main hall	We keep it outside the kitchen	Its in the kitchen	Our tank is outside.	Behind the kitchen on the table	We keep them near the kitchen off the ground	Off the ground	In the kitchen	Kitchen	Clean place, inside house. The rest is kept in water tank outside.
Does it matter how and where you store your drinking water? Why?	No	Inside only	Yes, affects quality		Yes, you must keep it in matkas inside the house to keep it cool	You should keep it out of the reach of children	Its better to keep inside	Its important to separate the drinking water from the other water		Can't keep clean water outside, otherwise the germs and bacteria will contaminate it
How do you get your drinking water out of the storage container?	Lota	Lota	We use a water can	Lota or glass	Purify it with filter	Vessels	Matka	The lota or the glass	Matka	A clean barti or clean matka
Where did you learn these techniques?	I learned from my mom and dad	From my parents and it's traditional	Mom	Parents	From my mom	It's traditional	My parents	Parents and culture	My mom and dad	Mother
How and when do you clean the container?	We use bleach powder when the water comes	We rinse it with water only, otherwise the cloth and soap will damage the pot	We only use water when it comes	We clean it by water			With water, at the time the water comes	When it is empty, we clean it	We use bleach powder and cloth	We clean the utensils for drinking water purposes in the evening when the water comes. We wash it with washing powder.
Remarks			Access to water is the most important thing here				It is good that you are asking these questions. Water is the main worry in Jodhpur.			
QUALITY										
How do you clean your drinking water?	We use the purit filter	Bleach powder	We boil it 2 or 3 times	Plastic hand-held filter	We put thick cotton cloth and pour the water through, into the matka	The water that comes is already purified, but we also have purit	We use purit	Filterkury	Plastic filter	Aquaguard machine. We prefer from thick cloth.
Where did you learn these methods?	The same	It is what my mother did	My mom	Mom	Parents	My mother did this	I learned from my elders	It is traditional		Elders
What do you know about the relationship between sanitation and SDW?	You have to wash your hands before getting the water, otherwise you will get sick		Cleaning very important for health	You should wash your hands	No, I don't know	If you drink bad water, you will get sick	Necessary for good health	Drink clean water, dirty water has germs and makes you sick		We keep the drinking water in a clean place to keep germs and bacteria from here.
Do you use drinking water and washing water differently? If so, how?		We keep them separate	Very different for drinking and washing; leftover drinking used for washing	One is clean and one has germs	Purified water is for drinking, recycled cant be used for drinking	They are as different as day and night, purified not up to mark for recycled water	Both can be used for cleaning, but dirty water is use for washing only	Both are same		We keep them separate.
Do you worry about getting sick from drinking unsafe water? If so, what precautions do you take?	Yes	Yes, and we take precautions	We are worried about media stories of drinking water at own risk. We clean our water. But we still worry.	No because we use a filtered water	No, because it is filtered	Not much, because our water is filtered.	No	No, but the color is yellow and when it is they filter it and make it pure	We do not drink the water in the tank outside because it is harmful for us	Yes, we must purify the water or we will get sick

Remarks										Water is essential to life because a man cannot live without it
CULTURAL SIGNIFICANCE										
Do you know of any health traditions involving water? If so, what are they and why do you think they exist?	Not putting hands in drinking water, and also we do not drink cold water after coming from the sun	Don't put hands in water, vessels should be clean, wash hands before drinking, touching vessels or food	If water is good, don't drink or you'll get sick	Before taking water we wash our hands. You should not drink cold water when you come in from the sun.	Don't drink cold water after coming in from sun	We don't drink rain water, it's dirty	Keep drinking water vessels closed and don't drink dirty water	If you don't drink enough you'll get sick	Water comes in the festivals holi diwall	We will become sick if we drink impure water, Do not drink cold water when you are sweating or you will get cough.
Do you use water in your religion? How?	Yes its important	Yes	Yes, we respect water in the temple. We wash our hands and feet.	You have to use water in every culture, though	Yes	Yes, we treat water as gods/goddesses of Ganga	Yes because it is necessary for survival	yes, house warming; pooja, local gungoor festival, ganga		From ancient times it is coming that water is like a god. We worship water in Hindu culture and it is the life of human beings.
Where did you learn this?	My parents	My parents and tradition		Mom	My mom and dad	I learned from my elders	Yes	From my parents		Tradition
Do your parents, grandparents and children do this the same way?	Yes	Yes		Yes	Yes	Yes	Yes	Yes	Yes	Yes
Remarks			Water is important for all because it is life						These are a lot of questions.	

II. Slum

Survey ID #	11	12	13	14	15	16	17
Gender	F	F	F	F	F	M	F
Age	No answer	20			Declined to answer		35
Caste	Muslim	Hindu	Hindu		"	Hindu	Hindu
Education	None	None			"	None	None
# In house	30	10	5		"	5	6
Religion	Muslim	Hindu	Hindu		"	Hindu	Hindu
ACCESS	Tanker						
Where does your water come from?	Kilana	Nearby houses	Nearby houses only		Kilana lake	We get our water from nearby houses	We are requesting tanker owners to fill one or two matkas. If they are giving its okay, otherwise we are taking from nearby houses.
What is the source of this water?		Houses	Houses			Kilana	Houses
How much does water cost you per month?		Free	Free			Free	Free
How often do you get water?	After one day the water comes	Alternate day	Alternate days			Alternate days	Alternate days only, when water

							is coming
How long does the water come?	Every 4 hours	Depends on the house and how much they are giving	3-4 hours			Depends upon the houses giving water	We don't know
If you run out of this water, what do you do?	If it does not come we bring from the water tanker	We are taking water from tanker or we are going house to house	We are begging water from houses		We do nothing; we just do not have water. We sit like an idol. We will not take bath.	If one house says no we go to other house	We are taking water from houses
Are you satisfied with your access to SDW? What is your ideal situation?		Not satisfied	Yes, we are satisfied.	No, we don't have enough to bathe and we don't have much to drink so its not sufficient for us		Dissatisfied, we don't have government supply	No we are not satisfied, we are begin water from peoples
When you go to market, weddings or restaurants, where do you get your drinking water?	We do not take to any functions because the water there is purified	They're only at photo. Some people keep pots there and give one glass to everyone and according to wish the drinker give money. 1 Rs-10Rs;	Yes we are taking water to market; in marriages, we are getting water from tube wells	We take water along with us when we go to market. We take water where we get the water in between, any sources that are there.	No we don't take to market, if we find any source there or in between we take from there. For marriages, we get water from a water tanker	We get water there; we are getting water either from tankers or from tube well and take to the weddings. It's not so much clean but we are drinking that water	Phiyo is there at market; tube well is there in marriages
Remarks							
STORAGE							
How do you store your drinking water?	Matka	Matka	Matka	Matka	We keep in a mutkee	Matka	Pots, matka
Where do you keep this?	On steel rack	Outside	Outside, off the ground	In a clean place. We keep it outside because we don't have enough place to keep it inside.		Outside on the ground	Outside
Does it matter how and where you store your drinking water? Why?	Elders	If we want cold water, we are keeping inside or in the shade. Outside means it will get hot water only. But we don't have enough space in our house, so we keep it outside.	Yes, because we don't have space inside.	First we fill it in a bucket and then we pore it in a matka		No it doesn't matter	Yes, outside because space problem is there
How do you get your drinking water out of the storage container?	We use balti or matka to fill in the drinking water	Glass or lota	Lota or glass			We use a glass or lota	Matka
Where did you learn these techniques?		Ourselves we know, from tradition	Tradition		Elders	Traditional	Parents
How and when do you clean the container?	We clean from washing powder or any other clean cloth. We clean the vessels.	When we are taking water from the houses, there only are we cleaning	Alternate day, when water is coming, I am cleaning the pot with cotton cloth	We clean the vessel from the clean cloth.	We keep the vessels clean so that the water is purified and safe for drinking	When it will get empty, we clean with cotton cloth	We are washing this matka with hands by water when alternate day water is coming
Remarks							
QUALITY							
How do you clean your drinking water?	Thick cloth	By thick cotton cloth	By filter	We use a clean cloth for purifying the water for drinking.	We keep it in a clean way and vessel and we purify it with a clean cloth	We use the plastic filter	Plastic filter
Where did you learn these		By seeing you people, nearby	Parents		We have learned from good	Parents	Parents

methods?		houses			families, rich families only		
What do you know about the relationship between sanitation and SDW?	Water bottle, safe water is there					It is necessary for our health issues, otherwise we will get ill	It's compulsory that we have to drink safe water; if we drink bad water with dust particles and stuff we will get sick from that. So always we have to filter the water, otherwise we will get different diseases. We do not clean the floors with water because we don't have permanent houses, we use a broom.
Do you use drinking water and washing water differently? If so, how?		yes, by drinking we come to know if this is good or bad water and if the bad water if there we use that water for washing clothes	yes, we throw dirty water out	We take the unclean water for any other purpose, for washing or anything besides drinking		Yes, the one is for drinking the other is for washing clothes and then we throw that out. We won't drink that water.	Yes, we are using differently. If we are drinking dirty water we are getting diseases, but if we don't have another option we will filter that water again and again and then we will drink
Do you worry about getting sick from drinking unsafe water? If so, what precautions do you take?	We worry about getting fever from drinking bad water, we keep clean water from drinking and use germ-free water	Yes, if we're coming from the sun and we drink water we get cold and cough	Yes, we always keep our pits up from the floor and cover it so that the children don't put their hands in it	We keep it closed with any other thing so that any bacteria may not go inside the matka.	Yes, I worry about this thing	We have tension of getting sick, if we get sick we go to the hospital for the doctor	If we are drinking dirty water we are getting diseases, but if we don't have another option we will filter that water again and again and then we will drink. We always cover drinking water and we are not putting hands in that
Remarks							
CULTURAL SIGNIFICANCE							
Do you know of any health traditions involving water? If so, what are they and why do you think they exist?		No	When we come from the sun, we don't have to drink water. We sit for 2 minutes, after that we have to drink water.		We don't drink water after coming from sunlight	When we're coming from the sun we don't have to drink so much cold. We don't have to drink so much cold water and so much hot water. We have to drink the middle.	We don't have habit of drinking cold water, so we are drinking normal water only. If we drink that cold water we get ill, even at phiyo (free of cost).
Do you use water in your religion? How?		We see the a big cement watertank just outside the temple for washing hands and feet before entering, and the tap at the temple	I don't know, but water is very important for living	Yes, we worship the water in the temples also.	In Hindu culture its necessary to worship and pray for the water, because in Hindu temples we serve water to the god	Yes we are using but in Hindu tradition. In temples we are seeing water in tap for hand washing and drinking.	No, we don't know about this thing. We never go inside the temple; we are just seeing the outside only.

Where did you learn this?		We have seen so many temples nearby	Normally, we learn from our parents	I have learned from my mother and father	We have learned from your elders	We have seen these things at the temples	
Do your parents, grandparents and children do this the same way?		Yes	For elders, for children even they learn these things from their teachers also	Daughter gets information from teacher nearby house when she studies		Yes	
Remarks							

III. Old City

Survey ID #	18	19	20	21
Gender	F	F	M	F
Age	52	18	73	73
Caste		Brahmin		Brahmin
Education	10th	Current student		Illiterate
# In house	4	4	5	12
Religion	Hindu	Hindu	Hindu	Hindu
ACCESS				
Where does your water come from?	Kilana	Tap	Kilana, then filter house, then mainline	Well
What is the source of this water?	Gandhi Nahar (canal)	Kilana		Kilana
How much does water cost you per month?	85	56		75
How often do you get water?	Usually alternate days, but now, in summer, the water is coming every third day	Alternate days	Alternate days	Alternate days
How long does the water come?		Full day		2-3, we can't depend on it
If you run out of this water, what do you do?		We always fill vessels, buckets and all so we don't run out	We are filling all vessels and we have tanks, even after that we have a private well, so we are bringing water from well also. We use well water for bathing and all. Drinking water we take from mainline.	Nothing, we can't do anything
Are you satisfied with your access to SDW? What is your ideal situation?	No	Yes we are satisfied	Yes we are satisfied	Yes we are satisfied
When you go to market, weddings or restaurants, where do you get your drinking water?	We are purchasing mineral water	We don't take it with us; they have mineral water there		No, we don't take it with us. At wedding, we will drink whatever is there.
Remarks				
STORAGE				
How do you store your drinking water?	Matka	Matka	In matka	Matka
Where do you keep this?	Inside, behind the kitchen on top of the bar	Near the kitchen, off the ground	Near the kitchen off the ground	Outside the kitchen in parinda (separate place for drinking water)
Does it matter how and where you store your drinking water? Why?		Yes		Yes, outside.
How do you get your drinking water out of the storage container?	Glass	balti or matka	Lota	Matka
Where did you learn these techniques?		Mom	Traditional	Elders
How and when do you clean the container?		We are cleaning vessels with our hands with soap	When water comes	By cotton cloth we are washing that
Remarks			We keep a matka in every room, except the kitchen	
QUALITY				

How do you clean your drinking water?	We use a plastic, aquaguard filter	Plastic filter	We use plastic filter and we have electronic filter also	Plastic filter we are using
Where did you learn these methods?		Mom	Parents	Parents
What do you know about the relationship between sanitation and SDW?	If you are not drinking pure water then we get ill, and if you are drinking bad water various disease like pneumonia will be spread			SDW is very necessary. If we don't have this, we will suffer from various diseases.
Do you use drinking water and washing water differently? If so, how?	"	Yes, we know the difference between the two. Clean water we use for drinking, and bad we do not use.		SDW we are bringing from wells because that is pure water. Normal water is for washing vessels and clothes and we use tap for that.
Do you worry about getting sick from drinking unsafe water? If so, what precautions do you take?		No		We are not drinking water from tap, only from the wells we never put dirty hands in SDW
Remarks				
CULTURAL SIGNIFICANCE				
Do you know of any health traditions involving water? If so, what are they and why do you think they exist?		We have to drink water all times, because drinking water is good for health		Whenever we come outside, our body gets very hot from the sun and our temperature becomes high. At that time, we should not drink water.
Do you use water in your religion? How?		I don't know	We are bringing from wells and we use that for god, for praying and for bathing the gods, because that water is very pure	Yes, it is there. It is necessary.
Where did you learn this?		Mom		Parents
Do your parents, grandparents and children do this the same way?		Yes		Yes
Remarks	In July and August, monsoon comes. Not so much flooding comes here, though.	Everything is good here, we don't have floods.	Flood is not there. In the rain, water is coming and it goes from this road to Jalori gate. There are no separate pipes for the rainwater, so it goes on the road.	No flood is coming here

IV. Shastri Nagar

Survey ID #	22	23
Gender	F	F
Age	25	48
Caste	Jain	Prajapat
Education	Mcomm	10th
# in house	7	15
Religion	Hindu	Hindu
ACCESS		Waterworks company
Where does your water come from?	Filter house	Water house
What is the source of this water?	Filter house	Kilana
How much does water cost you per month?	Depends on how much we consume, 300-400 Rs in winter	
How often do you get water?	Alternate day	Alternate day
How long does the water come?	Early in the morning, 2-3 hours	12 at night in small quantity, at 6 in morning it will start
If you run out of this water, what do you do?	We purchase water from water tankers	2-3 hours
Are you satisfied with your access to SDW? What is your ideal situation?	We are satisfied, because this colony is the government's first colony in Jodhpur so we have good access	Yes we are satisfied
When you go to market, weddings or restaurants, where do you get your drinking water?	Yes, we take water with us; it depends on the marriage as to if we take water or not, if in the city then good water is there. If outside, the water is a little salty. We purchase water in rest.	We are taking water bottles to market; we only eat at home but at marriages we take bisleri waters
Remarks		
STORAGE		
How do you store your drinking water?	Matka and aquaguard	We don't have aquaguard, we just keep in matka and steel

		vessels
Where do you keep this?	In kitchen, on platform, and covered	
Does it matter how and where you store your drinking water? Why?	We have the aquaguard, so in the kitchen only	
How do you get your drinking water out of the storage container?	Lota, we don't dip our hands in the matka	
Where did you learn these techniques?		
How and when do you clean the container?	Regularly	
Remarks		
QUALITY		
How do you clean your drinking water?	Filter, and every 6 months we clean the tank for the drinking water as well	We have plastic filter and even before this we are taking water from the tap, which is covered with a cloth filter.
Where did you learn these methods?		Traditional
What do you know about the relationship between sanitation and SDW?	We are using three stages of water. First is filter from mainline, then tank filter, then tap filter. We are using three stages of water filter but I don't know what other people are using.	
Do you use drinking water and washing water differently? If so, how?		If more dirty water is there, then we are using the phit kure (white stone makes dust settle at bottom)
Do you worry about getting sick from drinking unsafe water? If so, what precautions do you take?	Yes, very much. Especially in summer. It is very hard to get clean water, especially depending on where you living. We never keep our hands in the matka	
Remarks	If we don't like the smell or look, we don't drink it. This only happens when we go out.	
CULTURAL SIGNIFICANCE		
Do you know of any health traditions involving water? If so, what are they and why do you think they exist?		
Do you use water in your religion? How?	It's not just in Hindu that it's important. In all cultures it is important. For Rajasthanis, its very important we have to clean water properly, in summers especially.	We are praying to the Ganga water. It's very important in our religion to respect he Ganga water.
Where did you learn this?		
Do your parents, grandparents and children do this the same way?		
Remarks		

V. Villages

Survey ID #	24	25	26
Village	Champa Beri	Champa Beri	Goliya Vide
Gender	M	M	M
Age	70	30	55
Caste		Jath	
Education		None	BA
# In house		6	
Religion	Hindu	Hindu	Hindu
ACCESS			
Where does your water come from?	We use the rainwater and tankers	Rain	The monsoon season and then tanker starting around December. The well water comes from the school in the village about 3 km away.
What is the source of this water?	The tankers come from the bigger village, Koduka. They have more ground water and a bore well.	cucha tanker (temporary), not covered, hold rain sometimes all year, 5-6 months. Tanker water comes from Bakersub village.	The tankers bring the water from Bharkabar. The well comes from a bore well.
How much does water cost you per month?	Each tanker costs 1000 Rs.	1000 Rs for 1 tanker	Each tanker costs 1000 Rs. The well water is free. To build a big tanker with JBF it cost us 25000 Rest.
How often do you get water?	We need 2 tankers a month, when we run out of monsoon water. The rainwater lasts 3-4 months.	1000/tanker, 4000 L every 15-20 days	We need 3 a month
How long does the water come?	It will only rain a few times in monsoon.		Monsoon season lasts 2 months
If you run out of this water, what do you do?	We get a tanker if we run out	Purchased from Bakersub tube wells	The women also bring head load each day from the well in the village. It's about 2

			hours of the day and they take the goats with them to water them there.
Are you satisfied with your access to SDW? What is your ideal situation?	No, this is the main issue. We need more water.	We are working with JBF to make a permanent, large underground tanker to keep rain water longer	We would like the rainwater to last us all through the year. During monsoon, our tankers overflow. If they were larger, we could keep more water.
When you go to market, weddings or restaurants, where do you get your drinking water?	No		The only time we bring water with us is when we go to the field to use the restroom.
Remarks	When I was younger, we did not have to worry so much about water. Now, it rains less and less. I think it is because of man and his impact living here.	Matka	
STORAGE		Mutkee	
How do you store your drinking water?	We keep it in matkees	Matka	We use 2 of our 4 tankers for drinking water and the other 2 for other water.
Where do you keep this?	Inside and outside, on the ground.	On floor outside, but feels it should be kept outside	We put the drinking water in matka near the house. We have 5.
Does it matter how and where you store your drinking water? Why?	They should probably be kept inside.		The matka should be kept closed to keep germs out.
How do you get your drinking water out of the storage container?	We use a lota to take water from the matka.	balti	We get the water from the tankers with a separate bucket than the non-drinking water. We use a lota to get water out of the matka.
Where did you learn these techniques?	Parents	Parents, tradition	These are traditional
How and when do you clean the container?	Once the water is gone, we rinse it with water.	Tanker and rooftop catchment area cleaned before rainy season	We clean the container once it is empty. Before each monsoon season, we clean the tanks.
Remarks	*Matka had green moss on outside, surrounded by bees and flies, though closed		
QUALITY			
How do you clean your drinking water?	We filter the water through a thick, clean cloth	Thick cloth	The water is poured into the matka through a clean cotton cloth
Where did you learn these methods?	These are traditional methods	Traditional	Traditional
What do you know about the relationship between sanitation and SDW?			You need to wash your hands to keep from getting sick and getting germs in the water when you get it out. We are interested in working with JBF to have toilets built, but right now all family members go in the field.
Do you use drinking water and washing water differently? If so, how?			We keep them separate and use separate tinsels.
Do you worry about getting sick from drinking unsafe water? If so, what precautions do you take?			Yes, but what do we do. We filter it and wash our hands and if we get sick then we go to the hospital.
Remarks	There is also a hand pump we can use, but the water is saline and not good for drinking. The government does not supply water here.		The water is not so good of quality. The rainwater is best, then the tanker water but the well water is very saline and not good for drinking.
CULTURAL SIGNIFICANCE			
Do you know of any health traditions involving water? If so, what are they and why do you think they exist?			
Do you use water in your religion? How?			
Where did you learn this?			
Do your parents, grandparents and children do this the same way?			
Remarks			

