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Reviving traditional water sources for resilient water future: case of Darjeeling City, India

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Abstract Rethinking to revive traditional water sources is the need of the hour, considering the present context of water crisis at both the global as well as local level. Darjeeling city, located in the eastern Himalayan region is endowed with numerous natural springs, and people use these as their daily sources of water for long. However, these indigenous water practices are constantly being threatened by the so-called development process of city-making. Many of the natural springs have already dried up and many others are in shrinking phase of flow. Municipal water supply system, developed by the British in the early nineteenth century is not sufficient for the entire city at present, and not affordable for the people of all classes too. In this circumstance, private water supply and rainwater harvesting have emerged as the alternative sources of water, which again are not so viable for the poor. Majority of people, who are essentially poor face an acute water crisis throughout the year, except a few months of monsoon season. The city administration concentrates only on the insufficient centralised hydraulic infrastructure rather than managing and reviving the natural springs. Using both the quantitative and qualitative methods, this empirical study critically assesses the present waterscapes of the city considering its socio-physical nature. The article analyses the process of expanding private water market using common water resources with illegal and tacit support from the local administration. It argues for the intervention of city administration and effective community participation to revive the springs for making the city's water future secure.

Keywords Water scarcity · Traditional water sources · Centralised water supply system · Alternative sources · Darjeeling

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Introduction

Rethinking to revive traditional water sources is the need of the hour, considering the present context of water crisis at both the global as well as local level. History and dynamics of water crisis may differ based on spatiality and temporality, but the stories of drying-up of natural water sources are almost similar all over the world. Concentrating only on the formal hydraulic system or centralised supply system has emerged as the incomplete idea at the context of considering water as a hybrid resource. Hybrid in the sense, it makes a bridge between social and ecological aspects. The recent philosophy of water does not support dualistic thinking, where different aspects of social, cultural,

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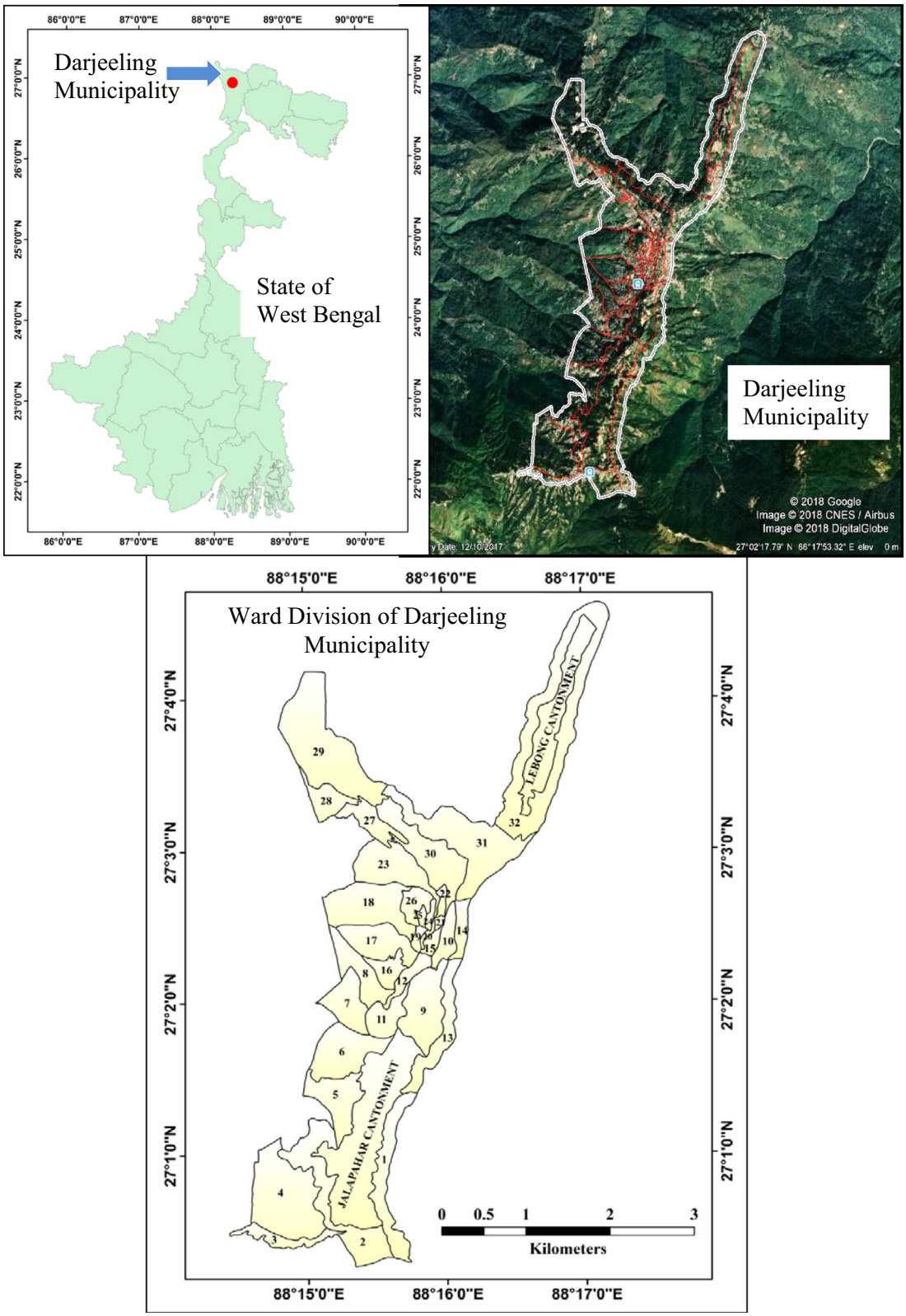
economic and political strings are intertwined with each other, forming a complex knot (Baviskar, 2003; Lahiri-Dutt, 2006, 2009; Ahmed & Zwarteveen, 2012). According to Swyngedouw (2004), "hybrids are formed by a variety of processes, by 'natural' such as biological, physical and chemical ones, by material, cultural and discursive practices of various actors, and by social relations between actors". Therefore, to satisfy human requirements, and maintain environmental balance a comprehensive thought on water issues is required, which cannot be possible without considering the traditional water sources and indigenous water practices of the particular space.

Darjeeling city, located in the eastern Himalayan region (Fig. 1) is endowed with numerous natural springs, and people use these as their daily sources of water for long. However, these indigenous water practices are constantly being threatened by the so-called development process of city-making. Many of the natural springs have already dried up and many others are in shrinking phase of flow. Municipal water supply system, developed by the British in the early nineteenth century is not sufficient for the entire city at present, and not affordable for all classes too due to its higher cost. To get an in-house municipal connection, households have to submit around Rs. 50,000–60,000 initially to the municipality, and the cost increases with increasing distance of the households from the main supply line. Annual tax of domestic water supply is Rs. 500, which is again a burden for the poor and marginal. In Darjeeling city, majority of the people suffer from regular crisis of water shortage (Chakraborty, 2018; Drew & Rai, 2016). Adequate and affordable domestic water supply is one of the biggest challenges in many of the Himalayan cities nowadays (NITI Aayog, 2018), and Darjeeling is one of them. Climate change has adversely impacted on the functioning of the ecosystems, especially on the water cycle, and several studies have already been completed on this issue in the Himalayan region (Chinnasamy & Prathapar, 2016; Li et al., 2015; Pandey & Jha, 2012; RIS, 2016; Sharma et al., 2016; Shrestha et al., 2018; Tambe et al., 2012; Vashisht & Sharma, 2007). Beside the Himalayan cities and other hill cities of India, many of the other Indian cities also suffer from acute water crisis these days, though the crisis does not affect all user groups in the same way (Anand, 2017; Kumar, 2014; Shaban & Sharma, 2007; Zerah, 2000). Increasing demand due to population growth, increasing commercial activities like tourism, and environmental deterioration has made the condition severe for the Himalayan cities (NITI Aayog, 2018).

Fig. 1 Location Map ▶

In this circumstance, private water supply and rainwater harvesting have emerged as the alternative sources of water, which again are not so viable for the poor. Majority of people, who are essentially poor face an acute water crisis throughout the year, except a few months of monsoon season. The city administration concentrates only on the insufficient centralised hydraulic infrastructure rather than managing and reviving the natural springs. Primarily, financial affordability controls the regular and adequate water access of the people (Harden et al., 2007), but there are some other factors also. As water distribution and supply infrastructure is associated with the organisation of productive activities, so it is linked to the social, political, and economic aspects of that particular place (Bell, 2015). Use of different water sources and water adequacy is determined by several socio-political dynamics and the dynamics touch the lives of people in different ways.

This empirical study critically assesses the present waterscapes of the city considering its socio-physical nature. To explore the crisis and its change over time following target groups across different classes of society have been selected. These are: 350 households (175 from slum and 175 from non-slum), 20 elderly people, water vendors (20 tanker drivers; 8 pull-cart owners; 4 water hawkers; 2 water groceries), 12 municipal officials and councillors etc. Information for this article has been collected following mixed methods, which includes participant observation, focus group discussion, and questionnaire survey. The article starts with analysing the city's changing waterscapes in detail, which includes—traditional water practices before the construction of formal water infrastructure; its journey from the decentralised to centralised supply system; process of destruction of the natural water sources; and the present day crisis scenario in brief. The next section critically evaluates the emerging alternative sources, and its viability to all the classes of the city. Thereafter it focuses on how the private water market flourishes using the Common



Water Resources, and finally it tries to find the way towards a resilient water future for the city.

Waterscapes of the city: past and present

Water flows through several paths, and touches the lives of the city people differently, which makes complex waterscapes in the city. Water has such significance in modern urban lives that it can reshape the urban space both materially and discursively, and have great impact on social relations as well (Gandy, 2004; Kaika, 2005; Loftus, 2009; Loftus and MacDonald, 2001; Swyngedouw, 2004; Radonic & Kelly-Richards, 2015, p. 392). Water gives birth to many kinds of inequalities across different classes in society. Therefore, to understand the nature of the city's waterscapes, water flow pattern must be analysed. Here, flow of water can be categorised broadly into three kinds (Fig. 2), that is, municipal water supply, natural springs, and private water supply. Municipal water supply reaches the users through in-house connection and community taps (Fig. 3A). Very few households have the opportunity to get in-house supply of municipal water. The second category is the natural springs (*jhoras*), which are considered as the lifelines of the city (Fig. 3B). Springs are usually considered as Common Property Resources (CPRs) in the city, but there are also a few small springs under the private ownership. For instance, during fieldwork, three such water sources have been identified. Few people have small water sources on their own land. They sell water to their neighbours on annual or monthly payment basis. However, common resource represents all the natural resources used for human welfare, which are not necessarily owned by an individual or a group of individuals. All individuals of a locality (well defined group of users) can access these resources freely, and these resources are out of reach of the market (Hasan, 2002; Regmi, 2011). Therefore, private springs cannot be included under the common resource category. The last category of water supply is private supply (Fig. 3C), which is the most viable option for financially affluent households, though the poor are sometimes also compelled to buy water from private suppliers. Different modes of private supply exist in the city, which varies based on demand, purchase capacity, and physical accessibility of the households.

At present the city's water market is entirely controlled by the tanker suppliers, having larger capacity to supply, and higher customer base. Thus, it holds the major shares of the private water business. This system runs using common water resources (springs outside the municipal area) for business purposes, and that supply serves mainly the elites and the commercial sectors like hotels, construction works etc. Among the four different modes of private supply, water hawkers and water pull-carts are the oldest, and water grocery is the newly added system in the water

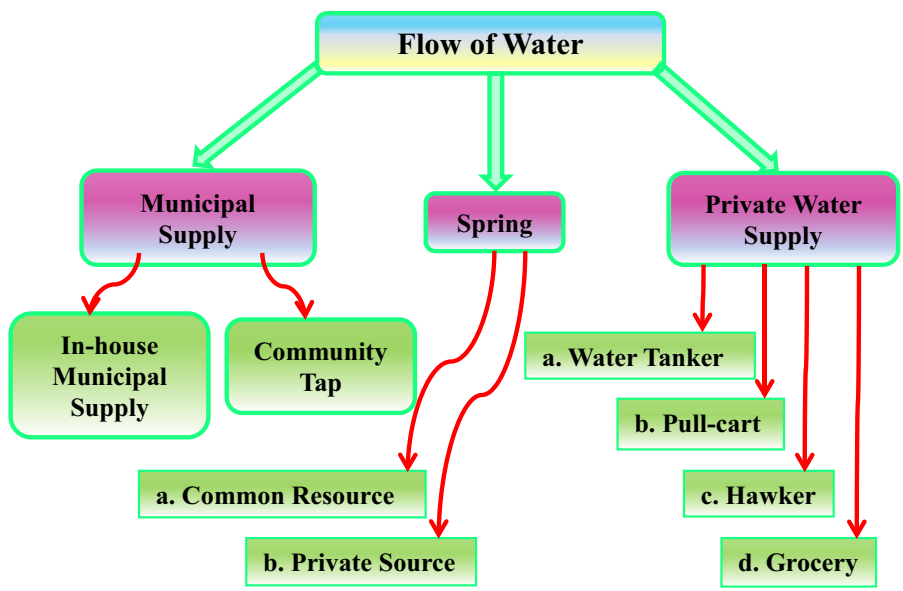


Fig. 2 Conceptual diagram of water flow

Fig. 3 Different modes of water supply **A**. Collection of water from Community Tap; **B**. Collection of water from spring; **C**. Collection of Water from Private Suppliers *Source* Field Survey, 2015–16

market. Present waterscapes of the city are complex as well as significantly different from that of the past, and that change is quite normal in the context of changing social and commercial set-up of the city.

Indigenous water practices

To understand the present waterscapes of the city, it is crucial to look back at the time when a densely forested mountainous tract was first transformed into a place for a British sanatorium. The development of Darjeeling as a hill city is rooted in colonial history, and the development of a centralised water infrastructure was a model of the developmental strategies of the British in Indian cities. Prior to colonial period, India's water provision was chiefly managed by the local communities and that was certainly based on their indigenous knowledge (Jha, 2010). Darjeeling was no exception. Before the advent of the British, the area was settled by some indigenous people (Campbel, 1868; Dash, 1947). Thereafter, with the escalating development work, people started to migrate to this area from the surrounding hill regions as construction labourers. People, residing in these areas used to collect water from the springs.

With the British rule, almost all the colonial cities got the system of centralised water supply and management for the first time. And these supply systems were mainly for the British military and for the Europeans and elite Indians; not for all sections of the society (Jha, 2010; Sharan, 2014). History and politics of these colonial water initiatives in the metro cities of India have been lucidly analysed by the scholars like Dossal (1988, 1991), Sharan (2014) and Lahiri-dutt (2015) for case of Mumbai, Delhi, and Kolkata respectively. Hill cities, developed by the British have almost the same story. Darjeeling is one of those cities, where colonial rule made significant changes in the physical as well as in the social space. Colonial initiatives changed the water culture of the locals to a great extent in Darjeeling.

Darjeeling municipality was established in 1850, and the twin lakes (*Senchal* north and *Senchal* south) were constructed in 1910 and 1932 respectively, to ensure regular in-house water supply to the elites. Water has been stored into the lakes after collecting from the surrounding springs in the *Senchal* areas (*Senchal* Wild Life Sanctuary). Water was supplied to the common residents through community taps, which they called public hydrants. Before that, numerous natural springs in and around the city fulfilled the

water demand of the common people and was more than enough, as stated by all elderly research participants. That means, after 60 years of establishment of the municipality, the traditional decentralised water collection system changed into a structured centralised supply system, along with the construction of the twin lakes.

Destruction of traditional water sources

At the time of construction of the lakes, the population in the city was very less. The water storage capacities of these reservoirs were 20 Million Gallon (MG) and 12.5 MG respectively, meant to serve only the then population of about 10,000–40,000 people (Darjeeling Municipality, 2012). Previously, there was no such water scarcity in Darjeeling, as the population pressure (both permanent and floating) was less. The city was not as commercialised as it is at present. The current water supply is not sufficient for the entire city as the capacity of the city's water infrastructure did not grow much with the time and increasing demand. Moreover, many perennial springs (locally called *Dhara* or *Jhora*) flowed through the city, are now dried up.

The twin lakes and innumerable springs in and around the city were adequate to serve the people with plenty of water. The nature of the city was different from that of the present. Presently, it is highly commercialised with a flourishing tourism sector. Further, the city is overcrowded with its permanent and transitory population. In this regard, Drew and Rai (2016, p. 222) estimated that around 2,00,000 people constitute the floating population of the city and stay there on a part-time basis. Demand of land for residential as well as for commercial purposes has increased manifold. Many multi-storeyed buildings are already present in the city and several others are being constructed. Although such high-rise buildings are not expected in the fragile hill environment, but their number is on the increase.

Such activities destroy the natural springs within the city, which are the only sources of water for thousands of people residing there. In Indian water policies, there were no such defined actions for protecting the recharge areas of the springs. Therefore, the immediate catchment areas and recharge zones are not considered as areas that need to be protected. To mitigate this gap in the water policies, the Government of India has recently taken up a few projects on 'springshed management' to maintain Himalayan sustainability in terms of the environment and the people's livelihood in 2017, under the command of NITI Aayog. However, such initiatives have been taken up primarily in some selected blocks of the Himalayan states; there are no such programmes in Darjeeling city.

Deforestation along the *Senchal* range is one of the important factors responsible for reducing the water storage in the twin lakes (Darjeeling Municipality, 2012). Considerable deforestation took place in the decade of the 1980s, when the violent agitation of Gorkhaland movement reached its peak against the state government (Chatterji, 2007). Chatterji (2007) has discussed about the environmental loss through cutting of trees and the effect on tourism in the hills in her book entitled *Contested Landscapes: The Story of Darjeeling*. The long trajectory of socio-political movements in the hills affected the hill environment severely. As a result, the number of springs in the *Senchal* range has decreased (presently numbering only 11) and consequently, supply of water in the lakes has also decreased, as mentioned by the staff members of the waterworks department of the municipality. Therefore, increasing commercial activities within the city and deforestation along the *Senchal* range have both impacted the sources of water within and outside the city, ultimately negatively affecting the water future of the city (Koner & Samanta, 2021).

Similar statements have been recorded during the field visits from the research participants, who are regular users of spring water. They have stated that the discharge of the springs has deteriorated. Except in the monsoon season, they have to wait for a long time at the springs due to less discharge of water. Real estate and infrastructure development (multi-storied residential apartments, roads, high-rise commercial buildings and other offices, big hotels and guest houses), deforestation and unmanaged solid wastes reduce the seepage of rain water into the sources of springs (Koner & Samanta, 2021). For example, a few years ago, a multi-storeyed commercial building was built above the source area of a spring locally named as *Laldiki,* which used to provide water to a large number of people from that neighbourhood. Some site specific environmental factors highly affect the quality of spring discharge. These are–water intake/seepage rate which in turn depends on the land-use pattern, nature and degree of disturbance resulting from deforestation

and human activities; slope of catchment, and geology of the catchment area (Vashisht & Sharma, 2007, p. 839). During interviews, local people mentioned that the flow of water from the spring has reduced after the construction of the building just above the source point. The municipality has given permission to the owners of the building, without considering the environmental outcome. This is not an exceptional case; rather, such incidents are quite common in the city. Political influence and corruption are active at all levels to support the development of illegal infrastructure, thus reducing the natural availability of water (Samanta & Koner, 2016).

One of the officers of land revenue department of Darjeeling municipality shared his experiences during a formal conversation in May, 2018. He stated, *"The hills must have a different committee, which will take ultimate decision about the land use pattern of the city. The committee must be constituted of the people from different backgrounds, who can take the right decision, considering the environmental perspectives of the hills. Before starting any construction, that committee will supervise and decide whether the land is suitable for construction or not."* Haphazard constructions can be seen throughout the city, as perceived by local people, and stated by one of the key informants, Mr. Rai (retired professor; 69 years old). Considering the circumstances, it can be said that the city administration must follow a well-planned springshed management system, where both the local communities and public authority can participate actively. Such kind of joint management strategy is a collective action by the city government, other stakeholders, and the users, which accelerates the efficiency, equity, and extension of service coverage mainly to the poor.

Shift from the traditional decentralised to formal centralised supply

With the initiation of the twin lakes, a new era of organised water supply system started in the city. This may be defined as a new beginning or a major shift in the water culture of that area. With this initiative, the indigenous practices of the locals started to alter slowly. They began to depend more on municipal supply, as all the elderly research participants mentioned. They stated that after completion of the twin lakes (*Senchal* North and South), municipal water supply was potable, regular, and adequate. That was the time when local residents and the city administration started to neglect the innumerable natural springs in and around the city. The process has thus been initiated a long time ago and is continuing till date. People began to adapt from the decentralised to centralised supply system. This change was the result of the colonial legacy, which started with the emergence of the British Empire in India. All colonial cities in India passed through the same experience. These practices resulted in the decay of indigenous water practices, and decisively destroyed the decentralised structures of water management. In this regard, scholars (Kumar, 2014; Samanta, 2018; Shrestha, 2014) have argued for keeping the indigenous water management practices running simultaneously with the centralised supply system. They are of the opinion that those decentralised systems make the entire water supply system even more resilient.

In the city's water history, the years 1932 and 1986 can be marked as landmark years. Since 1932, the water supply system started to shift from decentralised to centralised; and after 1986, the system has slowly started to shift again towards decentralised management, though under private initiatives (Fig. 4). Because of the prevailing distrust of the public management of water, financially affluent people are keen to get private water supply these days. Following Radonic and Kelly-Richards (2015, p. 393) it can be said that "local socio-environmental relationships and histories must be better understood before decentralized alternatives can be advocated for or implemented". The same understanding is essential for managing water in Darjeeling city to make it more sustainable.

Present condition of water availability

Now, the city has a population of over 1,20,000 (Census of India, 2011), who survive on the same source of water as it was at the time of British. Demand from the permanent population as well as from the transitory population have increased manifold (Chakraborty, 2018). Crisis of water primarily reflects on the city's limited capacity to serve the limited number of people. A wide gap exists between the demand and supply of water within the municipal area. Due to many institutional (technical, financial, and political) problems, it is difficult for the municipal authority to

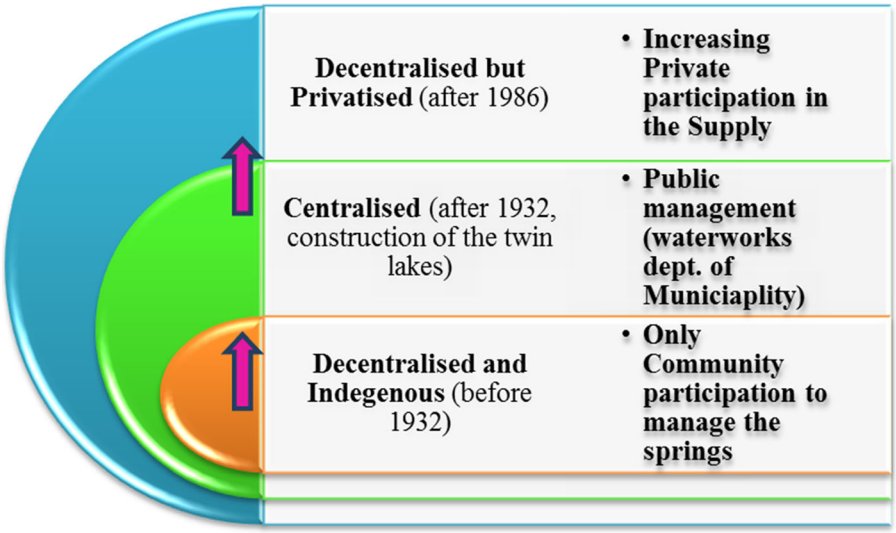


Fig. 4 Transformation of water management

cope with the growing demand of water. Out of 21,782 households, only 2145 households have municipal water connections, i.e., about 10 per cent of all households. Besides, 500 community taps or public stand-posts are located in different areas of the city (Darjeeling Municipality, 2012). Thus the total number of water connections in the city is 2645. From the field survey, it is observed that on an average 20 households are dependent on one community tap. Thus, the estimated total number of households dependent on municipal supply is 12,145. If we consider the average size of a household as 5 following the ratio of census population and the number of households, then the estimated population dependent on municipal supply is 60,725 persons, which is nearly half of the population of the city.

A water budget of daily demand and supply has been prepared by the waterworks department considering 70 L per capita per day (lpcd) or 15.5 gallons of water. The estimation shows that the people get water after every four days, due to daily shortage of water (Appendix 1). Another estimation of the department shows that people will get water after every seven days, if 135 lpcd of water is to be supplied to them (Darjeeling Municipality, 2012). These deficits represent the limited capacity of the municipal authority to meet the present demand of the city. However, these estimations only take into account the permanent population. As headquarters of the district, a popular hill city, and reputed educational centre, the city has been experiencing continuous pressure of transitory population for many years. These are not considered while estimating water demand and supply. Moreover, many historical, political and economic aspects are associated with the growth pattern of the city, which impacted the environment in and around the city highly. In these circumstances, city administration is not concerned with the environmental deterioration, thus leading to the further scarcity of water.

As municipal supply is very irregular, insufficient, and highly unpredictable in nature, and also not available in all the corners of the city, people use multiple sources, such as spring water and water from private suppliers. Accordingly, 100 per cent of the respondents have replied that they use more than one source to arrange water for their daily requirements. Chakraborty (2018) made similar observations in his study. Figure 5A and B shows the percentage of households using multiple water sources in the city, which clearly exposes the diversified dependence of the households on the different sources of water. Zerah (2000) has rightly opined that the dependence on multiple water sources signifies the unreliability of public supply, which is very relevant for the case of Darjeeling. Whereas, scholars such as Kumar (2014) and Samanta (2018) have argued for using multiple water systems, as they opine that use of multiple water sources may improve the reliability of supply, and can help absorb any kind of shock from disruption in the centralised municipal network system.

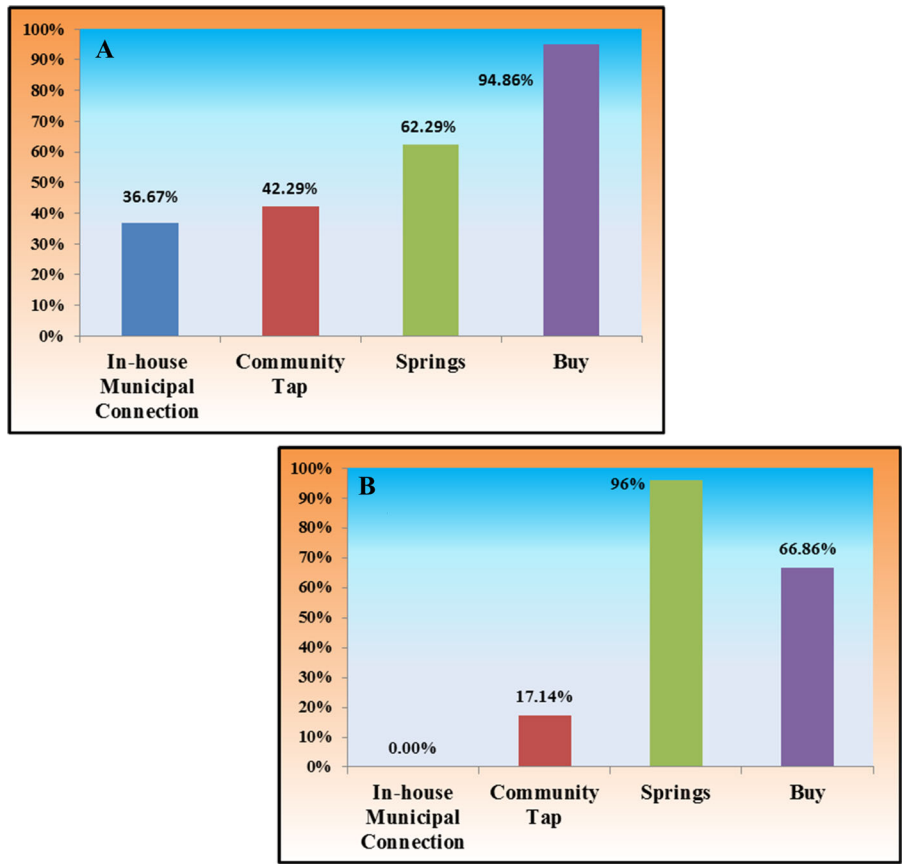


Fig. 5 Use of multiple water sources (**A**- households in non-slum areas; **B**-households in slum areas) *Source* Field Survey, 2015–2017

The Fig. 5A and B show the clear variations in terms of using water sources among the non-slum and slum households. In the non-slum areas, around 36 per cent households have the facility of in-house municipal supply, and more than 42 per cent households get access to community taps, whereas in the slum areas, no households are connected with the in-house municipal supply and only 17 per cent get access to the community taps. More slum households use spring water (96 per cent) than the non-slum households (62 per cent). In case of using private water, almost 95 per cent non-slum households have stated that they buy water according to their requirements, whereas only 66 per cent of the slum households have stated that they also buy water, but not very often. Basically, the poor are compelled to buy water during the dry season, when the crisis is high.

Now the question is why these dissimilarities happen among the different classes. These dissimilarities are determined by several factors, such as: (a) location of the households and availability of water sources near the households; (b) financial capabilities of the households; (c) Social status, and political connections of the households. Location controls supply in many ways, such as whether the area is connected with municipal water network or not, whether there are any springs located nearby or not, slope and distance of the households from the main roads, etc. These factors also determine the cost of private water supply, and the mode of transport for supplying the water. Households having enough financial capabilities can enjoy adequate and easy access to water, either through in-house municipal supply or by timely supply of private water. Location and financial condition of the households are again linked to each other to a great extent, because financially affluent families reside within the core areas of the city or beside the main roads. Socio-economic conditions and spatial location of the households highly determine the types of water

sources used by the households in the city. Beside these factors, political connections also play a critical role in determining regular access to water in the city. Therefore, the practice of using multiple water sources is determined by multiple socio-political factors, which are certainly not favourable for the poor and marginal section of the society.

Alternative sources: analysing viability

In this water-scarce situation, two forms of alternative sources of water have emerged to fulfil the demand of the users. These are rain water harvesting and private water supply. However, both the alternative sources are not so viable for all classes of residents in the city. In case of rainwater harvesting–people try to minimise their daily water shortage by using rainwater during rainy days, and 100 per cent households have stated that they use rainwater to whatever extent they can. In this case also, practices vary among the users of different classes. Large scale rainwater harvesting, which includes proper installation of the entire system, is only possible in the households having concrete roof and enough space at their houses, which again depends on affordability. Having a highly rugged terrain, and bearing the chances of earthquakes, Darjeeling is not so suitable for installing the system of rainwater harvesting everywhere, as mentioned by the engineer of the waterworks department too. Due to these reasons, majority of the people do not want to install the system at their houses, and in any case, they do not have sufficient space for installing the system. The municipal authority is also well-aware about the fact, and has agreed with that there are risks in installing the system, but recently they have been giving emphasis on household-level rain water harvesting to reduce the degree of water scarcity. Presently, no new buildings get permission from the municipal authority without having the system of rainwater harvesting.

In case of private water supply, as mentioned before that the different modes of supply exist in the city, and the cost of water varies with the varying modes of supply. During the dry months, almost all households of Darjeeling city have to buy water, and it seems like a compulsion for them. Considering all the modes of water transport (water hawkers, pull-carts, tankers, and groceries) the price of private water varies from Rs. 30 to Rs. 50 per 100 L of water, depending primarily on seasonal variability, and mode of water transport. Households that purchase water in bulk from water tankers get water at comparatively lower prices, such as 100 L of water at Rs. 20–Rs. 33. However, poor and marginal groups cannot spend a large amount of money at one time to buy water in bulk from the tankers. Thus, they buy water from the water pull-carts, local grocery stores or from the water vendors at a higher price than that expended by the well-off households (Fig. 6).

Field observation shows that the poor have to pay 1.5–2 times more than the financially affluent class to get the same amount of water (Fig. 6). This is not only true in the case of Darjeeling; rather, urban poor in almost all the Indian cities have to pay disproportionately of their household budget for water (Jha, 2010, p. 5).Similar observations have been pointed out in some African countries by WUP and WSP (2003). Moreover, seasonal labourers and beggars also buy water here. People who are really on the margins of the society have to buy water at higher prices, and this pushes them towards a more marginal situation. According to the WHO's recommendation (2003), only three to five per cent of an individual's income should be used for purchasing water. However, in Darjeeling for the households of low-income group, the cost of water is much higher than the recommended standard of WHO (2003), even at the minimum cost of water (Rs. 1200 per 6000 L of water). For the households having income more than Rs. 25,000 per month, the percentage of expenditure exceeds the recommended limit during the dry season. The cost of tanker water is only affordable for households having monthly income of Rs. 35,000 per month or more (Appendix 2).

The field data (Appendix 2) support the fact that majority of the people in Darjeeling municipality (78 per cent of the surveyed households) have to pay a huge share of their income for buying water, if they buy regularly from the tankers. It also reduces their affordability to get private supply of water. Affordability is not simple to measure (Sangameswaram, 2012; WHO & UNICEF, 2017), and sometimes affordability also determines the level of crisis (Johnston, 2008). These statements are essentially true for the case of the city like Darjeeling as well. It is observed in the field that the percentage share of expenditure on water among different income groups increases with decreasing household income

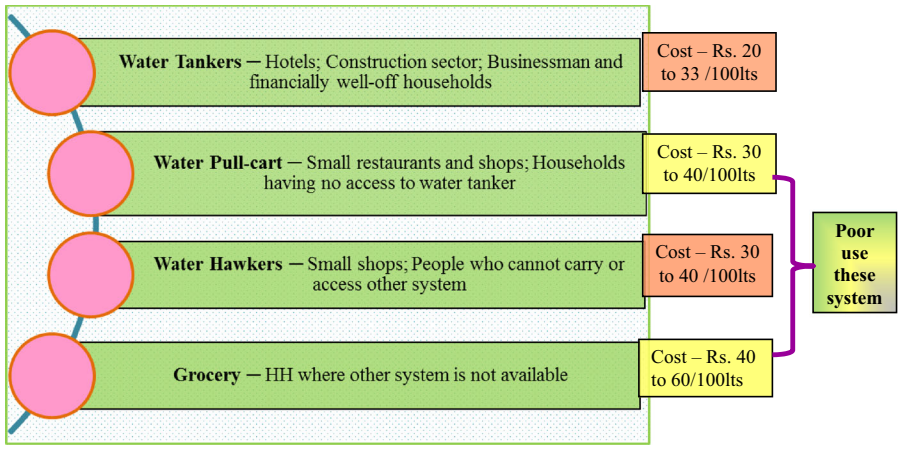


Fig. 6 Customer base of the different mode of private water supply

(Appendix 2). Wealthy families can manage the crisis by purchasing water, but the poor cannot always afford it.

Alternative sources: not for poor

From all the above discussion, it is very clear that along with the municipal water supply both the alternative sources are not so viable for the poor. As mentioned before, poor cannot afford the cost of private water supply whatever the modes of supply are, and also cannot install the entire set-up of rainwater harvesting due to some limitations. Outcry for water is a regular affair in Darjeeling. As municipal supply is very irregular, insufficient, and unaffordable for the major section of people, primarily they depend more on spring water and water from private suppliers, based on their financial affordability. People collect water even from the leakage points of pipelines as observed in the field. Day by day, it is becoming increasingly difficult for the dwellers to sustain life in this city. Having lack of affordability poor are compelled to depend more on spring water, which is very time and labour intensive. With the increasing demand and decreasing rate of spring discharge average waiting time at the spring has increased. Usually long queues are common during the cold nights of February to May. During those dry months, sometimes people have to wait from evening to 2 a.m.; or they have to stand in a queue from 3 a.m. to avoid the morning rush hour and higher gathering of water collectors. Time varies along with the weather and the dryness of the summer season. During three months of March to May, collecting water takes more than five to seven hours or even more, as stated by 32 per cent non-slum and 79 per cent slum households.

Following Kumar (2014, p. 2), it can be summarised that the prime challenges of the city administration regarding water services include—reducing per capita water availability and reliability of the water utility, huge wastage of water, increasing inequity, and inefficient pricing and its impact across different classes. Here, water is not a scarce resource for all. Those, for whom it is adequate, can use it according to their requirements; but the others have to struggle to satisfy their daily requirements. This negotiation of the poor always happens by reducing the amount of water used daily. After collecting data from the users, clear differences have been identified among the three categories of higher, middle, and lower income groups of people (Appendix 3). In Darjeeling, low temperature prevails throughout the year, thus people need less water for their daily use in comparison to cities located in warm climates. However, the data reveals that people from low income groups in the city use less than 20 L of water daily (46 per cent of the surveyed households) which is far below the national standard of per capita water use. Thus, this group of people is not only economically poor; they may be considered as water poor as well. Sangameswaram (2012) has opined that the basic water requirement varies from 20 to 50 lpcd as mentioned by different international organisation, such as WHO, World Bank. Zerah (2000) and Thompson et al. (2000) assessed that if people consume less than 25 L of water, it deteriorates the quality of hygienic practices, and these have long-term health impact too.

Inequalities in terms of access to water between rich and poor are clearly noticeable and the crisis badly affects the women and children of the poor households. Inequalities, discriminations and deprivations are very common, especially in case of access to resources based on class, caste, gender, disabilities and other marginal situations in the present context of the globalised world (Swyngedouw, 2009; UN Water, 2015; Anand, 2017; Tiwale et al., 2018; Agol & Harvey, 2018). This is the biggest curse of the capitalist liberal economy. In the context of South Asia, Prakash et al. (2013) have observed that having structural inequalities along the lines of class, caste, and gender in society, compounded with mismanagement of water resources produces an adverse effect on a large section of the people. South Asia is facing the challenge of unequal distribution of water, as water is not accessible to all. NIUA (2005), Mengistu (2012), Kumar (2014), Anand (2017), etc., have shown that inequality is the major issue affecting water supply in Indian cities. Moreover, there are some legal issues linked to the growing private market of the city as well. These issues must be considered, as these violate the rules of managing CPRs. City administration does not concentrate on these issues deliberately, which indirectly encourages the fast process of commodification of water using common water resources.

Flourishing water market using common water resources

Private water supply is the new form of decentralised water supply and management in the city, though the nature of decentralisation is different from what existed before 1932 (Fig. 4). The massive gap between water demand and supply has encouraged some groups of people to start selling water for a profit (Chakraborty, 2018). Primarily it was started in small scale as the demand was less too. People would vend water by different modes of small scale trading and they used to collect spring water from their locality within the city. There were several water hawkers (oldest practice in the city's private water market) in the city, and they were more in number in the 1990s as well as in the first decade of this century. After that pull-carts entered the water market to satisfy the demand. They also used to collect water from the local springs. These were the examples of small-scale unorganised water trading using common water resources. However, with the growing scarcity, these pull-cart owners cannot collect water from the local spring free of cost now. As they do their business, they also have to pay Rs. 20 per day to the *samaj* (spring maintenance authority by the local community) or else they buy water from the water tankers at the cost of Rs. 60 to Rs. 100 per 240 L of water. That means per 100 L of water, the cost varies from Rs. 25 to Rs. 45 based on the seasonal variation of water availability and demand. For them, spring water is cheaper than water from the tankers, although they do not want to go for that option, as it is time consuming and can create problems with the local people. Within the city almost all the springs (usable for domestic purposes) are mutually managed by both the local community and the municipal authority. These are not being used for business purposes, which justify the basic concept of CPRs. Over time, with the rising demand, scale of business as well as modes of water transport both has changed. Demand and the customer bases of all these systems became comparatively smaller and less significant in comparison to the system of water tankers. Presently, around 80 water tankers operate in the city, as stated by the interviewed drivers of the water tankers. Each tanker contains 6000 L of water at a time. And they can supply two to four times in 24 hours (considering the time of a round trip from water source point to supply destination and again to source point). If we consider three trips as average per day, then one tanker carries 18,000 L of water per day. So, 80 tankers carry more than 144,000 L (around 92,903 gallons) of water per day from the peri-urban areas to the city area, which indicates the increasing level of dependence and exploitation of common water resources of surrounding rural areas by the city. The area, where these springs are located is a protected area under the command of forest department of West Bengal government, but local communities are permitted to enter this area for collecting fuel, fodder etc. This bigger supply system runs by the few groups of people using CPRs of *Senchal* protected areas. Urban local bodies or local community have no control over the system; people are just consumers at the receiving end of the system. Large-scale community participation is merely visible regarding spring water management in and around the city. Common water resources cannot be used for business purpose, but it happens in Darjeeling as discussed earlier. "CPRs include all

resources like village pastures and grazing grounds, village forest and woodlots, protected and unclassed government forests, waste land, common threshing grounds, watershed drainage, ponds and tanks, rivers, rivulets, water reservoirs, canals and irrigation channels" (NSSO, 1999). Mountains springs are also in the group of CPRs. CPRs are the important bases of the economy, society and environment, and these have the higher potential to support the poor and marginal. Managing CPRs are vital for safeguarding the natural resources as well the ecological balance (Saini et al., 2009). CPRs are those resources which are accessible to the whole community of a village, and everyone has equal rights. No individual can enjoy the exclusive property rights (Karanth, 1992; Ostrom & Hess 2007; Jodha, 1986).

In case of India, contributions of CPRs are significant in providing livelihood support to the landless and poor across various agro-ecological systems as mentioned in the report of SAPPLPP (2009). After the 1990s, the trend of privatisation has increased all over the world, although they are mainly concentrated within the larger economies (Budds & McGranahan, 2003).The debate on public versus private ownership is very acute in case of water (Bakker, 2007), but the ownership of common water resources is in between these two: it is not entirely public nor private. Nobody has exclusive right on these CPRs. As none is in privilaged position to claim ownership, it may create the deteriorating condition of these resources as per 'economic rationality' argument (Hasan, 2002). Expanding demand, scarcity of fresh water resources, and weak governance has made serious challenges in water resource management (Mohammadpour, 2017). It also leads to the misuse or exploitation of the CPRs by the process of privatisation as seen in the study of rural Karnataka, by Karanth (1992).

Here, the private suppliers do collect water from the springs outside the municipal area (*Tin Mayl, Panch Mayl, Rangbul,* etc. near *Senchal*) without paying any cost to any authority. Moreover, these suppliers do not have to pay any tax to the municipal authority for doing their business in the city. They have no business licences too. They simply collect water free of cost from the village area, and sell it within the municipal area. Thus, excluding fuel cost and driver's charge rest are their profit. Profit also fluctuates throughout the year with the varying seasonal cost of water (appendix 2). When demand reaches its peak, profit maximises. Using common water resources, a few groups of people do their business smoothly. They get illegal and tacit support from the local administration. It is the elites, businessmen and political party members who are mainly involved in the private water supply system. Therefore, the city administration is informally bound to facilitate the system to favour those groups of people, because of the political–economic nexus practiced in the city.

CPRs must be used for the well-being of a community, and it is essentially for collective use only (Hasan, 2002; Regmi, 2011). Therefore, water of these springs cannot be used for making personal profit. Though different managerial issues and practices are there in regulating CPRs, but is neither fully public nor private (Blomquist, 1998). Hasan (2002) stated that the common pool resources have certain characteristics such as difficulty of exclusion, susbtractibility etc. that make them difficult to manage under any kind of property regime. And due to this complexity in resource regulation, it needs to regulate the behaviour of its users. Hasan further argues for strict rules for a sustainable level of exploitation of the resources and some kind of enforcement mechanism as well. These can be followed in case of Darjeeling, as no well-defined rules of resource regulations are there. Using this gap one group of people is making money at the cost of the many, especially poor.

Conclusion: towards resilient water future

All these explore the fact that the people arrange water primarily according to their capabilities, which further determines their choice of water use pattern and practices. This difference in affordability compels the poor to negotiate daily with the limited water for fulfilling their basic requirements. Diverse lived experiences and varying perception based on unequal water access of varied user groups divides the city into different perceived spatial zones. It is very much clear that whatever the alternative options are, these are not viable for the poor. In this water-scarce condition, many sources of water in and around the municipal area have already deteriorated over time, and many others are in the process of deterioration and consequently, the supply of potable water is being reduced day by day. Almost all the Himalayan cities are passing thorough the similar environmental crisis, as

reported by the NITI Aayog (2018). With the increasing uncertainty of water, difficulties of the residents increase. Uncertainty of water impacts unfavourably the lives of large sections of people in Darjeeling city, and they try to cope with the changes according to their adaptive capabilities and willingness to pay.

To overcome the crisis and minimise the complexities, immediate actions must be taken by all the stakeholders and users. Transparent and effective water governance can reduce the intensity of the problem. Municipal authority must consider the floating population (residential students, seasonal labourers, and tourists) in calculating total water demand and supply. Also, they can support the poor to store rainwater, which can minimise the degree of scarcity. Restrictions on illegal constructions especially near the spring's catchment areas are essentially needed to protect the springs. They must renovate the existing lakes and focus on increasing storage capacity through new lakes and tanks considering the increasing demand. Moreover, the excess spring water during monsoon can be stored to use it during dry season. In this very situation, after critically assessing the present waterscapes of the city, the article argues for joint management strategy to revive the springs considering the city's socio-physical nature, which includes effective community participation in managing and protecting these springs (Chakraborty, 2018), as the users have more indigenous knowledge about and attachments with the local environment. In this regard, Swyngedouw (2005) stated, "Neoliberalisation of water governance has in many cases limited the ability of the urban poor to participate in the management of the water resources they need on a daily basis". Therefore, community participation will certainly increase efficiency, equity, cost recovery, and extension of service coverage among poor communities. Moreover, municipal authority can take some initiatives to collect water from those springs around *Senchal*, from where private suppliers do. They can supply more water to the people against cheaper rate. Increasing market orientation regarding water supply is not seems to be profitable for the poor.

In the market regulatory water system, an obvious question arises: is the cost affordable for all or not? Within a hierarchical society, a minimum cost may appear as maximum burden for the major percentage of people, as is the case in Darjeeling. Here, a large section of people (96 per cent of the slum households) are excluded from the municipal and tanker water supply network indirectly by the cost of those services. In this regard, Delgado-Ramos (2015) has shown how negative externalities originate from the consequences of unequal purchase capacity of the poor. The public–private debate is pronounced across the world. With the commencement of the neo-liberal economy, the nature of water has changed and it has emerged more as a commodity (Bakker, 2003; Budds & McGranahan, 2003; Loftus & McDonald, 2001). It is almost a global phenomenon nowadays. The trend of treating water as a commodity is continuously increasing in the urban areas of the global south as well. However, private companies aim to maximise their profit through full cost recovery and thus cannot include all groups of society within the service network (Bakker, 2007; Loftus & McDonald, 2001). Thus, reviving those springs in and around the city jointly by the municipal authority and the local community can only enhance the water security and make the water future even more resilient.

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Human or animal rights Oral consent of the human participants has been taken for this research.

Appendix 1: Water budget of Darjeeling municipality

Gallons/Day				Litre/Day*
Total demand	Domestic (1,20,000 population)	18,60,000	19,70,000	88,96,774.194
	Others (Hospital, army, St. Pauls)	110,000		
Water production per day			8,50,000	38,38,709.677
Wastage	25%		2,12,500	9,59,677.4194
Net water available			6,37,500	28,79,032.258
Fixed supply	Hospital, Army, St. Pauls		1,10,000	4,96,774.1935
Net availability of water after deduction of fixed supply	(6,37,500–1,10,000)		5,27,500	23,82,258.065
Water deficit per day	(18,60,000–5,27,500)		13,32,500	60,17,741.935
Water supply once after		4 Days		

Source: DM, 2012a. (*70 L = 15.5 gallons).

Appendix 2: Percentage share for buying water from the water tankers

Income range in rupees	**Price of water per 6000lt. of water**			
	Rs. 1200	Rs.1500	Rs.1800	Rs.2000
< 5000	> 24%	> 30%	> 36%	40%
5000–10,000	24 to 12%	30 to 15%	36 to 18%	40 to 20%
10,000–15,000	12 to 8%	15 to 10%	18 to 12%	20 to 13.33%
15,000–20,000	8 to 6%	10 to 7.5%	12 to 9%	13.33 to 10%
20,000–25,000	6 to 4.8%	7.5 to 6%	9 to 7.2%	10 to 8%
25,000–30,000	4.8 to 4%	6 to 5%	7.2 to 6%	8 to 6.67%
> 30,000	< 4%	< 5%	< 6%	< 6.67%

Appendix 3: Per capita water use of different user groups

Groups of households **	Drinking	Cooking (including vegetables and utensils cleaning)	Toilet & latrine	Bathing	Washing clothes	Others (gardeni ng, cleaning houses, vehicles, pets, etc.)	Total (lt.)	% of HH (Actual No.)
Higher Income	3	6	25	35	20	8	97	18% (63)
Middle Income	3*	5	20	30*	20	5	50-83	36% (126)
Lower Income	1	3	5	10*	10*	3*	9–32	46% (161)
								100% (350)

Source: Field Survey, 2015–17 [** (Actual no. of households); *Not regular].

{**Note:**Households have been categorised into three classes on the basis of available assets.

(electronic gadgets, vehicles, etc.), access to services (newspaper, internet, etc.) and payment.

of electric bills per month}.

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