FACTORS AFFECTING ACCESS TO DRINKING WATER: AN APPRAISAL OF TOWNS IN DARJEELING HILLS

Thesis submitted to Jawaharlal Nehru University in partial fulfillment of the requirementsfor the award of the Degree of

DOCTOR OF PHILOSOPHY

PRITIKA PARIYAR

Center For The Study Of Regional Development

School Of Social Science

Jawaharlal Nehru University

New Delhi-110067

India

2019

जवाहरलाल नेहरू विश्वविद्यालय
JAWAHARLAL NEHRU UNIVERSITY
Centre for the Study of Regional Development
School of Social Sciences
New Delhi-110067

Date: 19/07/2019

Declaration

I hereby declare that the thesis entitled "**FACTORS AFFECTING ACCESS TO DRINKING WATER: AN APPRAISAL OF TOWNS IN DARJEELING HILLS**" submitted by me for the award of the degree of **Doctor of Philosophy** is my bonafide work and that it has not been submitted so far in part or in full, for any degree or diploma of this university or any other university.

Pritika Pariyar
Pritika Pariyar

CERTIFICATE

It is recommended that the thesis may be placed before the examiners for evaluation

Prof. Sachidanand Sinha
(Chairperson)
Centre for the Study of Reg. Dev.
School of Social Sciences
Jawaharlal Nehru University
New Delhi - 110067

Prof. Dipendra Nath Das
(Supervisor)
Centre for the Study of Reg. Dev.
School of Social Sciences
Jawaharlal Nehru University
New Delhi - 110067

Tel: +91-11-26704466 / 4463 / 4103
Fax: 91-11-26742586, 26741504
Email:chair_csrd@mail.jnu.ac.in

DEDICATION

DEDICATED TO MY BELOVED AAMA, BABA, DADA AND ENTIRE PEOPLE OF DARJEELING HILLS

ACKNOWLEDGEMENT

The journey of my much awaited PhD would not have been possible without the help of my Supervisor Prof. Dipendra Nath Das whose constant guidance and untiring effort have shaped my thesis therefore I am really grateful towards my Supervisor.

I am truly indebted towards several individuals whom I cannot thank enough, amongst them is Prof. Shrawan Kumar Acharya CSRD/SSS who became my Guardian and a family during my stay in JNU and always encouraged me to move forward even if I stumbled back. I would also like to thank the entire faculty members, technical and administrative staffs of my center CSRD.

I am grateful towards all my respondents from the Hills who welcomed me open heartedly and gave me lots of information about my queries. I cannot thank enough all the engineers and government officials, the party members and the MLA's of the respective towns for responding to my questions. I am also indebted towards all the communities whom I have interviewed, the hope, aspiration and happiness in their eyes are the one which I will never forget. I am thankful towards Brother Puran Rai from Darjeeling who gifted me a book by author D.S Rasaily (2014) titled "**Darjeeling Paharka Nagarpalika Kshetra Ko Vikash Ra Khane Pani Ko Itihas Sanchipta Ma**" (Direct Translation) *Development of the Municipal area of Darjeeling Hill and the history of Drinking water in Brief* which helped me a lot in writing my thesis.

I am thankful to Mr. and Mrs. Jai Rai and family and the two adorable PG sisters Geetanjali and Pratiksha with whom I stayed during my fieldwork in Darjeeling, though I stayed there as a PG but they treated me like their own daughter/sister and I am fortunate enough to be in contact with them so far. I would like to thank my aunt Mrs. Geeta Lohagun (Adhikari) with whom I stayed during my fieldwork in Kurseong and her bushy dog Rolley who became my constant companion during my stay. It would not have been possible for me to conduct the interviews without the help of my beloved sister Priska Pariyar who recorded the entire session of the interviews without any complaint.

I am thankful towards my friend Bhawana, Rajni, Disha, Shreya, Pournamy, Archana, Hijam, Depesh, Rakesh, Sahnawaj, Dr. Komal Prasad Dulal and Dr. Ramesh Kafley

and my entire classmates for being there with me through thick and thin. My brothers and sisters and friends from “Gorkha Students JNU” will always have a special place in my heart as we celebrated both happiness and sadness together they are like a family away from home.

Last but not the least, I would like to thank my beloved parents my mother, father and brother who kept on encouraging me to study and taking care of everything I need, especially my father whose ideology is that a girl should pursue higher education and be economically independent hence, I am fortunate enough to have such parents.

Pritika Pariyar

JNU

New Delhi

2019

TABLE OF CONTENTS

LIST OF TABLES

LIST OF FIGURES

LIST OF MAPS

Page No.

LIST OF IMAGES

Page No.

ABBREVIATIONS

ACWADAM	Advanced Center for Water Resources Development and Management
AMRUT	Atal Mission for Rejuvenation and Urban Transformation
BDO	Block Development Officer
BJP	Bharatiya Janata Party
CGWB	Central Ground Water Board
CPGD	Climate Proofing Growth and Development Programme
CSO	Central Statistics Office
CSS	Central Sector Scheme
BPL	Below Poverty Line
CPHEEO	Central Public Health and Environmental Engineering Organization
DGHC	Darjeeling Gorkha Hill Council
DM	District Magistrate
DPR	Detailed Project Report
EIRR	Economic Internal Rate of Return
EPA	Environmental Protection Act
EPR	Environmental Protection Rules
FGD	Focus Group Discussion
FIRR	Financial Internal Rate of Return
GH	Gallon/ Gallons per hour
GOI	Government of India
GoWB	Government of West Bengal
GTA	Gorkhaland Territorial Administration
GPS	Global Positioning System
HADP	Hill Areas Development Programmed
HH	House Hold/ House Holds
HKH	Hindu Kush Himalaya

ICIMOD	International Center for Integrated Mountain Development
IHR	Indian Himalayan Region
INR	Indian National Rupee
IWM	Integrated Water Management
JNNURM	Jawaharlal Nehru National Urban Renewal Mission
Km	Kilometer
LAIDS	Linearised Almost Ideal Demand System
LPCD	Liters Per Capita per Day
LpH	Liters per hour
MC	Municipal Corporation
MG/MGD	Million Gallons/ Million Gallons per Day
MGNREGA	Mahatma Gandhi National Rural Employment Guarantee Act
MLA	Member of the Legislative Assembly
MLD	Million Liters per Day
ML	Mega Liters
MLR/ MNLR	Multi Nominal Logistic Regression
MM	Millimeter
MoEF	Ministry of Environment, Forest and Climate Change
Mo UD	Ministry of Urban Development
NGO	Non Governmental Organization
NITI AYOG	National Institution for Transforming India
NKWS&MD	Neora Khola Water Supply and Maintenance Division
NMHS	National Mission on Himalayan Studies
NOC	No Objection Certificate
PHE/PHED	Public Health and Engineering Department
RM&DD	Rural Management& Development Department
RTI	Right to Information
SAAP	State Annual Action Plan
SAE	Sub Assistant Engineer

SIDA	Swedish International Development Cooperation Agency
SLIP	Service Level Improvement Plan
SPA	Special Central Assistance
UDPFI	Urban Development Plan Formulation and Implementation
ULB	Urban Local Bodies
WBCPGD	West Bengal Climate Proofing Growth and Development Programme
WBPCB	West Bengal Pollution Control Board
WGDP	Western Ghats Development Programmed
WHO	World Health Organization

Chapter 1
INTRODUCTION

1.1 BACKGROUND

The major concern for the degradation of the Himalayas is water which is not just an important resource but also a source of survival for the people. However, the hydrological process of the Himalayas has been harmed extensively due to the widespread deforestation. There's a dearth of knowledge regarding the Himalayan ecosystem although it is said to have significant value to the Indian landmass (Ives, 1986). In the Himalayas, there's a lack of information about the water resources and its supply, variation, quality, and production. Because of the effect of the Indian monsoon in the Himalayas, the summer months have plenty of water and the winter and springs have a shortage of the same. The late summer months bring heavy rainfall causing floods in both highland and lowland areas. If the monsoon is late or weak, there will be a severe water shortage hindering the day to day activities of the people (Kattelmann, 1987). There's an earnest requirement for water resource planning and management (Lepcha, 2013). Although considered as the water towers the upland areas of the Himalayan state face severe water scarcity and the lowlands face the floods. Besides, there has been less study on the water supply management and day to day struggles of the people living in the uplands areas. These people face water shortages because whatever rainwater they receive flows downwards due to gravity. The local authorities provide water by pumping it from the Potable River or streams or spring which is a costly affair as it requires money and electricity to pump it into the lakes. With the increasing population in the Himalayan states, there has been tremendous pressure on its available natural resources. One major problem of the Himalayan region is that there is no adequate monitoring station which in turn has hindered the assessment of hydrology in the region. A multidisciplinary approach has to be adopted. There is a growing population in Darjeeling, besides there are a significant number of students who come to study staying at different hostels within the town plus a large number of tourists come every year and stays in many hotels. Therefore the native people, students, and tourists utilize a massive amount of water for their domestic need (R.K.Guha & Kujur, 2009). The region receives the highest rainfall of (2718 mm), however there is an extreme overflow which advance to soil erosion and landslides repeatedly causing destruction to transportation, agriculture and the inhabitants. Additionally, a massive rise in the population of Darjeeling has

started to put pressure on infrastructure like housing, roads, access to drinking water and sanitation (GWB, 2012). There are many issues of water in the hills like complication of water rights in the area, limited access to water sources like lakes, river channels and upland reserves aggravate the necessity to buy the water. Besides, the water scarcity shoots up during the tourist season. The Municipal supply is irregular and inconsistent during dry periods and the tourist season leading to the transportation of water from valley to the upland areas. Many leakages are found along the pipeline and there is not much concern for repair. Because of the lack of accessibility of the formal water the poor people are forced to take water from wherever they can (Mell & Sturzaker, 2014). Darjeeling municipal town has a deficient in of water storages for supply, and the per capita availability of water in the town. Merely 50 percent of the households have access to municipal water supply. There is a huge gap between demand and supply because of the water problem. (Hazra, 2015).

Groundwater of Darjeeling hills appears under the unconfined state in the uppermost mantle, which is 3-5m thick however the thickness reduces downward. Because of the steepness, groundwater percolates to the nearby springs and *jhoras* and is inapt for dug wells. The topographical form limits the building of bored wells and the improvement of groundwater as well (R.K.Guha & Kujur, 2009). A considerable portion of rainwater received is lost as runoffs via streams (*kholas*) because of the vertical landscape (Avasthe, Kumar, & Rahman, 2013). The important thing that limits the recharge of the streams is the Impermeable rocks and excessive slope inclination. The minerals being the gneiss and metamorphoses do not permit the rainwater to permeate through the greater depth. Moreover, deforestation and solid slope surfaces obstruct the recharging processes. The main reason for the water scarcity is the increase in water used for various commercial related activities (Das R. , 2014). The severe landslides in Darjeeling during cyclone called *Aila* in 2009 broken the conduit systems of springs and *Jhoras*, which later has to be renovated by The PHE (GoWB, 2012).

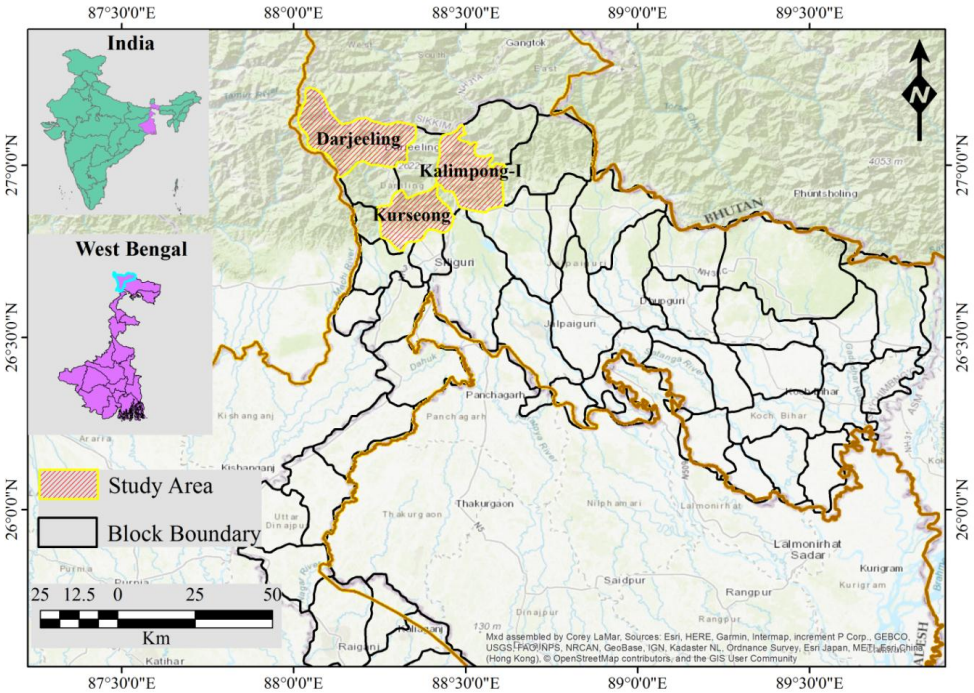
1.2. AREA OF STUDY

Darjeeling Hill has a total area of 1072.12 sq. km and includes Darjeeling, Kalimpong and Kurseong and has a population of 1, 91,847 (2011 census) with an average elevation of 6,710 ft (2,050 m) on the Darjeeling-Jalapahar range that begins in the south from Ghum. The soil composition of the Hill is that of sandstone and

conglomerate arises from the solid fragments of the ranges of the greater Himalayas. Yet, the soil is not permeable and good for agriculture. Being a mountainous area it's topsoil is weak and prone to landslides especially in the monsoons (Rai B. , 2015).

There are 5 Urban Local Bodies (ULB) in the Darjeeling district with three municipalities namely Darjeeling, Kurseong and Kalimpong, one Notified Area called Mirik and Siliguri Municipal Corporation (SMC). Between all these towns, the municipality of Darjeeling is the oldest whose progress was seen during 1835 when the British take hold of the area under the guidance of Dr. Arther Campbell, a member of Indian Medical Service. At first, the whole of the district was under the same executive body and was acknowledged as "Non-Regulation District" later, in 1850 the Darjeeling Municipality was created. However, due to prominent growth in Tea and cinchona, the area gets famous amongst the Britisher's. There are currently 2 sub-divisional towns with Darjeeling as the District headquarter (however, Kalimpong has become a district in 2017). Kurseong being a second oldest town was obtained from the kingdom of Sikkim by the British in 1835 and the Municipality was formed in 1879. Another town called Kalimpong was obtained by the British in 1866 however the municipality was formed in 1945. Darjeeling became a famous tourist destination and with the flourishing tea industry, the population was also increased considerably (R.K.Guha & Kujur, 2009).

Map 1 Map showing the study area



1.3. LITERATURE REVIEW

1.3.1. MAJOR DETERMINANTS OF ACCESS TO DRINKING WATER

The major determinants of access to drinking water have been discussed by many authors whereby they have mentioned about the socio-economic, demographic factors that does affect the household accessibility of the source of drinking water. Asante (2003) have analyzed the socio-economic part of access to safe drinking water without demarcating the main sources of drinking water. (Osei, 2005) Examined "the water security and water demand in the Volta Basin of Ghana using Linearised Almost Ideal Demand System (LAIDS)" and concluded that price, household size, residential area and household expenses on water among other things are important forecaster of the demand for drinking water. (McGarvey, et al., 2008) desired to ascertain "the relationship between socio-demographic characteristics and household drinking water quality in Coastal Ghana" and found that variance in community and household socio-demographic and behavioral factors instigate the quality of drinking. Amponsah, et al., (2009) have examined the socio-economic factors of drinking water from numerous sources. The health and productivity consequences of contaminated drinking water made for the importance of the study. subsequently Choumert, et al., (2014) studied the importance of access to piped water; due to the high expenses related to installing new piped connections. It is found that for the low- income countries it is beneficial to lease a property with an accessible water connection in the urban housing market in Kagali, Rwanda. Their results denote that expanding the piped network to a new house will raise the rental price of the house which is enough to pay for the cost of installing the new connection under two years. Soares, et al., (2002) Evaluated access to drinking water and total and per capita household expenses on drinking water with regards to socio-economic indicators such as "urban vs. rural setting, household income, type and regularity of water supply service, time spent obtaining water in homes not served by running water, and type of water-purifying treatment, if any" and found to have significant relationship. Again Rostapshova, et al., (2014) studied the important methods influencing the household's choice regarding their primary source of drinking water, focusing on access, use, and treatment in two cities of Tanzania. They found that in both cities, that access to piped water aligns strongly with socioeconomic position. Besides, the

choice of primary drinking water varies a lot in these two situations, and by socioeconomic status. (Dagnew, 2012) Evaluated "the factors affecting residential water demand among different households of the town of Merawi, North Western Ethiopia". The factors that have implicit affect on household water demand and source choice decisions in the town were: HH expenditure, income-generating activities (employment) of household members, demographic factors such as family size and age-sex composition, housing ownership and characteristics of the HH head.

1.3.2. DRINKING WATER ISSUES IN THE HIMALAYAS

The importance drinking water issues of the Himalayas has been highlighted by Mahamuni & Upasani, (2011) whereby they express that the main source of water in the Himalayas is the spring water which is normally possessed and handled by the community says Hence, the spring provides the significance of a "shared" resource. The Himalayan region is now facing a severe decline in their spring discharge which indicates that there is a considerable decrease in the aquifer recharge system or some artificial wells have tapped these aquifers. The recharge is done according to its hydro-geological condition of the area like types of rock and its structure. The importance now is to recharge these springs. Geomorphology plays an important part when it comes to spring recharge and is being encouraged in the Himalayan region. The important aspect of the management of the spring water is their type, quantity, quality, cyclic features as well as the socio-economic and administrative unit of the communities. The place of recharge is possibly found in many places like inside the forest land, private land, common land, revenue land, etc. Therefore, there is a need for technical expertise for the significance of spring recharging with the help of their location, types and the dependent population.

Kumar & Rawat, (1996) States that compared to the rest of the country hilly areas are very different owing to its rising and falling landscape and rigid geographical structure. In the Himalayas, the groundwater is only accessible through springs and forms the main source of drinking water for the residents in the areas of higher elevations. The downward flowing river of the valley does not provide water for the people living in the higher elevations. The development of the towns in the Himalayas is hindered by the unequal water supply. Because of the deficient in natural storages, there is poor availability of freshwater in the hills. The Himalayan regions are facing

lots of problems like insufficient surface water in higher altitudes of the hills, the decline in spring discharge, contamination of the water bodies in the urban areas, Rising demands of water in the towns, incessant soil erosion and siltation of the lakes, growing destruction from flooding and landslides.

In the Himalayan communities, spring is of paramount importance for the survival of its dependents says (Pradhan, 2015). However, in terms of policy and practical levels, they are not given appropriate attention although they have a pivotal role in water security. There is a huge disparity when it comes to tackling the changes in these conventional sources of water. Therefore, the policy and decision-makers should educate and make individuals and the community members aware of this crucial topic.

Despite having many perennial and non-perennial rivers and streams the Himalayas deals with drinking water problems. The steep slopes and sandy soils could not hold water thus resulting in the high runoff. For their daily requirements, about 60 % of the hilly residents depend on natural springs. However, these springs have dried up due to unevenness in the environment and its degradation (Rana & Gupta, 2009).

Sharma, et al., (2010) states that the northeast region of India has not gained any profit even after having plentiful water resources capability. Throughout the rainy season, there is turmoil because of too much water causing floods, landslides, soil erosion, etc. After the rainy season, there is a severe water scarcity which hinders the economic activity in the farming and the households. This exhibit a situation of 'water poverty' region turning into a 'water abundant' region. There is a need for a modern design of the drinking water supply system incorporating PHED, irrigation and agriculture scheme. This scheme will be only accomplished with the contribution and motivation of the communities of the village in support of local NGO's, village chiefs, and village level institutions.

Khawas, (2004) Interprets nearly everyone in the hill depends upon the spring water where it forms the major source of domestic and drinking water. It also marks the condition of underground water and the water table. The volume of the spring increases in the rainy season and decreases during the dry season. However, this conventional spring source is disappearing quickly particularly in the urban areas

because of deforestation and demolition of other ground plant life's resulting in weathering of the soil, reduction in the permeability of the rainwater and recharging of the groundwater. Hence, it is crucial to protect and preserve the springs to facilitate the connection between the magnitude of big rivers and the environment within. Management and utilization of these sources should also be optimized as it is the only source of domestic and drinking water throughout the Himalayas.

Vlachos & Braga, (2001) Focus on their concerns about the relationship between the water and human settlements in the Himalayas which is changing the environment as well. The preliminary section rotates around the prospect and challenges included in development as the administration of water is expanding urban settlements worldwide. The central idea is that there is a need for an advance, the involvement of "integrated water management".

In both Sikkim and Darjeeling Himalayas rivers and lakes are regarded as holy. They are the source of different activities like ecotourism, rafting, irrigation, drinking water supply, recharge of aquifers, etc. However, there is a need to boost the efficiency of the use of water as it has been predicted that the rainfall pattern is likely to be both erratic and inadequate. To meet the requirement of both the household and productive need it is essential to alter the design of the water delivery system (Avasthe, et al., 2013).

1.3.3. DRINKING WATER ISSUES IN THE DARJEELING HILLS

The study on water resource of Darjeeling has been presented in the work of Das, (2010) whereby he has focused on water crisis in Darjeeling town and the problems faced by the people because of it. According to him, numerous problems have deliberated the water scarcity in Darjeeling. These problems are leakage, massive deforestation, drying of springs, defective water supply systems, and high population growth. He suggested that the most excellent system of water management in the town is the harvesting of the rooftop rainwater.

Again Chettri & Tamang, (2013) Discussed that the water resource in Darjeeling town is directly proportional to the growth of the population due to the vast expansion of the urban area. The study also highlighted the policies amended by the municipality consecutively to lessen the water crisis in the town

Khawas, (2003) Presented a detailed study on the management of the urban areas under Darjeeling municipality. While discussing urban management, he highlighted the importance of Darjeeling Municipality about the management of the most crucial urban facilities like water supply, sewage and sanitation, solid waste drainage, etc and claims that even now Darjeeling municipality undergoes the problems of institutional and planning.

Bomjan, (2008) Talks about the problems of Darjeeling hill town like the expansion of the urban area and land use in short duration. She opines that the massive problems of the town are caused due to the immigration of the people towards the town thus resulting in massive population growth. Therefore, this has caused arbitrary use of land and brutal damage to natural resources. The hill invites many tourists which are the cause of water scarcity, especially in two peak seasons March to May and October to November.

According to Ghatani, (2015) Darjeeling water management system is ancient and undeveloped. The growth of infrastructure has been held back due to a shortage of funding and inappropriate methods of governance. Moreover, the characteristics of demand and supply have been deluded resulting in the rise of the amount of water shortage. There could not have been efficient water management in the town due to the absence of unity amongst the public and decision-makers. This absence has curtailed effective public participation in the sustainable management of water resources. She opines that a feeling has surfaced that the municipality is a hollow formation rather than being an important segment of the community. Subsequently, the involvement of the private players is significant in meeting the water needs of about half of the population of the town. The factors affecting the water management system in the town is inappropriate institutional management, lack of awareness among the public, insufficient number of reservoirs, illegal tapping, and leakages in pipelines, etc. finally leaving the area with the severe water crisis.

Mukherjee, (2013) Analyze the sustainable management of natural resources enhancing the livelihood in Darjeeling –Sikkim Himalaya. His study was conducted repeatedly for three years from March 2010 to February 2013 at Regional Research Station (Hill Zone) under the guidance of Uttar Banga Krishi Viswavidyalay, Kalimpong. Management of the natural resource particularly centers on systematic

and scientific knowledge of resources, ecosystem and the sustaining ability of those resources. The study reveals that the ecosystem of the hills confronts land and forest degradation due to overutilization of the existing resources.

Factors like Urbanization and population have put much pressure on water systems and waste management. In Kurseong the British made the reservoir and distribution system has not been upgraded so far thus it could not fulfill the water demand at present. Besides, the depletion of the water sources has widened the gap between demand and supply in the region. The residents receive water on alternative days through formal connection and some also use informal sources for the supply. There are innumerable households and commercial sectors in the town that depends on the informal water suppliers and through illegal tapping. Furthermore, people are unaware of the quality of the water they purchase and are susceptible to many health-related problems. The region needs a "sustainable long-term water supply" to end the water problems for which "the India-Sweden Integrated Water Management Project was initiated in 2008" (Alisch, et al., 2012), (Arsenault, et al., 2012).

In Darjeeling district, the problems of water supply are nefarious which is centered by restless "ethnicity-identity political conflicts" hence it is difficult to understand the dispute over water making this problem unreliable. The location and environmental politics in the region question water justice worldwide because the above factors here decide what will occur or not regarding water. The region has a "hybrid system" of water management with the involvement of community, state and markets alike. These systems of water distribution are cemented with "political, social, economic injustices and symptomatic of a democracy deficit". Because of the political priorities, the discrimination over water supply has been hidden (Joshi, 2015). Since mountain aquifers consist of hard rock it is not at all easy to retrieve the groundwater. The authority over the water supply challenges the popular "fixed-position, theoretically normative claims of justice and solidarity as being synonymous with certain specific institutional models" (Castree, 2011).

In Darjeeling hills, the supremacy of the urban water demarcates the lack of water because of many water providers both official and unofficial which consecutively influence the availability and accessibility producing the official water supply, unofficial water markets and conventional spring source (Shah & Badiger, 2018).

Further, the situation is heightened by the lack of strong political determination and governmental effort to enhance the existing water supply (Mondal & Roychowdhury, 2019).

Chhetri, (2018) has discussed thoroughly about how the water resources have been privatized in Darjeeling town and how it has affected the general public at large. It has been found in his study that there has been a massive inequality of water amongst the general public of the town because of the privatization. Further, the water markets are running illegally across the town through ownership of these sources. It has been suggested that there is a need to promote the community based water management and a proper channel of water distribution to end the privatization models.

1.3.4. COMMUNITY PARTICIPATION IN WATER MANAGEMENT

According to Lammerink, et al., (1999) Community water management is a collaboration involving both water sector organization and the communities. They can spot the problems lurking in the local water supply system and can also discover the possible solutions for it through management by communities. Because of this method the provider becomes the moderator to harness the community water management. Communities becomes dynamic contributor rather than inert beneficiaries and are responsible for their measures

Humans have become expert in tracing down the underground water sources all because of their understanding, inspection and investigation of the areas. In the Himalayan regions the development of the cultures has made them experts. With the advantage of beneficial litho logical system the areas owns many natural springs but the system of water harvesting could not been developed because of the excessive drainage density (Rautela, 2000).

Forsyth, (2005) argues that it is important for the public to undestand the affects of land use on water resources as it shapes the official environmental plans and also the opinion about land use. His article urges to have debate on the connection between the public opinion to that with the justification of changes in hydrology. The articles also argue that a hydrologist should view that the opinion of the public and science surfaces equally. They can also help reduce the arguments between them by unfolding difficult environmental problems into more varied and adaptable forms.

(Sharma & Joshi, 2014) states that the Himalayan region cultivates a unique water harvesting. Historically the state was not in charge of water supply to its people nor had any involvement in water use. However, they had a system of managing the water with the help of the community this system later give rise to the traditional water management. The state had also acknowledged the rights of the community over the use of natural resources. In Kumaon the traditional system of water harvesting was done through "guls, naulas, dharas, lakes, kund, khal, simar or gazar" which are even now used for water supply. This paper highlights the pioneering work in Nainital breaking the customary practice of water conservation which got disappeared with time. This paper shows that the region offers the best practice of water management for the modern world.

However, Joshi, (2014) discovers "how the women of Darjeeling Himalaya who are engaged in the politics relate to the regions enduring water challenge?" Owing to its environmental susceptibility and delicate social system in the eastern Himalayan areas summon women's unity over the issue. However, in Darjeeling district she found variety of women in various positions with both power and weakness are not capable, unwilling and indifferent to tackle the discrimination over water which calls for observation on both myth and illusion over gender-environment and gender-politics.

Straub, (2009) reviews the institutional agenda that controls of water supply services especially on developing countries. It first highlights the disparity in the water sector specifically relating to those between the types of resources, utility, authority and purpose of several representatives who are interested. Subsequently, it focus on 3 major problems like dispute on provision by public versus private, the proposal of authoritarian agenda and budgetary model of the subsidies presumably by drawing some guidelines for suggestion and references for case studies. She points out that the water in urban areas is not eligible as a public good bur still has some quality to justify involvement of public in its supply.

(Bakker, 2008) Defines that the views of community are gaining significant attention during discussion on what will be the substitute over privatization of water. Her paper presents an analysis of the notion of community water supply which is summoned as a substitute over privatization. It also reflects the classification of rights of the communities and control over water supply. She has also criticized the faulty ideas of

community's position in the plans along with the capability of the 'commons' endorsing the community controlled water supply systems. The paper closes with a short argument over the future debate on 'community' substitute to privatization, concentrating on water supply.

1.3.5. MECHANISMS TO REDUCE THE WATER PROBLEMS IN THE HIMALAYAS

Sharma, et al., (2010) talks about the change in the development of conservation policies and practices, the condition of protected area management, plans on wetland protection, and the landscape management, community-based conservation plans, and the union of policies and practices in the HKH region. According to them, there is a need to highlight the contribution of the mountains on the universal supplies and services which can be done by developing the policies related to the mountains

The people of the Hindu Kush Himalayan areas are facing severe seasonal water shortages due to erratic rainfall and climate change says (Vaidya, 2015). Special consideration should be given to appropriate watershed management contemplating the relationship between the upstream-downstream areas and proper institutional planning. It is important to involve the local users and their resolution in sharing of the water and the community services. To preserve the institutional plans of interdependence and collaboration amongst the community members it is essential to formulate premeditated involvement. There are some local methods of collecting the water by the individuals and the communities which will be useful in times of needs and these methods will not just help them but will also initiate their resistance. Yet time and again the government policies have ignored these aspects and are often been discouraged by the centralized method of rules and regulations.

Nayar, (2006) states that the universal answer to the water crisis is the enhancement of the control over water rather than investing in improved technology. The aspect that needs consideration is new policies for the localized provision of water supply where there is a modification not just in the role of the government but also in the beneficiaries. This paper emphasized that the water crisis can only be solved by breaking the classified agenda of water. Lastly, they have suggested that the most influential and lucrative solution is to reform the control of water inside the water

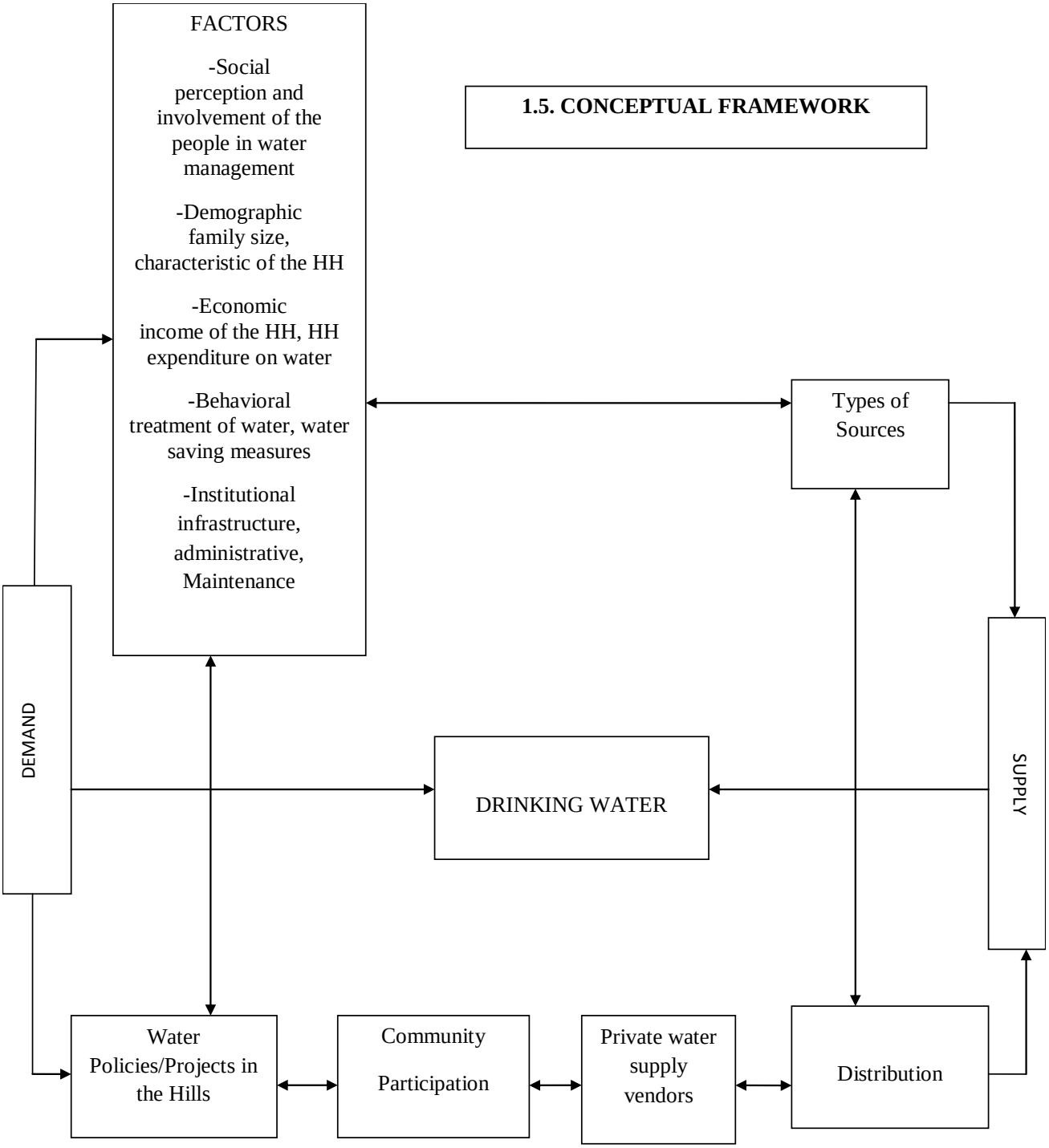
sector. While according to Chawan, (2005) water is an important aspect of life and cannot be replaced. The water cannot be purified and it is costlier to transport. There is very limited sustainable freshwater and is not available everywhere. Globally it has been revealed that the cyclic movement of water has approached its maximum value, as a result, the countries having excess water will suddenly feel the dearth of water. The concern of humans over water is divided into 2 *quantitative* and *qualitative*. "**Quantitative** is mentioned as that concern where we will have sufficient water to meet our needs and the effect of deflecting the water from one point of a cycle to another. **Qualitative** refers to issues, such as whether the water will be of sufficient purity so as not to harm human or environmental health". He also defines that water is a rare commodity without which there is no sustainable development. Therefore, there is a need to prevent excessive runoff with the help of an increase in access or shifting it to the drought-prone areas. All these things are possible via afforestation of the area, the transmission of the basin and through sustainable development exclusive of damage to the natural surroundings. Thus India has to deal with its water resources wisely, favorably and rightfully.

1.4. STATEMENT OF THE PROBLEM

Even after having countless rivers, springs and streams the Darjeeling hills towns face a severe water crisis. However, the situation gets bad during the dry periods when there is less or no rainfall. The volume of both the river and springs gets reduced and some non-perennial springs get dried up making the life of its dependents pretty much difficult. During these difficult times, many private vendors are running to deliver the water to its customers and those who cannot afford it are seen standing in a queue to get the water from the perennial springs. However, year after year these springs are also reducing its volume, some are even drying. The studies on the Himalaya shows that is due to many natural and anthropogenic factors. Nowadays even the perennial springs are not free from these factors as its volume is also reducing day by day. Those who can afford will buy from the vendors irrespective from where they bring the water however those who cannot afford will be the worst sufferers. Like many hills of India, Darjeeling hills face the gravest problems of drinking water due to many Natural and Anthropogenic factors. Furthermore, there are no alternative sources of water supply like wells or dug wells compared to the plain region. The

population growth plus the floating population like tourists and students and also those who migrate from rural areas to towns have put tremendous pressure on the water supply in the region especially during the dry periods. Besides, deforestation and pollution near the source is also one factor which hampers the water supply. Furthermore, there is improper management of the water in the town one can see a bundle of pipes in the drains '*nali'* which not only shreds the beauty of the town but also reflects the condition of the water management by the local authorities. There are many cases of illegal connections in the towns where people tend to punch the mainline pipes and take the water to their homes this happens all along the mainline pipes going towards the town. The opinion of the upland communities has not been done so well on the studies of Himalayan water resources hence many things have remained unanswered like how the authorities are handling all these issues? How the households are accessing their drinking water and from where? How do they manage their daily lives when the water is not sufficient from the main sources? How are private vendors functioning in the town? Who are their customers? How much do they deliver? Besides, there are also such communities '*sama*j' who are not just accessing the water from the spring but also managing and protecting it thus how are they coping with the issues of management? How do they function and what problems do they face? All these things need to be studied in details and there is an urgent need to bridge this gap. Likewise, the appraisal of demand and supply side of water availability and accessibility and the condition of the water supply systems, the stand of the local authorities to resolve the problem, the status of the water policies and projects and their backgrounds are also largely unstudied.

1.5. CONCEPTUAL FRAMEWORK



1.6.OBJECTIVES- The basic objectives are

1) To examine the availability of sources of drinking water and its distribution and the role of the local administration in the towns of Darjeeling hills

2) To understand the types of private water supply vendors and their role in water supply in the study area

3) To study the accessibility of sources of drinking water in the study area and factors affecting it in the domestic households

4) To understand the need for community participation in drinking water in the study area

5) To understand the policy/projects initiated in drinking water in the study area

1.7.RESEARCH QUESTIONS

1) What are the different types of sources of drinking water available in the towns of Darjeeling hills? What is the role of the local administration in providing the drinking water in the towns and to what extent it has been provided? What are the various obstacles encountered by the said authorities in terms of drinking water across the towns?

2) What are the different types of private water supply vendors? How do they provide water in the town? What are the prospects and problems of supplying the water in the town and also in their business?

3) What is the variation in accessibility of sources of drinking water in the domestic households of the study area and the factors that are affecting this accessibility? What are the patterns of water consumption in domestic households?

4) What are the local efforts and community-based strategies for addressing the issue that can be devised to obtain the drinking water? Can the situation be improved by the participation of the communities along with the municipal service providers? To what extent women play a role in shaping the need to participate

5) What are the policies and projects initiated regarding the drinking water by the government authorities particularly hill area-based policies/projects? How far it has been successful and what are the further improvement needed in these policies and programmes that can be included for future aspects?

1.8.DATABASE AND METHODOLOGY

The data for this study has been obtained from both primary sources and secondary sources. Collection of the primary data has been done with the household survey of the study area with the help of questionnaire; There are altogether 600 samples out of which around 500 is household, 3 municipality/PHED waterworks engineers (2 assistant engineers, 1 executive engineer) and 2 party leaders (1 governing and 1 opposition leaders) and 1 MLA each were also interviewed in each town with different sets of questions in order to understand the crux of the problem, 50 private vendors are also interviewed and 1 Focus Group Discussion (with 6 male and female) was conducted with those communities who are involved in the water management and are adopting various ways to cope up with the water shortages within the town.

Having different sets of target groups in the study, sampling methods like Purposive and snowball have been used. The areas for the survey have been chosen according to the information provided by the key informants like municipality and PHED. A Simple random sampling technique is being used for the selection of the households and female respondents were chosen as "*men remain distant when it comes to water collection, storage, and management"* (Chakraborty, 2018). There is no physical water scarcity as such however there is evidence of Institutional water scarcity[1] which has been covered by many articles and newspaper. According to (Poonia, 2015) "*Demarcating the water-scarce area do not follow the pattern of water availability because the north-east and eastern part of India is rich in water availability but experiences water scarcity which proves that water supply and water scarcity is not related to water availability as there are already evidence of experiencing water scarcity in these areas characterized by highest rainfall in India*". Household Survey is done to understand the socio-economic, demographic, Behavioral and Institutional factors affecting the accessibility of the Drinking water. Further engineers of municipality/PHED from the water work departments, party leaders and MLA's have also been used from whom the information about the general aspect of water availability and it's problem, also the information from the private vendors have been

[1] An area that has high availability of water along with high demand but is low on supply faces institutional water scarcity. This type of scarcity is created by the institution as demand is high which needs to be satisfied. High demand is incentive for institution to provide water supply. Most of the Himalayan districts come in this category (Poonia, 2015).

acquired to understand how they function and supply the water in the town. Selection of the community is done by putting a question in the household questionnaire '*Whether the respondent is a member of any community and whether that community is involved in water management?* After getting the answer the community was selected for conducting the FGD by meeting and taking permission from the community president. Focus Group Discussion (FGD) has been done with the communities to have an idea about their local strategies for addressing the issue of obtaining the drinking water during shortages and the management and protection of the spring which is a boon for the hilly areas. Secondary data include census reports, district gazetteers and data from different municipalities and PHED offices.

There are altogether 600 samples where 500 samples represent the households, 14 samples represent municipality/ PHED Waterworks engineers, Party members and MLA, 50 private vendors and 3 FGDs with 12 members.

Table 1 Total Sample size 600

Towns	**Household**	**Municipality/PHED/party leaders/MLA**	**Private Vendors**	**Communities**
Darjeeling	200	5	20	1 FGD(12 members)
Kalimpong	150	4	15	1 FGD(12 members)
Kurseong	150	5	15	1 FGD(12 members)
Total	500	14	50	36 MEMBERS

The party leaders and MLA is being taken in order to have an additional information about the drinking water in the towns since they are quite active in the town and being in a responsible post have a good knowledge about the place and its problem.

1.8.1. Data Collection Method and Techniques Used

The data for this study has been obtained from both primary sources and secondary sources. Collection of the primary data has been done with the household survey of the study area; selected waterworks engineers, Private vendors, community members along with political party leaders and MLA with the help of a questionnaire. Prior to the main survey a pilot survey was done in 2016 in order to understand the situation of water problem in the town and also to collect the secondary data available in the respective offices of the towns. The main survey was done in April-June 2017 however due to political unrest and 107 days of strike the survey has to be continued in January 2018. The multinomial logistic (MNLR) regression model has been used to examine the factors affecting the sources of drinking water. This model is relevant for the study because "the dependent variable i.e. the sources of drinking water is more than two types with no natural ordering, representing the different options households face in terms of access to drinking water" (Amponsah, et al., 2009). There are five options the households could access from: tap water into dwelling, tap water into yard/compound (treated), spring water into dwelling and spring water in distance, and water tankers. "The multinomial logistic regression is often regarded as a desirable analysis because it does not assume normality, linearity, and homoscedasticity. MLR has assumptions such as the assumption of independence among the dependent variable choices" (Starkweather & Moske, 2011) . Besides cross tabulations work has also been done in order to get the percentages of the important variables. Many audio and video recordings were also made while taking the interview of the respondents. Before that prior permission was taken from them and clarification was made that the purpose of taking it is purely academic. Many individuals have given interview on the condition that their name, post and place should not be mentioned anywhere in the study thus their confidentiality has been maintained throughout the study. The personal views, thoughts and statements have been highly respected throughout the study and careful efforts have been made not to discriminate or hurt the sentiments of any interviewed respondents.

1.8.2. Distribution of the Zones

The zonal distribution of the town is either done by the municipality or PHED. From that zone pilot survey was done and wards were selected for the study on the basis of the pilot survey and the information provided by the officials.

Table 2 Zonal classification of Darjeeling town

Zones created by the UDFPI[2]	Ward numbers	
Zone A	1,2,3,4,5	Note* These zones are made according to the continuity of the wards and the wards which are close together are clubbed in a single zone
Zone B	31,32	
Zone C	14,31, 11	
Zone D	23,28,29	
Zone E	6,7,8	
Zone F1	10,15,19, 20,21, 24,25,26	
Zone F2	9,12,16, 17, 18,22,27,30	

Source: Darjeeling Municipality Office, 2015

Three zones were selected upper, middle and lower and wards were chosen according to those zones.

Zones	Wards
A	29,30,32,
B	7,13,18 ,25
C	1,4,6

[2] UDPFI –Urban Development Plans Formulation and Implementation guided by Ministry of Urban Affairs and Employment.

Table 3 Zonal distribution of wards Kalimpong town

Zone	Wards
A	1,2,3, 10,11,12
B	4,5,6,7,8,9
C	13,14,15,16,22,23
D	17,18,19,20,21

Source: Kalimpong Municipality, 2013

Zones	Wards
A	1, 3,7,9
B	19,14,20,23
C	16,17

Table 4 Zonal distribution with zonal reservoir tank in the Kurseong Town

Zones	Area with zonal reservoir tanks	
Zone I	New reservoir area	
Zone II	Victoria area	
Zone III	Dowhill Post office area	*Note These zones are made according to the topography and water demand of the area
Zone IV	St. Helen's area	
Zone v	Municipality area	
Zone VI	Chruch top area	
Zone VII	Eagle's Craig Tank area	
Zone VIII	AIR radio station area	

Source: PHED Office Kurseong, 2016

Zone	Wards
A	1,2,4
B	6,9, 11,13, 17,
C	19,20

Chapter 2

Status of Drinking water in the towns of Darjeeling Hills: Availability of sources and its distribution

2. INTRODUCTION

Historically the settlement in Darjeeling hills is said to have been attracted by the presence of springs, however, with the rapid growth of population coupled with uncontrolled deforestation, impulsive land use has eventually deprived the region. Therefore, there has been a significant drop in the availability of the surface water during the dry months which is evident in the entire hills. The urban areas face difficulties of water with regular conflicts as well as uncontrolled corruption/misuse has arisen (Basumajumdar, 2016). (Shah & Badiger, 2018) opines that "water scarcity is manifested through the combination of physical, economic or institutional factors both spatially and temporally and on different social class and geographical location". The per capita availability of the water in Darjeeling is 3883.72 m^3/year which comes under water surplus region and is safe concerning quantity and quality (CSO, 2018). But the region also has higher runoff which is difficult to store the rainwater as well. Hydro geologically, in the mountainous zone of West Bengal hill springs and streams are a source of water though it is not a very dependable source and these regions depend on institutional supply and suffer from water scarcity (WB PHED 2002 as cited in (Syamroy, 2011). Syamroy also opines that though Darjeeling is safe concerning natural water availability but popular perception is that Darjeeling is in a water-scarce situation. This is because Darjeeling may be safe concerning the flow of natural water supply but is lacking from the institutional water supply position. This chapter will discuss these various issues and is dependent upon both primary and secondary sources, which includes the interview of the key informants like the Engineers and Assistant Engineers who are responsible for the drinking water supply for the Town, additionally the interview with both governing and opposition party leaders and the MLA's have been taken into consideration some of whom also shared the RTI data which they obtained from the local administration. Secondary sources like the articles, books, unpublished thesis, newspaper, etc are also being referred. The interview with the officials was done after doing all the other surveys like the household, the private vendors and the community FGD. While doing the other

surveys some extra information regarding water came to light. Therefore, apart from the structured questionnaire, some questions have been included to ask the respective authorities on that extra information plus some follow up questions has also been done.

2.1.AVAILABILITY OF DIFFERENT SOURCES OF DRINKING WATER IN THE TOWNS OF DARJEELING HILLS

According to the census of India there are 8 different sources of drinking water available on the hills namely tapwater, well, handpump, tubewell/borehole, spring, river, tank/pond/lake and other sources which are given in annexure

According to the primary survey, the most common sources in the urban areas are either the municipal tap water, springs, and water tankers because, in the Himalayan region, there are no tube wells and bore wells to harness the groundwater resources (CGWB & Gupta, 2014). Use of Tube wells, Boreholes, wells, and canals are prominent in the foothill region of Darjeeling. The CGWB has also calculated the groundwater potentiality of the foothill region Siliguri and Kuseong (Sukna and Sevok foothill) and not the hilly region.

Whilst the water supply system in Darjeeling hills has been termed in various ways by various authors. Like (Mell & Sturzaker, 2014) regarded the water system in Darjeeling hills as Complex system, (Joshi, 2015) define it as the Hybrid system, (Shah & Badiger, 2018) define it as the intertwining and overlapping system, (Chakraborty, 2018) define it as matrixes of power relations involved in the water supply, and (Chhetri, 2018) defines the water management system as Privatized system.

During the primary survey it has been found that there are 3 different sources of water available for the people i.e. Tap water, spring and water tankers.

Table 5 Main sources of drinking water available in the hills

1) **Tap water** (provided by the municipality/PHED)	**2) Spring water** ✓ owned by the individual (dwelling) ✓ owned by the community (away)	**3) Water tankers**

Source: Primary Survey, 2017-2018

Table 6 Main sources of drinking water in the hills according to its accessibility

Source according to its location	Quality
tap water into dwelling	Treated
tap water into compound	Treated
Spring water into dwelling	Untreated
Spring into distance	Untreated
Water tankers	Untreated

Source: Primary Survey 2017-2018

The above table depicts the different sources of drinking water and its accessibility in the town. There are three sources and different ways to access them. The municipality/PHED only controls the tap water which is formal and the rest is informal water sources. Majority of the residents are also found to have been depended in this non-municipal or informal sources because some of them do not have municipal coverage in their area and for some it is cumbersome to wait for the municipal supply [3] and for some spring water into distance is far more convenient as it is free of cost and are available whenever they need as an additional requirement. The case of spring water into dwelling is unique in the hills and is covered by many authors like (Drew & Rai, 2016) (Lama & Rai, 2016) (Mondal & Roychowdhury, 2018) (Chakraborty, 2018) (Chhetri, 2018) in their work and have mentioned these types of sources as informal source which are provided by the private spring owner

[3] Note: The municipal water supply is given on the seniority basis i.e. on the date and year of applying for the water connection

who share/sell their spring water. Here, the private spring owner means that the spring has emerged in his/her land and it's up to the owner to sell/share this spring water. Supply from these private springs is done with the help of a pipe system (Ghatani, 2015)**. "**The areas like lower *Toonsong, Ganesh gram, Alubari*, Japanese temple, *Nimki dhara* thrive on the business" (Chakraborty, 2018) and areas like *Chitrey*, Tibetan refugee camp, *Battikal, Limbu busty*, *Mount valley* also has this private sources supplier in Darjeeling. In Kalimpong this kind of source is available in areas like *Durbin*, East main road, *Grave dhara*. In Kurseong it is available in areas namely *Sitalu Busty, Chimley, Dokan Dara* etc. This is also one reason why the source and its location have been kept open in order to have a better understanding of the sources available and its accessibility.

During the primary survey nowhere in the towns any households or individuals or water vendors are found to be using hand pumps, wells, tube-wells, and canals as the source of drinking water. However, in Kalimpong town the borehole was initiated in haat bazaar (one has already been initiated in Albela School) and the people were also accessing the water from it but were soon closed down by the leader of the opposing political party.

"*We had to stop the use of the borehole because this has never been used in our hills and we might never know its consequences, it might disturb the aquifer system of the hills and may further dry up our spring sources*" said the Mr. Chettri party leader[4].

The consequences of the borehole in the Himalayan region has been recently reported by the CGWB in Namchi south Sikkim where the yield of few springs had died down because the groundwater was interrupt due to the borehole. According to CGWB, there is a necessity to have a in- depth study of the geological configuration and human habitation down below next to the slope direction of fractures before choosing the place for the boreholes (Gupta & CGWB, 2014).

[4] Field interview with the leader of the party on 25th March 2017, Kalimpong

Image 1 The borehole located near hat bazaar Kalimpong which was closed down by the said political party

Source: Primary survey, 2017

The above-mentioned borehole was installed by the governing party which was later closed by the opposing party; however, the local residents who were accessing the water from the said borehole were not happy with this decision.

हामीहरुलाई अधिकारीहरुले पुग्नेगरि पानी दिदैनन् अनि यो पार्टीको मान्छेहरुले पनि Borehole बंध गरिदियो उनीहरुले हामीहरुबाट के आसा राखछन् ?

(**Translation**: *The authorities do not give us enough water, and these party people also closed down this borehole, what do they expect us to do*?) said one 40 year resident from *Haat* Bazaar Kalimpong[5]

The resident of this locality has tap water into plot/yard which comes for 1 hour and at least 10/12 households take the water. When this borehole was made the residents were quite happy as the volume of the water was also enormous which could easily fill their container said the residents. The residents also complained about the massive leakage from the municipal/PHED supply happening in the town and also showed the video footage and pictures where the local residents are trying to stop the leakage from the pipes and vaults by using plastics. The same video footage and pictures are then forwarded to the SAE or Sub Assistant Engineer of the PHE Department. The above person also showed the footage and said:

हामीहरुले कत्तिपल्ट कम्प्लेन्ट गॅयौ पानी लीक हुदैछ भनेर तर उनिहरुले विश्वास गरेनन् त्यसर्थ हामीहरुले विडीयो बनावनु थाल्यौ अनि अधिकारी विभागको बरिस्ठलाई पठाउन थाल्यौ

(**Translation**: We complained so many times that the water is leaking but they don't believe us so we have started to make videos and send it to the department heads). In the said video and images were showing how the locals were trying to stop the massive leakage in the valve with plastics by tying it with rubbers.

2.2. ISSUES OF WATER MAFIA AND CORRUPTION IN THE TOWNS

Before going through the detail of this chapter it is important to mention about the issue which came into light during the surveys. While doing the survey with several respondents it has come to notice that there is an issue of water mafia in the town. Some authors like (Drew & Rai, 2016) (Lama & Rai, 2016) (Mondal & Roychowdhury, 2018) (Chakraborty, 2018) mentions water mafia to be the private water vendors. However, another version of water mafias has been highlighted by

[5] Field interview on 30th March 2017, Haat Bazaar, Kalimpong town.

some during the interview by the different party leaders, individuals, officials and some secondary sources like articles, newspaper, and reports.

The **Prominent leader[6] of the ruling party** in Darjeeling said:

पहाडको पोलिटिक्सलाई हात पार्नकोलागि नेशनल पार्टीको नेताहरुले यो पानीको समस्यालाई जीवित राखेको हो टाइगर हिल (दार्जीलिंग) मा धेरै अवैध छेरहरु छन् जसबाट पानी लगीएको छ

(**Translation**: In order to take over the politics of the hills the leaders of the national party wants to keep the water problem alive. There are a lot of illegal tappings from the tiger hill Darjeeling from where the water has been taken)

One of the **renowned political party leader**[7] of Kalimpong mentions in the interview about water mafia as:

"*The water mafias are present within the department who promises to give special lines from the main feeder pipe itself to the one who can pay and the average general consumer hardly gets the water*".

Another **Politician from the opposition party**[8] of Kalimpong defines the water mafias as:

"The water mafias are the contractors, the shareholders of the commission and the department and have a strong linkage and all of them create the water problem knowingly. For e.g. there were 114 public hydrants in the town till 2001 however all the hydrant has been stolen and the department has given the private connection from that place which was supposed to be a hydrant. Furthermore, water in the lake of the town is much polluted, all that was needed was just 3 sludge machines (dewatering filter machine) which are worth only Rs. 46,000 each, instead the department build a tank of Rs. 92 lakh which was not needed at all. Because of all this issue by the water mafia who created the artificial water crisis, the party has filed the case against the department under compulsion"

[6] Filed interview was taken in Kalimpong town when the leader came all the way from Darjeeling for party meeting with his subordinates on 28th March 2017.
[7] Field interview on 25th March 2017, Kalimpong
[8] Field Interview on 30th March 2017, Relli road, Kalimpong town

The said **Politician** also revealed that:

कत्तिवटा विशेष लाइन् हरु दिएको छ V notch बाट जब कि त्यो लाइन् चम्बेरबाट दिनुपर्ने थियो (१ चम्बेर= ५० लाइन्स्) V notch बाट त्यसको मूल्य 90,000-1 लाख रुपिया पॅछ

(**Translation**: Some special connection has also been given from the V notch itself and not from the chamber (1 chamber=50 lines) which costs around 90,000-1 lakh rupees).

Similar thoughts have been shared in the **New Indian Express** that:

> "*The distribution of water (in Darjeeling) is controlled by the water mafia that allegedly has strong links with the municipal authority*' (Chanda, 2018).

The **Secretary of the General Committee** (opposition party 2017) in the Darjeeling informs:

म्यूनिसपेलटीमा सामग्री सपप्लाइॅर कहिलेपनि बदली हुदैन जहिलेपनि त्यै अरुण हार्डवेरस हुन्छ जसले सामग्री सपप्लाइ गर्छ खास त सपप्लाइॅर त सालै पछि बदली हुनु पर्ने हो टेंडर्स मार्फत

(**Translation**: The Municipality never changes their material supplier it's the one and only Arun Hardware who supplies the materials. Accordingly, the Supplier should be changed every year through the tenders)

Again, the **Secretary**[9] showed the RTI data and said:

यो RTI डेटामा उल्लेख गरिएको छ कि मुनिसीपलिटीले गाडीबाट पानी बाङनको लागि पैसा थापेको छ तर उनीहरुले यो साल गाडीबाट एकपल्ट पनि पानी बाडेनन्

(**Translation**: It has been mentioned here in RTI data that the municipality has received money to distribute the water through the water tankers. However, they did not distribute the water at all this year)

One of the **Community member**[10] with whom FGD has been conducted in the Kurseong town said:

[9] Interview scheduled on 27th April 2017 in the party office of Darjeeling town

जुन पानी मैन फीडर पाईपलाईनबाट आवेद ढंगमा चोरेको हुन्छ त्यो बेचछन् अनि आस्वासन दिनछन् यदि केहि भै हाल्यो भने 'मो छु' भनेर यसरि हरेक महिना पैसा उठवछन्

(**Translation**: Those illegal tappings which are seen along the main feeder pipelines are being sold, and also assurances are being given by saying "I'm there" in case anything happens and every month the money is being collected)

(**Chakraborty, 2018**) Has also mentioned in his article that:

"*These illegal tappers divert water by drilling holes into the several municipal pipelines and insert hose pipes to tap water. These are then sold to feed into the demand chain*"

Similarly (**Rai, 2018)** also writes:

"*Some illegal tapings and diversion of water from the actual receiver are done for monetary benefits. This creates as receivers will pay the tax to the administration but not receive very less supply due to illegal tapping lines*"

The fitters of the departments are also hold responsible by many individuals the (**KurseongMunicipality-SIDA, 2011**) reports that:

"*A widely known fact is that pipefitters are cheating the system by taking bribes for making an illegal connection. Currently, the pipe fitters are permanently assigned to their wards, which make them well integrated into the local communities and thus having difficulties exercising their duties of monitoring water use and reporting abuses*"

Similarly, another **Politician**[11] blames:

देपर्टमेन्टको फिटरहरु पनि बेईमान छन् कारण तिनीहरुले पैसावाला हरुलाई राम्रो पानी बग्ने लाईन दिनछन् जसले दिनमा दुइ पल्ट पानी दिन्छ बिहान अनि बेलुका

(**Translation**: Fitters of the department are also corrupt as they provide the good line to those who can pay and which provides water twice a day i.e. morning and evening)

One of the **Officials**[12] from the waterworks department in one of the town said:

[10] FGD scheduled on 15th May 2017 in Kurseong town
[11] Field Interview on 30th March 2017, Kalimpong

डीपार्टमेन्टले मान्छेहरुलाई १ घण्टाको लागि पानी दिन्छ तर हुन सक्छ वल्वमैनले बेइमानी गर्दैछ या ता होटेल्सहरुले उसलाई पानी को लागि पैसा दिदैछन् यस कारण हामीहरुले होटेलको लागि अलगै वाटर मिटरिङ्ग सिस्टम स्थापित गरेको छौ

(Translation: The department gives water to the people for 1 hour however sometimes it might happen that the valve man can also be dishonest or the hotels might be paying him the money to provide the water for that we have installed the water metering system in the hotels)

A waterworks advisory committee[13] said:

पहाडमा पानीको जटिल समस्याको कारण नै गलत ढंगमा बितरन भैरहेकोले गर्दा हो, पानी सिलीगुरिबाट ल्याईएको छैन न त प्लेनस्को जस्तै जमिनबाट तान्नु परेको छ, पानीको श्रोत हरु राम्रो अवस्थामा राखेको छैन अनि कैचमेन्ट एरियाको गार्डहरु पनि दोषी छन्

(**Translation**: The problem of water in the hills is due to the faulty distribution system as the water has not been drawn from Siliguri or not even been drawn from the ground like which happens in the plain regions. The sources of water have not been maintained and also the guards in the catchment area are at fault)

However, the political parties are also not free from the accusations:

डिपॉर्ट्मन्टले पानी चोर्ने अपराधीलाई पक्रेर ल्याएता पनि पोलिटिकल पार्टीको नेताहरुले फोन गरेर धम्कि दिन्छन् '*मेरो मान्छेलाई छोड्दे*' भनेर

(Translation: Even if the department catches the culprit who is involved in the illegal tappings/connections it is the political party leaders who often call the officers/engineers and threaten them to release 'his people') said one of the **Officers**[14]

The said official also revealed that they are bound to not say anything otherwise they could reveal everything. The officer is an asthayi employee answerable to the political party so the hesitation is pretty much understandable.

---

[12] Name, Post and place have not been mentioned as requested by the officer
[13] Filed Interview on 25th May 2017, Kurseong
[14] Name, Post and place have not been mentioned as requested by the officer

The **MLA** [15]**of the Darjeeling town** reveals:

"*Some influential people either in the municipality or through the municipality got their connection directly from the main two tanks of the town i.e. St. Paul's and Rockville. As the water is always available in those tank so they are getting it which is actually not permitted*"

One such Member of the central committee[16] (opposition party 2017) narrates:

सहरमा पानीको अभावको सबैभन्दा ठुलो फाइदा पोलिटीकल पार्टीहरुलाई भएको छ तिनीहरु पहिलेनै बेईमान थिए अब झन् बेईमान भए त्यसकारण जनता सबै सचेत हुनुपर्छ तब मात्र पानीको समस्या समाधान हुन्छ नत्र हामीले तीस्ता खोलौ फर्काएर ल्यायौ भने पनि समाधान हुदैन

(**Translation**: The major advantage due to the water scarcity in the town has been for the political parties. They were already corrupted however they now have become more corrupted. Therefore, public should be aware then only the water problem will be solved otherwise even if we bring the whole of the teesta river here it won't solve the problem)

The topic of water has become so ambiguous that people feel hesitant to talk about it. The issue of water is always being raised during the voting period and a series of an allegation by the political parties against each other about corruption on the drinking water is prominent to prove the worth for people to vote for them. However, the election agendas are not focused on the crisis of water (Mondal & Roychowdhury, 2018). During the primary field survey, it has been seen that the rival parties come out with the posters and templates, banners, and flaxes revealing the story of the corruption of drinking water all over the town. The common residents, the officers, and the engineers equally showed hesitation to talk about the water as it is always connected with the corruption which is depicted by the picture below:

[15] Interview scheduled on 27th April 2017 in the party office of Darjeeling town
[16] Interview scheduled on 27th April 2017 in the party office of Darjeeling town

Image 2 Banner disclosing the corruption in drinking water in the hills by the political parties

Source: Primary field survey, 2017

Picture discloses (during the municipal election of 2017) a well know party accusing the ruling party as:

२०१४ साल आषाढको महिनामा sintex भरि तिम्रो पैसा पाएको हो कि होईन? खर्सगको बजारमा पिउने पानी छैन PHE को पैसा तिमिले खाएको हो कि होईन?

(**Translation**: During the month of Asar (i.e. June-July) 2014 you received sintex full of money isn't it? There's no drinking water in Kurseong town you have squandered the money from PHE isn't it). This was the message meant for the ruling party who were on the municipal board till 2017.

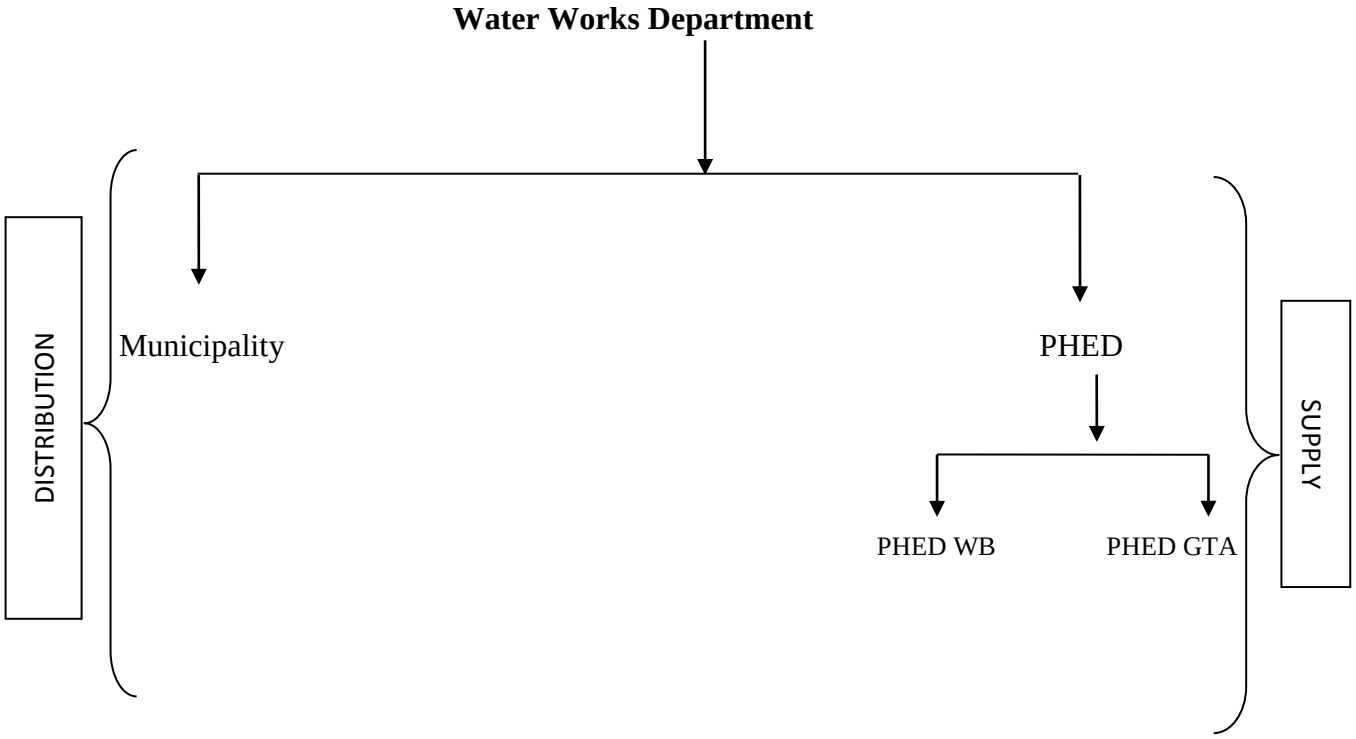
(Ftaïta, 2011) defines that "*water has become an issue of political power and economic capital that excludes the poorest sectors of society*". The above discussions have given a picture of the situation of the hill towns surrounded within the water which is often related with the political situation of the region. water supply in the hill town is often regarded as the 'Hydro-politics' i.e. who gets what through the politics of nexus and networking (Chakraborty, 2018) This has however become severe with time because people have now learned to cope up by buying the water or by managing through some way or the other rather than meddling with anything that involves with the political party. Again the hydro politics can be associated with the fear lingering since 1986 Protest (chyasi ko andolan) indicating the ironclad rule whereby no

common folks are ready to take the risk. Though some opposition parties seemed to be active in the region which was again condensed with the death of Madan Tamang[17] on 21st May 2010.

2.3.ROLE OF LOCAL ADMINISTRATION IN PROVIDING THE DRINKING WATER IN THE TOWNS

There are two departments that are responsible for the water supply in the towns. The department works hand in hand if one supplies the water the other one distribute it. The department and its function gets further complicated because of this bifurcation.

Figure 1 The department responsible for water supply in the towns of Darjeeling hills



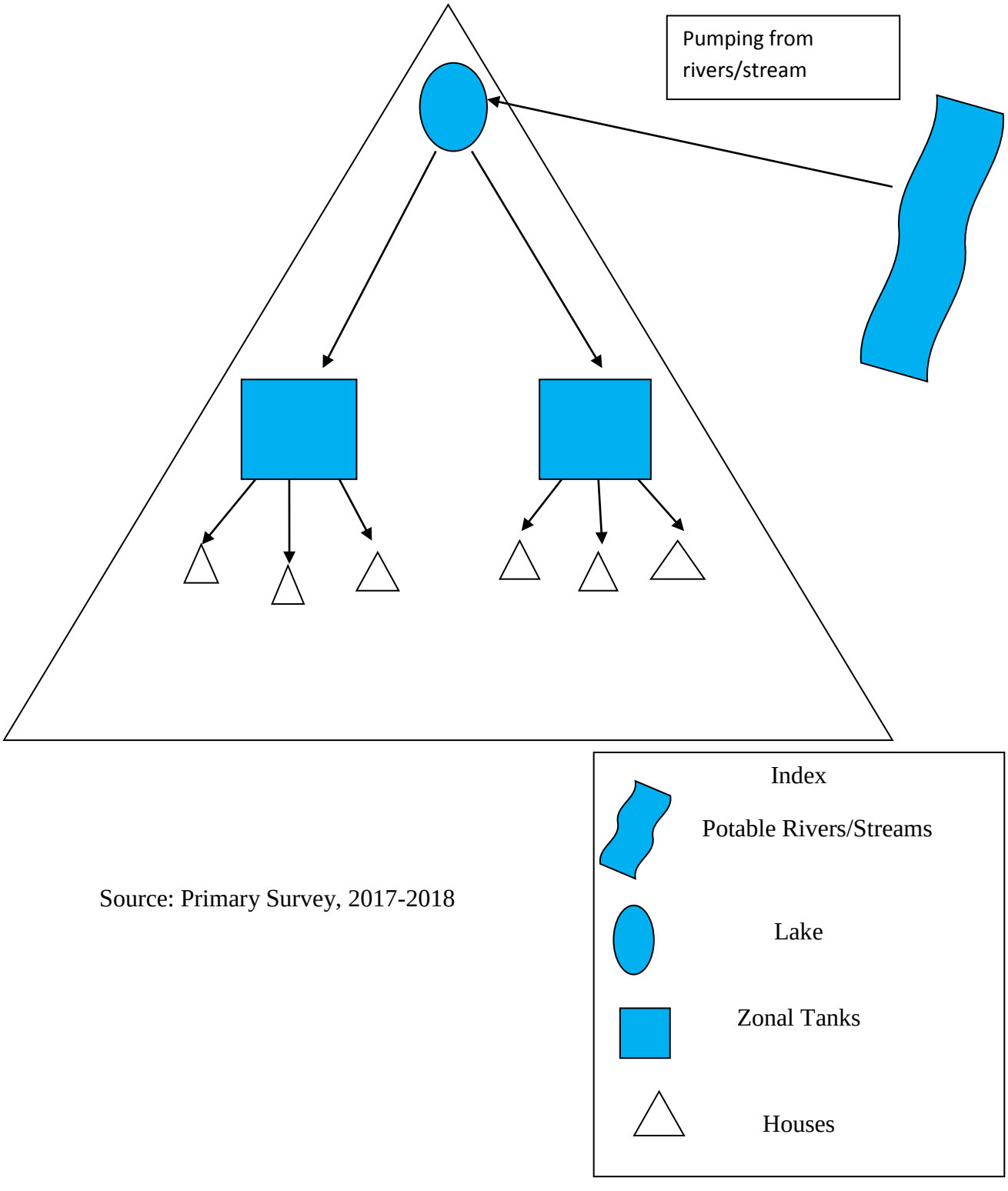
Source: Primary survey, 2017- 2018

There is a bifurcation of the water works department whereby PHED supplies the water and the municipality distributes the same. Darjeeling municipality have their own source and lakes which they maintain themselves and takes an additional required water from the PHED, whereas both water supply and distribution in Kalimpong town is done entirely by the PHED water works department and the municipality has little role on this. However the PHED Kalimpong have proposed to hand over the duties of distribution to the municipality according to the engineer of the town. The process of supply mainly involves certain procedure, first the potable

[17] The prominent opposition party president of Akhil Bharatiya Gorkha League (ABGL)

water source (river or springs) is being traced by the department and is being pumped and feeded into the artificial lakes and from lake the water is being transmitted into the zonal tanks and from there it is distributed to the households as shown in Fig 2 below.

Figure 2 Illustration of water supply and distribution in the towns of Darjeeling Hills by PHED & Municipality



Source: Primary Survey, 2017-2018

Water supply in both the rural and urban areas of Darjeeling district (hilly areas) is been under Darjeeling Gorkha Hill Council (DGHC) now GTA, except Neorakhola Water Supply scheme which is being managed by PHED. In these areas, small springs and streams are tapped for collection and storage of water for drinking purposes (Syamroy, 2011). Furthermore, the PHED is divided into two 1) PHED under the local council called Gorkhaland Territorial Administration or GTA is responsible for the water supply and sanitation facilities of the hill areas of Darjeeling district along with the operation and maintenance of the system and 2) PHED under the Government of West Bengal is accountable for planning of the water project, preparation of the reports and financial investments and often looks after the bigger river project like Balason, Neora, etc. Again, the PHED employees are also divided into two a) those who are appointed by the state government are known as 'Isthayi' or permanent and b) Those appointed by the local government (DGHC/GTA) known as 'A-isthayi' or casual. Some of the interviewed officers/engineers are asthayis who are answerable to the political parties[18] (semi-autonomous body)[19] that's why some hesitated to answer the questions. Having too many actors in the water supply system is sure making things very complex in the hills.

2.3.1. DARJEELING TOWN

In Darjeeling town the water supply is being looked upon by the two departments 1) PHED which supplies the water and 2) Municipality which distributes the water to the entire town. There are two municipal lakes called the Sinchel Lake north and south and the PHED has one lake called the Sindhap Lake. The lake was constructed in 1910 and 1932 respectively and was for around 10,000-15,000 populations. The Sindhap Lake was constructed by the P.H.E. Department in 1984 (Chhetri, 2013).

However, since most of the pipes are laid down during the British period and some of which are damaged and leakages are prominent. Because of this, the department is providing water to the people after every 3 to 4 days gap. The daily requirement of the

[18] Name, Post and place have not been mentioned as requested by the respondent

[19] The semi-autonomous body was formed in 1988 to look after the administration of the Hilly region of Darjeeling district with the agreement between the Central government, state government and the local party called Gorkha National Liberation Front resulting into the formation of the autonomous body called Darjeeling Gorkha Hill Council or DGHC (which was replaced in 2011by Gorkhaland Territorial Administration or GTA).

drinking water in the town is 2MGD however this volume is not sufficient because of the leakages in many places.

A new project of 205 crore rupees from the Central government has been sanctioned which is going to mend the entire pipes. Under this project, 30 zonal tanks will be built and the distribution system will be restored. So far, the department is unable to meet the demand of the water until and unless the whole distribution system gets restored. The most crucial problem of the water in the town has been the absence of water storage. The department will be able to tackle the problem if there will be a 4th lake (currently 3 lakes) so that the overflow spring water during the monsoon season can be stored in this 4th lake. The department said that they cannot depend fully on the water provided by the Balason**.** The Balason is a river and this river water gets quite dirty during the rainy season and the same will be pumped into the municipal lakes which make the lake dirty as well and the same has to be treated and provided to the people. This river water can be a temporary solution to the problem in the town. However, the permanent solution as per the municipal engineer is to make a fourth lake so that the overflow water from the springs can be stored in that lake. The responsibility to make the 4th lake rests with the PHE department and the municipality has already talked about this matter to the PHED. The PHED has got the land to build the 4th lake but due to the paucity of the fund, they are not able to build the lake.

There is also the case of illegal tapping of water (photos available in the municipal website 2015[20]) in which the engineer pointed out that the people have stolen the water through the illegal way because of the water problem and when it is caught the department simply throws the water pipes and report to the police and fined if necessary and if it is possible then the department also regularize the connection and gives water abiding by the system to the tappers. As for the new water connection, there is a procedure where the forms are being issued by the department on the Month of June and July (monsoon season). Then the connection will be issued turn wise on the basis of seniority.[21] The person will get the connection after 2/3 years of applying and 17,000 Rupees per connection is being charged. However after raising the issue

[20] Retrieved on 3/11/2016 from their official website: http://dm.gensoftindia.co.in/waterworks/Scarcity-of-Water.aspx

[21] Name, Post and place have not been mentioned as requested by the officer

that some respondents said to have paid 55,000 to up to 1, 50,000 the engineer told that the department never takes such amount of money from the people they provide them the proper receipt. The interviewed officer[22] of the Darjeeling town says:

पोलिटर्इिशन्सहरुले के गर्छ कसो गर्छ दिपार्टमेन्टले यस बिसयमा केहि भन्नु सक्दैन डिपाट्मॅन्टसंग यी पोलिटर्इिशन्सहरुको केहि सम्पर्क छैन उनिहरु अवछन् आफ्नो सॉर्स लानछन् अनि त्यसपछि के गर्छन डिपाट्मॅन्टले त्यो जान्दैन

(**Translation**: Some politicians come what they do how they do the department cannot say anything on this matter. There is no contact of the politicians with the department they come to take their source and what they does the department doesn't know)

However, he said that the general public is also at fault because some don't like to wait for their turn and they do not want to go with the departmental system. A query on the community-based approach in water has been put forth whereby he said the department could do it but however, directly cannot be said. The officer believes that the fund from the government should come first. Once the department received the fund and the work on will be performed. A community based work has been done in Mount Hermon, however it couldn't be successful because of long-distance and also the source was found near to a *'murda hatti*' or pyre house so all the flies come to the water source which made it impossible to work.

About the private vendor, the department hasn't approached them regarding the issues of water. These vendors usually supply water to the hotels. The department cannot judge whether that water is drinkable or not but still they are selling. Sometimes they are also found stealing the water from the department's mainline pipes. When such cases come to light than the department hands over these vendors to the police. However, the problem of giving them to the police is that the department head/ chairman have to visit the court frequently. The water thieves were caught in 2016 in Jorebunglow. The names of both the party were given and after 2/3 hearing they got fined and was later released. The department tried to stop the water theft within their jurisdiction. According to him the town really needs big water storage to store the

[22] Interview scheduled on 24th April 2017 in Darjeeling Municipal office in Chauk /Chowk Bazaar

wastewater so that they can at least supply the water even if it's not 100% coverage. The water work engineer mentioned that AMRUT is also related to Balason, until and unless the Balason will not give the water than that project will not be successful. The new project AMRUT will be more costly than the bottled water because the annual management cost of this project is 4.35 crore. If this 4.35 crore is divided by 12 than the maintenance cost of each month will come into the light. How many consumers are there in Darjeeling? And how much one consumer is paying for the water? And that too is being paid annually said the officer. He also mentioned that the department doesn't know whether this project will get successful or not and if it's not successful there will be a problem. There is an acute crisis of water during the lean periods otherwise there is enough water during the non- lean periods. The people of Darjeeling are very much conscious about the water as they store the water in each and every container and also during the rainy season they harvest the water. The department wants to aware the people about water use, conservation; management through workshops says the engineer (Darjeeling Municipality, 2017).

During the year 1910-1915 the water supply system of the town was intended for a 15,000 population, later, new water supply was established namely *Khangkhola* Station, *Rambi* water line, *Sindhap* Lake, *Bokshi Jhora* and *Bangla Khola* which still couldn't cope up with the arising population and their demand. Therefore, the drinking water has become a never-ending aspect for the last two decades. The water crisis has touch its height because the quantity of the natural springs water has critically reduced since there is immense illegal cutting down of the trees in and around the catchment area (Darjeeling Municipality, 2015). Even after having so many sources the department has failed to cater to the need of the water in the town. Still, some wards of the town are not covered under the water supply system and those wards are managing their water needs by buying the spring source from the nearby places wherever it's available.

The MLA of the town Mr. Rai[23] informs that the reason for the water problem in Darjeeling is basically due to the fact that there has been no infrastructure development for the management. Towards the end of 2000 the West Bengal government realized about the problem of water scarcity in the region and they

[23] Interview scheduled on 26th April 2017 in Bhanu Bhawan in Darjeeling town.

constructed a third lake called 'Sindap'. However, after the completion of the lake it was discovered that only half of the lake could be filled against its full capacity. The lake was badly constructed that the water used to leak. It never used to be filled till its full potential; hence, as a result this lake could not solve the water problem. Even after so many years the lake was never repaired. He informs:

"*I had done some research and found out that the leakage was catering to the need of the people who lives below the lake i.e. the Rangbul area. The residents did not allow it to be repaired because they won't get the water once it is repaired*"

The lake today has been repaired on the condition that the municipality should give a dedicated water connection to the area. Besides, there are many direct connections from the main reservoir which is actually not permitted and also too many leakages where about 10-20% of the water gets wasted and the older pipes should be changed says the (MLA Darjeeling., 2017).

Likewise the Secretary of the Branch Committee in Darjeeling town[24] (opposition party 2017) informs:

पानीको वितरण व्यवस्था एकदम ठिकछैन यताको, बर्खामा पानी २ दिनको अन्तरालमा दिन्छ भने सुक्खा दिनमा ४ दिनको, फेरी पानीको पाइपहरुको गाठो छ यता यदि कुनै पाइप बिग्र्यो भने म्यूनिसपेलटीले बनावनु सक्दैन कारण त्यो पाइप अरु पाइपहरुको बिचमा दब्बेको हुन्छ जुन घरको पाइप बिग्रेको थियो उसले नया पाइप किन्नु कर लाग्छ अनि त्यै गाठोमाथि फेरी त्यो नया पाइप थपिन्छ

(**Translation**: The distribution system in Darjeeling town is not good at all. During the wet season they give water after 2 days, the same is given after 4 days during dry season. Also there's a huge piles of pipes if one of it gets deteriorated the municipality cannot mend it because it has been buried under so many pipes. The households whose pipes have been deteriorated has to buy new pipes and lay over the piles once again)

[24] Interview scheduled on 27th April 2017 in the party office of Darjeeling town

However, PHED engineer claims that the main factor aggravating the water problem in the hills is the deforestation and the presence and growth of the conifer called pine or *Dhuppi* (Cryptomeria Japonica) which often reduces the water yield. The same thing has been claimed by one of the party leaders from Kalimpong. While some studies have found the evidences like (Calder & Newson, 1979) where it shows that every 10% of an upland catchment covered by mature conifer (closed canopy) forest will potentially reduce the water yield by 1.5-2%. Likewise (Wang, 2017) mentions that unlike deciduous trees (Oak, Maple, and Hickory), Evergreen trees like pines retain their leaves throughout the year and have higher annual Evapotranspiration hence reducing the stream flows. A study by (Cornish, 1993) has found out that if the clearance of forest in the catchment area reaches less than 20% then there is a little detachable water yield. the assistant engineer PHED Darjeeling town says: जहाँपनि धुप्पी हुन्छ त्यसको मुनि अरु केहि पलाव्दैन अनि हाम्रो एक्स्पीरीअन्स् बाट थाहा पाएको हामीले कि त्यसले धाराहरु सबै सुकाई दिन्छ त्यसलाई खासै चिनबाट ब्रिटिशइर्सहरुले यहाँ ल्याएको हो सुन्दरता अनि घर बनावने काठको लागि, धुप्पी भन्दा यहाको अवस्थित रुख-पातहरु बडी मात्रमा रोप्नु ज़रूरी छ कारण धुप्पीले पानीको श्रोत सुकाइ दिन्छ

(**Translation**: Wherever there is pine tree there is no undergrowth and we know from the experiences that the pine tree really dries up the streams. It is originally brought from china by the Britisher's for the scenic purpose and wood products for the construction of the houses. The local trees should be planted in a massive way rather than planting the pines as it dries up the sources of the water).

The local water retaining trees and plants are *Uttis*[25], *Dhokrey Phool* [26](also known as *Sanai Phool*), Kera[27], *Kaizal*[28], *Panisaas*[29]. These locally available trees and plants have been using by the local residents since times unknown as it is said to retain the water and are being planted especially in and around the water sources.

[25] Scientific Name= Alnus Nepalensis
[26] Scientific Name= Brugmansia Suaveolens (Hindi- Dhatura)
[27] Scientific Name= Musa (Musa Sikkimensis or Darjeeling Banana)
[28] Scientific Name= Bischofia Javanica
[29] Scientific Name= Terminalia Myriocarpa

2.3.2. KALIMPONG TOWN

The PHED in Kalimpong town was established in 1981 since then the department is accountable for drinking water supply in both the rural and urban areas. The department was handed over to the local autonomous body called DGHC during May 1990. The department is supervised by the Executive Engineer who looks after both the rural and urban area under the name of waterworks department. The said department is looking after the feeder pipeline which is 250 mm in diameter starting from the water source called *Thokchuk*. The water is being distributed to the town from this source and has a length of 22 km. The Department of Municipal Affairs supports 3 plans which are worth INR 5.86 crores. The said plans are as follows: 1) an extension of water supply from the accessible jhora[30] 2) renovation of the civil lake in *Delo* hill and 3) drawing up of the water starting from *Relli* to the major conduit in the area called *Pakthang* which is currently in progress. Furthermore, the pumping of the water to the town from the Neora River has been taken up with a pipeline of 25 mm diameter with a distance of about 75 km (PHED, 2017).

The Kalimpong municipality was founded in 1945 which looked after the infrastructure of the town such as potable water and roads. The municipality is constructing a water storage tank so that they can fulfill the necessity of the water plus an extra water supply from the Neora Khola Scheme is also required (The Telegraph, 2008). The requirement of the town is 10 lakh gallon which is been partially looked after by the Neora water scheme. Despite this, several people take water from the natural springs to survive (Ravidas, 2015). While most of the residents buy water from the vendors (Ravidas,2012). To solve this problem several plans were made however the water problem could not be solved (Rai, 2016).

There is a traditional system of managing the water where the authorities patch the supply pipes on an ad hoc basis. There are also illegal connections near the water collection and storage tanks in the upper parts of the town. The expense of that kind of connection is around 75,000 INR (Joshi, 2015). The Kalimpong Municipal Town has drinking water supply arrangements constructed under the British Period. Along with the growth in population, the demand for the area also grows. Since the design of the water supply was made long back, the supply remains restricted. Moreover, the

[30] Nepali term for drains

age-old water treatment systems have decayed over the period in many parts. After the independence, few efforts have been taken by the government but in most of the cases, the efforts have been failed says the PHED engineer. The modern-day scenario is that the whole municipal town is suffering from severe water scarcity (PHED, 2016). The P.H.E. Department of the town is the only one which takes all the responsibility of the entire water supply, maintenance and distribution. However, the department is trying to merge with the municipality where they should also be the part of it just like the other two towns. As the revamping will be complete than the department will hand over the distribution system to the municipality informs the engineer.

Kalimpong became the sub-divisional town in the year 1916 where the population was roughly 8500. Being famous as a hill station and trade route to Tibet shows an increase in the population to 16677 by 1951. The credit for the formation of the waterworks department is given to the Britisher's who took the task of the water distribution system of the town. Under this department, two water reservoirs were constructed, one with the capacity of 2ML and another with 4 ML. These lakes were fed from the river sources called *Tokchuk* and *Relli* which was connected by a 150 mm diameter pipeline for a length of about 28 km. During the Chinese aggregation of 1962 27th mountain division of the Indian army was stationed in place called *Durpin, Pedong, Monsong* and *Paiyong* area of Kalimpong. Due to the population growth and the need to cater to the army, the waterworks department was no longer able to sustain the supply as a result Neora Maintenance Division was created in 1995 with an understanding that it would cater to the need of the army and additionally would supply 8 lakh gallons of water per day to the civil population of the Kalimpong. However, the source of Neora is 101 km away from the town which results in pilferages and loss due to leakage for which Neora has been able to supply only about 5 lakh gallons during the rainy season and 2.5 to 3.5 lakh gallons during the dry season (PHED 2017). Here also the PHED is divided into two- 1) PHED under GTA and 2) PHED under the state government which maintains the Neora river and goes by the name Neora Khola water supply and Maintenance Division (NKWS&MD). The municipality provides water in the times during emergencies like lean periods whereby they buys the water from the private vendors and distributes them to the people. The current requirement of water is 13 lakh Gallons per day but, the

department can only give 8 lakh Gallon, and therefore some more augmentation work is to be done. To meet up the requirement of 13 lakh gallon the peripheral ward like 19, 20, 21 are given water on the next day, as the water is firstly given to the other wards informs the engineer.

In 1996 the water supply was commissioned urgently from the NKWS&MD, this scheme was made till 2010 according to the requirement of that time. Before this, the water supply was being initiated from the *Thokchuk* and *Neora Khola* during the British period where the population was hardly 14000+ and during this period the water supply of the town was divided in the name of *Khasmal* 1, *Khasmal* 2,[31] D.I Fund[32]and Development. Now, as the population and the number of wards have been increased the requirement has also increased to 13 lakh Gallon per day. However, the department surveyed the whole town in 2016 for the augmentation of the water plus revamping of the old distribution system of water. The survey was to make it possible to distribute the water ward-wise. It cannot be said that the water will be given sufficiently but can be given in a good and proper way informs the engineer. For this, 2 plans have been made 1) augmentation and 2) revamping of the old distribution system. At present, the department has no other means to cover up for the deficit of water but to distribute water in alternate days or after every 2/3 days gap as per the availability of the volume of water i.e. 8 Lakh Gallons. The gap has happened because first the water should be collected into the lake and when it reaches its volume then it is being distributed in the town. One household is enabling to get 300 liters of water every alternate day or after 2/3 days gap. Those who are having a half-inch pipe are getting 300 liters in half-hour (PHED Kalimpong, 2018). According to the MLA of the Kalimpong; the town faces a severe water crisis because of the old water supply system. The repair works has not been done periodically. There are many water sources available however it needs to be pumped in the upland area which requires a large amount. Another reason is the population growth because of which the department is not able to cater the demand in the town.

[31] Khasmal is a Nepali word for the land/forest that belongs to the forest department

[32] District Improvement Fund created as far back as 1838 for the proper maintenance and development of the upcoming town

फेरी खेति-पातिको लागि छुट्टै पानीको श्रोतहरु छैन त्यसॅथ मान्छेले जुन पानी खान्छन् त्यै पानीले खेति-पाति गरछन्

(**Translation**: Again, there's no other source of water for the agriculture so, the people do farming with the same water which they drink) informs the (MLA Kalimpong., 2017)[33]. She explains the water problem in the town has aggravated due to the population growth and urbanization which has hampered the local water resources of the region.

During the survey it has also come to light that some people are receiving more waters than the others. One such example is been cited by the resident of *Haat Bazaar* of Kalimpong town towards the *kaiyya*[34] line (R.C Mintri Road 10th mile, Kalimpong) who are liable to be receiving water more than the people who stay just below them (in hat bazaar). However, the household survey in the area doesn't reflect the same about which a 45 year old male respondent from *haat* bazaar Kalimpong says:

कसैले पनि भनदैनन् कि मो २/३ घण्टा पानी पाउदैछु भनेर कसैले भन्छ यस्तो कुरा ? उनिहरुले पक्का फिटरलाइ पैसा दिदैछ नत्र कसरि उनीहरुले हामी भन्दा बेसी समयसम्म पानी पाउदैछन्?

(**Translation**: No one is going to tell that they receive water for 2/3 hours, who will say things like that? They are definitely paying money to the fitters if it is not then how are they getting water for longer hours than us?) Questions the respondent.

2.3.3. KURSEONG TOWN

The Kurseong waterworks began operating in 1913. With the development of tea industry and tourism, there was a rapid growth of population rising 4 times in the urban area alone. The supply of water from the sources to the central reservoir is being maintained by the PHED and from these reservoirs; water is being distributed to

[33] Interview scheduled on 3rd April 2017 in the party office in Kalimpong town.

[34] Kaiyya meaning people from UP, Bihar who have settled in the town long ago and most of their occupation is selling the household goods like cloth, shoes, utensils, electrical goods, paints etc. The kaiyya line mentioned here has been settled along both sides of the road and majority of them are kaiyyas and has shops like these.

the public by the Municipality. The municipality has 47 employees (23 permanent, 24 casuals' employee) and PHED has 250 employees (PHED Kurseong, 2017). According to the demand of the current population including the migrants make up to 50,000 populations in the town so looking at all those aspects 85 lakh gallons of water is needed daily. However, the department does not have full coverage of water in all the wards. There are 3-4 wards which do not have coverage of municipal water. Minimum 17 wards are covered by the municipality where again the water is supplied partially to those wards. According to the Municipal engineer the reason for not providing the water to the above-mentioned wards is because they have the spring sources from where they can have access to the water. The main crisis of water in the town used to start during the dry periods starting from March till mid-June however, nowadays the dry season has started since January he says. The department receives 35-40 lakh liters of water every day which cannot be distributed daily hence it is being given alternatively. There are 3 main storages, out of which one is a central water reservoir of 27 million liter capacity situated in *Durpin* area. It is mainly a water harvesting lake. This lake caters to the need of the town during the dry periods. There are 3 service reservoirs where the water is being filled during the night and is being released during the daytime. One reservoir of 88, 000 gallons has been dismantled and is kept under construction by the PHE department as it was cracked during the earthquake. This lake was covering ward numbers 5, 8, 15 and parts of ward no. 7, 13, 11, and 12. These mentioned wards are receiving water directly because of the construction of the lake. The construction of this lake will take 1 more years. The reservoir in the *Durpin* area is called 'eagle's crack' this reservoir covers the wards like 16, 17, 18, 14, 19, and 20. There are 2 tanks out there that jointly supplies 95,000 gallons of water.

The department is trying to revive the natural springs with the help of the forest department, students from polytechnic college, stakeholders and the other communities. The department is meeting them continuously regarding this issue. However, many other departments should come and cooperate in this regard says the engineer. The reason for collaborating with the forest department is for the afforestation of the town to protect the sources by various means like fencing. Because of the rate of urbanization in the town people are building their homes near the catchments area. Therefore the forest is also told to check the encroachment of the

people. The main source of water for the town is coming via hill cart road but it has become a residential area where there is a case of tampering of the pipes, stealing of the water, wastage of the water, etc. The tampered pipe will lead to leakage from where they are using water 24 hours. Therefore the department is also collaborating with the block department and police authorities to end this problem. The department has a different tax system; it takes the property tax but not the water tax separately. Property tax includes the use of the street, drains, etc by the residents. The tax is fixed which is above 338 rupees quarterly. Those who are paying the quarterly tax of above rupees 338 the department provide them the water connection. The department is not taking any water levy charges. However, for the new water connection, the charge is minimum 6000 rupees (Kurseong Municipality, 2017). According to the MLA of the town the important factors of water crisis is said to the phenomenal rise in population and no corresponding growth in infrastructure. He opines that the water supply system of the town is fully dependent on the rainwater so that the degree of problems faced is directly proportional to the abundance of Natural resources. The MLA further mentions that:

"*There is disparity of water in the town because of illegal lines and which should be checked periodically and a strict legal framework has to be worked out to punish the guilty and remove such lines*" (MLA Kurseong., 2017)[35].

2.4.CONCLUSION

More than the physical water scarcity, there seems to be an economic, institutional and anthropogenic water scarcity in the town caused by lack of investment in good infrastructure or technology to draw water from the rivers, illegal tapping, leakages, corruption, etc. Moreover, the water supply system in the town is dichotomous and complex in nature with too many actors. There are two departments responsible for water supplying the town, PHED being the supplier and the municipality being the distributor except for Kalimpong town where the responsibility of both is taken completely by the PHED itself. Many interviews with the officers, political leaders, and common residents shed light on the issue of water which is being related to

[35] The answer was provided by the MLA via mail as he instructed to send the questionnaire through mail only. The question was mailed to him on 14th May 2017 and the answer for the same was received on 20th October 2017.

corruption. The corruption being within the department, by the politicians and so on. Many of the prominent political leaders in their interview have mentioned about the water mafia. However, it has come to light that they are also not free from such blame. A deeply rooted corruption right from the dichotomous system of water supply, illegal tappings, corruption, and blame game is seemed to hamper the water management. The situation has become such that the common residents have started to have trust issues towards the department and the political leaders. According to several engineers and officials factors like deforestation, absence of water storages, small conduit channel, primitive water supply system, population explosion, migration of people to towns, depletion of sources of water, increase in water demand and finance is the most serious issue that has hampered the water management in the towns. Their opinion is that it is not just the responsibility of the local administration only it is up to the hands of the local residents as well.

CHAPTER 3

TYPES OF THE PRIVATE VENDORS AND THEIR ROLE OF WATER SUPPLY IN THE TOWNS

3. INTRODUCTION

There are lots of literatures which reveal that the water supply vendor is those who supply water privately and do not come under the state authority. Historically water vending is an old practice over the world. Private water supply vendors who are often known as non-state water providers include both formal and informal local water vendors. In developing countries water vending plays an important part in the water supply system especially in poorer, lower-income and informal settlements (cited in Whittington et al, 1991; Snell 1998; Opryszko et al, 2009; Ishaku et al, 2010; Olajuyigbe et al, 2012; Onyenechere et al, 2012; Ayalew et al,, 2014) although vendors can be found in the wealthier areas (Kjellen, 2000) . One of the basic characteristics of the water vendors is that they can be unionized which means they can self-regulate water prices, monitor the quality of water distributed and innovate improved services or else they can also be non-unionized (Wutich et al,2016) in case of many lower-income countries (Ahmad, 2017).

The private water supply vendors in Darjeeling hills are not a new concept and there is both increase and decrease in the number of the water selling vendors and they are also said to be operating without any legal framework (Chakraborty, 2018). The water tankers, especially in Darjeeling, emerged during the 1980s when the towns started experiencing acute water shortages because there was due to shortage of official water supply (Rasaily, 2014 as cited in (Shah & Badiger, 2018). (Chakraborty, 2018) thinks these vendors are the water mafia because of *"their tendency to create a crunch in water and compel the residents to buy water (which is a commons) at the exorbitant price*". Similarly, authors like (Drew & Rai, 2016) (Lama & Rai, 2016) (Mondal & Roychowdhury, 2018) also opines that they are the water mafia. The local residents and some politicians also claim that the vendors make lots of money by selling the water, however, it is not easy to make the money claims the vendors as they also have to face certain difficulties which have been discussed in this chapter. Almost 50 vendors have been taken into the study where 20 is from Darjeeling town

and 15 in the other two towns with the fact that Darjeeling town has more population to cover and also the number of the vendors is more. In Darjeeling town, the water vendors are of varied categories right from the tanker trucks, hand carts vendors (also known as *gorkhey gari*) to hand carrier vendors. However, some authors have also put the private spring owner as of the vendors who allocate or else sell the water from their personal spring (Chakraborty, 2018) yet they have not been taken into consideration as the vendors as they are invisible in the water market unlike the other vendors who are physically present in the streets to sell the water. This chapter deals with the types of private vendors and their dynamic role in water supply in the town.

3.1. TYPES OF PRIVATE WATER SUPPLY VENDORS IN THE TOWNS OF DARJEELING HILLS

1) Tanker trucks- There are two types of tanker trucks:

a) Big tanker trucks with a solid iron tank having a capacity of 6000 liters; this truck is mainly concentrated in Darjeeling where the majority of them provide water to the big hotels.

b) Medium tanker truck with a plastic tank of 2000 liter – This truck carries 6 tanks in total (2 in case of small pick up). This type of truck carries plastic water tank which is fondly called ‘syntax’ by both the vendors and people which they think is the name of the tank but is actually the name of the company that makes the tanks.

The number of this type of vendor is increasing every year that the other types of vendors.

Image 3 Tanker trucks in service in Darjeeling Hill towns

Source: Primary field survey, April 2017

Source: Primary field survey, April 2017

Source: Primary field survey, April 2017

Image 4 Hand Cart Vendors- Hand cart vendor also known as ‘Gorkhey Gari’ is an important part of the town especially in Darjeeling

Source: Primary field survey, April 2017

Source: Primary field survey, April 2017

These types of vendors are quite active in Darjeeling town; the vendor's buy water from another vendor (water truck) as their previous source (spring in dali) has been sold by the landlords. The daily cost of buying water from the water truck is rupees 55/cart. They sell the water in small restaurants and households. These vendors are wage laborers and receive 3500 rupees per month however they do get the money if they fall ill. These vendors have 16 small jerkins of 30 liters each and they clean the container once in a month because of lack of water and time. Sometimes the vendors have to fill the water at around 11/12 pm. There were 36 carts altogether, however, most of the vendors left the job in search of other jobs and also because their previous source was sold now there are only 12 members remained somehow they are also leaving one by one. The police do threaten them however later the vendors solve the problem with them. There used to be the union which later got dissolved. The vendors had made the license in 1998 however as their union got dissolved so does their license now they have a number system. The vendors suggest that if the government does draw the water properly from the river and springs then there will be no problem of water in the town. Even the party leader whoever comes to power is reluctant to do anything for the water problem in the town say the vendors. One 41 years old hand cart vendor Chettri narrates:

'मेरो आफ्नै गाव-घर मा पानीको क़लहरु छैन त्यसकारण मो आफै यो गाडीमा पानी हालेर लान्छु अधिकारीहरुले मेरो गाव मा पानी को पाइप लगाइ दिनुपर्ने हो तर उनिहरुले यो सब गर्दैनन् म यो पानी बोक्ने काम १८ साल देखि गर्दैछु तर कहिँ-कतै क़लहरु छैन तपाईले यहाँ कतै देख्नु भयो पुब्लिक क़लहरु? उनिहरुले वोट मात्रै मांगछन्'

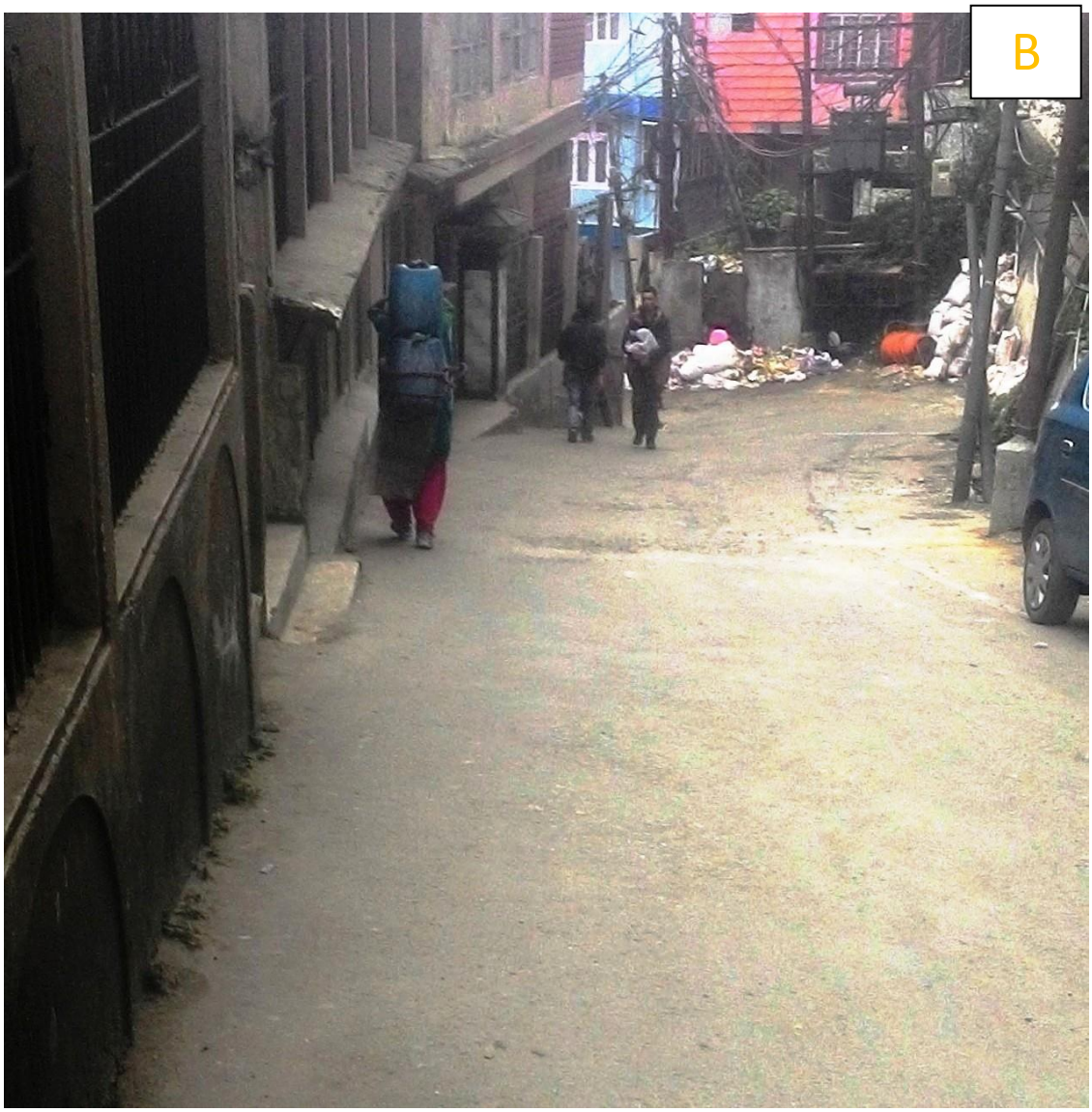
(**Translation**: There is no piped water in my home and vicinity as well so I myself take the water in my home via cart. The authorities should install the piped water supply in my area. However, they won't do it. I am doing this work for the past 18 years yet there's no public standpipe here, have you seen any public standpipe anywhere in the town? They only ask for the vote).

The vendor informs that earlier the people used to go to the municipality with their *khukuri*[36] on their hand in demand of the water problem was such at that time now also the situation hasn't changed says the vendor. However, Handcarts are also one alternative in times of water crisis but are too expensive for the poorer sections of the society. In a cart 16 pots of 15 liters each amount to around Rs 150 /- during the crisis season it may amount to around Rs 200/-. The cost is too high for households that require about 160liters of water per day. Around 40 such carts supply water to hotels and residences which are not connected to the municipal supply. If the customer buys water on a regular basis this mode is dependable but for someone who makes use of it only during the crisis season, the model is less dependable (Rai, 2018).

[36] Khukuri is a knife related to the Nepali speaking Gurkhas of Nepal and India and is used both as a tool and as a weapon.

Image 5 Hand carrier vendors

Source: Primary field survey, April 2017



Source: Primary survey, April 2017

This type of vendor is active in Darjeeling town; they sell the water mostly to the households. The vendor mainly comprises of women from the Tamang community and has migrated from Nepal. This vendor is of 6 people but they supply water to the house many times a day hence they do not have any fixed time for the supply. Vendors speak their own *Tamang* language besides Nepali. The female vendors work as a domestic helper in the town apart from their main occupation.

3.2. ROLE OF THE PRIVATE VENDORS IN THE TOWNS OF DARJEELING HILLS

In order to understand the characteristics of the vendors and their role in water supply several factors have been taken into consideration like- age, sex, education, religion,

marital status, main occupation, secondary occupation, income per month, business ownership, category of vendors, years of profession, source of water, reliability of the source, capacity of the container, average supply during lean and non-lean periods, duration of supply, major buyers, charge/ liter/tank/cart/ jerkins, method of money collection, competition and coordination amongst the vendors, interception in work, benefits of the profession, problems of the profession, registration to sell the water.

Table 7 Socio- Economic characteristics of the vendors in the towns of Darjeeling hills

Categories	**Numbers**
Age	
< 25	10
25-30	12
30-35	8
35-40	10
>40	10
Total	50
Monthly Income	
< 7000	14
7000-11000	14
11000-13000	10
> 13000	12
Total	50
Sex	
Male	46
Female	4
Total	50
Education	
No education	6
Primary	5
Secondary	27
Higher secondary (HS)	10
HS and above	2
Total	50
Religion	

Hindu	21
Christian	3
Buddhist	26
Total	50
Marital Status	
Never Married	16
Currently married	34
Total	50
Business Owner	
Self employed	32
Wage laborer	18
Total	50
Category of vendors	
Tanker Trucks (iron tank)	10
Tanker truck/pick up (plastic tank)	40
Hand cart	4
Hand Carrier	6
Total	50
Main source of water	
Spring	36
River	4
Public Tap	6
Tanker Truck	4
Total	50
Reliability of the Water Source	
Highly reliable	30
Moderately reliable	10
Not reliable at all	10
Total	50
Capacity of the container	
30 liter	6
1000 liter	13
2000 liter	21

6000 liter	10
Total	50
Duration of Water Supply per day	
2-4 times a day	30
4-6 times a day	8
Once in 2 days	1
Depends	11
Total	
Maximum bought by	
Household	31
Commercial (hotels + small restaurants)	19
Total	50
Method of Money Collection	
Customer directly deposit to the owner	10
Hand to hand	40
Total	50
Period Of Money Collection	
Daily	40
Monthly	10
Total	50

Source: Primary Survey, 2017

AGE of the private water supply vendors- The minimum age of the vendor is 18 years and the maximum is 53 years and the mean age is 32 years

GENDER- Out of the 50 water supply vendors 4 were women and the rest were men and these 4 women are the hand carrier vendors prominent in Darjeeling town. These women are from the schedule tribe group who work along with the men hand-carried vendors.

EDUCATION - There are 6 vendors with no education, 5 with primary education, 27 who have done secondary education, 10 vendors with higher secondary education, and 2 with HS above. While interacting with the vendors who have done their education HS and above, the reason for them to enter into this profession was

unemployment problems which have landed them into this profession “it’s better to do something than doing nothing” says one of the vendors.

RELIGION - There are three categories of religion found amongst the vendors out of which 21 were Hindus, 3 were Christians, 26 were Buddhists.

MARITAL STATUS - Out of 50 vendors 16 was never married and 34 were currently married.

MAIN OCCUPATION - The main occupation of all the vendors is selling the water to the households, commercial and institutional places.

SECONDARY OCCUPATION- Out of the 50 vendors 3 works as a driver besides selling the water, 1 as a farmer, 4 housemaids (female vendors), 1 as a part-time in a private company and 1 is seeking a job elsewhere.

MONTHLY INCOME FROM THE MAIN OCCUPATION- The minimum income is 3500 and the maximum is 20,000 whereas the mean income from the main occupation is 10,801 rupees.

BUSINESS OWNER- out of 50 vendors, 32 are self-employed who owns the water selling business themselves so they make the majority of the profit as they do not have to share their money or either they have to give wage to anyone. 18 are the wage laborer who is employed to sell the water in the towns and receives their monthly wage out of which 1 was working for his relative as a wage laborer.

TYPES OF VENDORS- There are four types of vendors Tanker trucks (iron tank) with 10 vendors, Tanker truck/jeep (plastic tank) which forms the majority of the water seller with 30 vendors, the hand cart vendors were 4 and 6 were hand carrier.

YEARS OF ENGAGEMENT IN THIS WORK - The minimum years of engagement in the profession by the vendor are 1 year and the maximum is 17 years and the mean is 5 years.

MAIN SOURCE OF WATER- about 36 vendors are using the spring as the main source of their water supply, 4 vendors are using the river as the source of water for

the supply and 6 are using public taps and 4 are using tanker trucks (the hand cart vendor as their previous source was sold by the landlord).

RELIABILITY OF THE WATER SOURCE – about 30 vendors said that the source of the water is highly reliable and about 10 vendors said it is moderately reliable and 10 said it is not reliable at all.

AVERAGE WATER SUPPLY DURING DRY AND WET PERIOD- During the dry and wet period the average supply depends on the types of vendors. The hand carrier vendor supplies 60 liters to their daily customer, whereas during the wet period they supply 240 liters. The hand cart vendor supplies 2000 liters to their daily customer during the dry periods however during the wet periods they supply around 6000-8000 liters. The tanker truck (iron tank) supplies 1500 -18000 liters and during wet periods they supply 6000- 30000 liters, on the other hand, the tanker truck/jeep (plastic tank) supplies 1000-2000 liters during dry period and during the wet period they supply 4000-8000 liters. Almost all the vendors agree that they have to give water to their daily customers no matter its dry or wet period of the year so they stop giving to the non-daily customer during the dry period.

DURATION OF WATER SUPPLY PER DAY- The duration of supplies varies from vendor to vendor about 20 vendor's supplies 2 to 4 times in a day, about 8 vendor's supplies 4 to 6 times a day, only 1 vendor supplies once in 2 days and about 11 vendor's said it depends on the demand.

MAXIMUM BOUGHT BY-for 31 vendors said the household's buys maximum water and for 19 said it is the hotels plus small restaurants.

CHARGES OF THE WATER- There are two ways to charge for the water a) charge per truck/ hand cart b) charge per jerkin. The charge per tank varies from rupees 600-1400 looking at how much and how many times the buyers are taking. The charge per handcart varies from 600-700 rupees and Charge per jerkin is sold by the 6 hand carrier vendors with 300 rupees per jerkins.

METHOD OF MONEY COLLECTION- 10 vendors said that the money collection and deposition is the matter between their owner and the buyer and about 40 vendors said that the buyers give money directly to them.

PERIOD OF MONEY COLLECTION- 40 vendors said that the money is being collected daily and about 10 said it is collected monthly.

These private water vendors are quite active in the hill town as there is a huge demand for water from households, hotels, and institutions. Most of the households rely on the private vendors so they formed the largest secondary choice set of drinking water for the people as the municipal tap water comes after every 3-4 days. They do earn money but not in an easy way tells the vendor however there are lots of people who think otherwise. For E.g. Mr. Subba the leader from the renowned party in Darjeeling[37] says:

'यहाँ पानी बेच्ने मान्छेहरु त मालामाल छ कारण तिनीहरुले हरेक महिना होटेलबाट पैसा उठावदैछन्'

(**Translation**: Here the water vendors make lots of money as they receive money every month from the hotels).

However, the water vendors said that they do not charge any extra money during the scarcity of the water; some even said that they give it free of cost to those who cannot afford; they say that they are doing this for the cause of humanity. Some even sell the water in the villages as the villagers are dependent upon the springs some of which are non-perennial which often got dry during the lean periods. Some of the vendors are also helping the municipality to supply the water during emergencies. They also supply to institutions like schools as the school also demands the water during emergencies. The most difficult situation for the residents of the hills is during the dry season where the volume of the water decreases even the municipality offices denies any new connection during this time and also hangs the notice saying "*As the dry spell has already started, as such the new water connection forms will be stopped till further order*"[38]. The water problem of the hills is complex and unique with so many water actors and also has a British made and left lakes and water supply system has either become boon or curse for the town.

[37] Interview scheduled on 27th April in Darjeeling town

[38] Mentioned in Memo No. 142/1/ww dated 1/12/2016, details taken during the pilot survey from the department office where it has been put up on the notice board.

Table 8 Business category of the vendors

Categories	Frequency	Percent
tanker trucks (iron tank)	10	20.0
hand cart vendor	4	8.0
water carrier	6	12.0
Tanker truck/jeep (plastic tank)	30	60.0
Total	50	100.0

Table 9 Business owner's ethnicity

Categories	Frequency	Percent
Nepalis	46	92.0
Others	4	8.0
Total	50	100.0

Source: Primary Survey, 2017

The majority of the vendor is the one with tanker truck/jeep with a plastic tank followed by tanker truck with iron tank and hand cart vendor and water carrier forms a small number and is active only on Darjeeling town. About 46 vendors said that the water business owner is a Nepalis and about 4 said that the business is owned by the others which they refused to tell.

Table 10 Problems while collecting the water

Categories	Frequency	Percent
No	32	64.0
Yes	18	36.0
Total	50	100.0

Table 11 Types of problems

Categories	Frequency	Percent
Wait for turn	13	26.0
Sources dry up	3	6.0
Volume decreases	2	4.0
Total	18	36.0

Source: Primary survey, 2017

Though almost all the vendors said that they do not face the problems while collecting the money from their customers but they do face several problems while collecting the water from the source. Some of the common problems are that the vendors have to wait for their turn to fill their tank and the situation becomes worse particularly during the period of low rainfall as the quantity of the water decreases which takes more time to fill the tanks taking the heavy toll on the vendors. The majority of these vendors take water from the spring some of which are used by the general public as well so some of these vendors also let the public fill their container first and then they take their turn.

Table 12 Medium to contact the vendors by the customers

Categories	Frequency	Percent
Through mobile phone	36	72.0
Face to face interaction	9	18.0
Delivery is fixed (no need to contact)	5	10.0
Total	50	100.0

Source: Primary Survey, 2017

There are three ways through which the customers contact these vendors as shown in Table 12 Out of all the methods the easiest way is to contact through the mobile phones which are about 36 vendors and 9 said the delivery is done via face to face interaction and about 5 said that delivery is fixed so there's no need for the customer to contact them.

सधै पानी लि रहने गाहकीहरुले त हामीलाई सम्पर्क गरिरहनु परेन किन भने उनीहरुले त सधै लिनै रहेको हुन्छन् तर जसले बेला-बेलामा लिनछन् उनीहरुले चै हामीलाई कि त फोन गरछन् कि त बाटोमा गाडी रोकछन्

(**Translation**: For daily customer there's no need to contact because they take daily but for those who are non daily customer they either call us or stop our vehicle in the road) says one 32 year old vendor from Darjeeling town.

Table 13 Some General problems face by the vendor

Categories	Frequency	Percent
No	34	68.0
Yes	16	32.0
Total	50	100.0

Table 14 Types of problems

Categories	Frequency	Percent
Bad Road condition during monsoon	6	12.0
Spring dries up during lean period	4	8.0
Bad traffic due to growing number of vehicles	4	8.0
Low demand during monsoon	2	4.0
Total	16	32.0

Source: Primary Survey, 2017

Table 13 and 14 gives the information on whether the vendors face some general problems and what types of problems they face. Besides the problem in water collection there are some general problems faced by the vendors where about 16 vendors agreed to have faced the general problems like Bad road conditions during

monsoon, , drying up of spring during lean period, bad traffic due to growing number of vehicles and low demand of water during the monsoon.

Table 15 Any competition among vendors

Categories	Frequency	Percent
No	45	90.0
Yes	5	10.0
Total	50	100.0

Source: Primary Survey, 2017

All the vendors agreed about good coordination amongst them however, about 5 of them agreed that they do compete amongst them as shown in Table 15.

Table 16 Collaboration with the municipality/PHED

Categories	Frequency	Percent
No	33	66.0
Yes	17	34.0
Total	50	100.0

Source: Primary survey, 2017

Table 16 shows that about 17 vendors agreed to have collaboration with the municipality/PHED and there are several ways of collaboration a) The department encourage to bring more water b) the department gave public tap to use c) the department promotes supply through vendor in emergency d) the department ask to supply more water in the town to the public. The case of option b is unique as earlier there was no public standpipe as such, there used to be a leakage in the pipe in that particular place and when the municipality got to know that certain residents are drinking water from that leakage the department converted it into a public standpipe now from where the hand carrier vendors are also delivering the water to the households.

Table 17 Interception in work

Categories	Frequency	Percent
No	34	68.0
Yes	16	32.0
Total	50	100.0

Table 18 Work intercepted by whom

Categories	Frequency	Percent
Administrative	5	10.0
Non administrative	11	22.0
Total	16	32.0
Total	50	100.0

Source: Primary Survey, 2017

About 16 vendors agreed that their work has been intercepted. Out of which 5 said that the interception is done by the administrative like police and 11 said non-administrative like roadside vendors. Upon asking about how the police intercepted their work? About which the vendors hesitated to answer. a question was asked about whom do they seek help during interception? for which the vendors said that it is a minor issue, which is often solved through talk and understanding between them as shown in Table 17 and 18. One 27 year old vendor from Darjeeling town narrates:

पुलिसले त सधै डग्दी दि राखेकै हुन्छ ड्राइवरहरुलाई त (हासछन्) उनीहरुले पैसा मंग्छन्

कोईबेला चै ड्रिंक्सहरु किनी मांगछन्

(**Translation**: Police has always been giving trouble to the drivers (laughs), they ask for money or they sometimes ask us to buy the drinks for them)

Upon asking whether the vendors ask anyone for help regarding this matter he adds:

हामी पानी बेच्नेहरु सानो अवधा को मान्छेहरु हौ यसो ठुलो ठाला भएको भापनि कम्प्लेन्ट गर्नु ठिकै थियो तर हामीले ऐले कम्प्लेन्ट गर्नु भनेकोनै आफुलाई खति पुराउनु हो

(**Translation**: We (vendors) are petty persons; if we had been in a bigger post then it would have been possible to complain as well. However, if we complaint now means we are harming ourselves)

Most of the vendors hesitated to talk about this matter; they said that it is a trivial matter which will be solved with mutual understanding between them. This depicts that the vendors are actually trying to deal with them to save their business.

Table 19 Registration for water supply

Categories	Frequency	Percent
No	15	30.0
Yes	35	70.0
Total	50	100.0

Source: Primary Survey, 2017

Table 19 shows whether the vendors have to get registration for the water supply whereby about 15 vendors said that they do not have a registration to supply the water and about 35 said they have a registration to sell (by being the member of the union). They said they don't have a license or registration separately to sell the water but they have a union known as 'चालक महासंघ' or drivers union where they have registered.

However, the drivers union is a union where almost all the cars have to be registered and not just the one that sells the water. Moreover, some vendor does not join the union which also points out that joining the union is not a compulsion which also makes clear that one does not require to get license/registration/permission to sell the water. To become a member of the union one has to deposit some amount of money ranging from 40,000 to 6000 rupees and also have to pay the monthly fee ranging from 300, 400 and 600 rupees. However, this is not the case for the hand carrier and handcart vendors they have a unique understanding between them and make sure that

all the members get equal opportunity to sell and earn the money. The number of members in the union varies between 40, 100 and 120.

A question was put forth about the benefits and problems of the profession in which they replied the problems are much more than the benefits. The benefits mentioned by them are money and employment which they do earn but not in an easy way. The problems include sleeplessness as the time for the water distribution is from 2 am to 8 am (especially in Darjeeling town for tanker trucks and hand cart vendors) the vendors have to wake up early and go to the source to collect the water on turn wise basis. Problems like bad road condition especially during the monsoon season, and especially there is very low demand for water during the monsoon season, the volume reduces especially in the dry period where the vendors have to wait for much longer time to fill the tanks, The vendors also have to face bad traffic as the roads of the hills are narrow. The problem of the hand cart vendors is that they have no other source of water except for buying from other vendors and slowly their number is decreasing as the vendors are searching for other jobs. For those who can afford, these vendors have become blessings in their life as they can contact and gets the water any time and any day but for those who cannot afford will either go to fetch water from the natural springs or either ask the neighbors for additional water or manage with whatever they get which UN has termed as "Climate Apartheid" Scenario where wealthy people often pays while the others suffer (Yeung, Gupta, & Guy, 2019).

3.3. CONCLUSION

This chapter deals with the details of types of private vendors and their role in delivering the water to the different consumers across the town and their benefits and problems from the business. In Darjeeling, the vendors are especially active in the middle reaches of the town which is the main business area and also because of the presence of the hotels and restaurants. The vendors usually take water from the lower reaches like *jorbunglow* where there is a presence of spring water and a long queue of vendors is seen while traveling up to the main town. In Kalimpong also because of the presence of the main business area the water vendors are usually active in the middle reaches of the town. In Kurseong because of the presence of the schools in the upper-middle reaches the water is being taken into both the middle and upper-middle areas of the town. The private vendors are not active on the upper reaches of all the three

towns because of the higher elevation (difficult for the tanker trucks to carry the water) and also there is a presence of springs nearby which does not demand the water from the vendors. The vendors have become the powerful market in all the towns that if at all they decide not to supply the water it will create chaos in the town especially for those who can afford it. As for those who cannot afford will walk several kilometers to get water from the community springs. The vendors seem to be been aware of the accusation from the people about making lots of money from the water selling business. However, the vendors reveal that it is always not so easy to make the money out of this business as they have to spend many sleepless nights to stand in the queue to get the water from the sources besides, many administrative and non-administrative authorities and individuals. However, one thing that needs to understand out here is that no matter how long and how much these vendors are working in the area these vendors can only be a temporary solution for providing water in the hills and that too for those who can afford. Almost all the Himalayan region is facing a water crisis and there is a need for a permanent solution to tackle this. However, the vendors can only reach where there is accessible road; the question here lies is what about those people who stays beyond the accessible roads they cannot draw the water from the vendors nor can they carry towards their home. For them the solution is either to manage with whatever they have or to use the natural springs.

CHAPTER 4

ACCESSIBILITY OF SOURCES OF DRINKING WATER IN THE TOWNS OF DARJEELING HILL AND THE FACTORS AFFECTING THEM

4. INTRODUCTION

The sources of water and its accessibility in Darjeeling hill is quite complex with just too many actors and dichotomous nature of the service providers. The study found out that there is more than 1 source from where the people are accessing the drinking water and it has been also discovered that the perception, knowledge, and involvement of the people in water management do affect the accessibility of water in the hills. As the thesis is an in-depth study of overall management of drinking water and accessibility in the hills and it has also been found during the pilot survey that people of the hills are not using the tube well, hand pump and canals as their main source of drinking water hence the census classification is not taken into consideration. To have that in-depth knowledge of drinking water the question of 'what is the main source of drinking water and its accessibility' has been kept open-ended to understand the various sources of water and it's accessibility and later coded as given below. It has been found that the volume of the water received by the household is so meager that people are bound to search the supplementary source and even consuming the water bought from the private vendors in water tankers without knowing from where they have taken that water from. The frequency and reliability of the water are so uncertain that it forces the people to rely on the other options which are of course not free of cost. The engineers and officials do agree that the water is provided to the city after every 2/3 day's gap. So, how do people manage their drinking water between this gap? The rich can buy from the vendors what about the poor? All the questions are being discussed thoroughly in this chapter. Majority of the respondents said that they do not have any doubts regarding the spring water as it is safe and also it has been managed properly by the community or individually by placing the poster of gods and goddesses (the cultural aspects of water management) which is very much prevalent in the hills. Therefore, to understand the drinking water uses it is very much important to understand the category of the drinking water which

people can access in the study area. There are 3 sets of water availability and 5 sets of accessibility of drinking water in the households which are given below.

4.1. TYPES OF THE SOURCES OF WATER AND ITS ACCESSIBILITY IN TOWNS

As mentioned in chapter 2 there are 3 sources available which are:

Table 20 Sources of Drinking water in Darjeeling Hills

4) **Tap water**	**5) Spring water**	**6) Water tanker**

Source: Primary Survey, 2017-2018

Table 21 Sources of drinking water according to its location

Source access	Providers	Quality
tap water into dwelling	Municipality/ PHED	Treated
tap water into plot/yard	Municipality/ PHED	Treated
Spring water into dwelling	Individual	Untreated
Spring water into plot/yard	Community	Untreated
Water tanker	Private Vendors	Untreated

Source: Primary Survey 2017- 2018

Image 6 Different sources of water according to its accessibility

a)Tap water into dwelling

b) Tap water into plot/yard

c) Spring water into dwelling

d) Spring water into plot/yard

e) Water tanker

Source: Primary Survey, April 2017 & January 2018

Other than the Tap water all the other sources are informal sources. The complexity of the sources of drinking water in the hills has been highlighted by many authors so keeping the situation in view the question of main sources was kept open and later coded. In Darjeeling hills the Natural springs are managed by two sets of people 1) individual (private) and 2) community (public). Individual spring management is done by the individual like the landlord in whose land the spring has emerged (refer to picture c where the spring water has emerged). Much literature point out this type of springs like (Lama & Rai, 2016) explains that *"traditionally these springs were Common Property Resources with a non-codified oral tradition of open accesses"*. Likewise (Chakraborty, 2018 as cited in (Shah & Badiger, 2018) points that the spring water owned by the individual are from the landlords *"who allow access to water from their spring and are supplied from their surplus storage of water"* which is either free of cost[39] or charged. People who own this kind of springs have realized the commercial value of the sources and have targeted consumers who pay rents to them however this kind of initiation has deprived the common people of free access to natural springs (Chhetri, 2019). The advantage of the privately-owned spring is that

[39] During the survey, it is found that the free of cost was given to the one whom the landlord is acquainted with. Otherwise it is generally charged per month or year.

the household can have access to this water within their dwelling than the community-owned. The cost of buying the water from this type of private spring ranges from 200-850 rupees per month and the initial payment ranges from 5000-10,000 rupees. Not everyone could afford this type of water source however those who can afford have this source as some said that there is no municipal water coverage in their area which binds them to buy from this source. Even the engineers agree that not all the municipal area is covered under the public water supply.

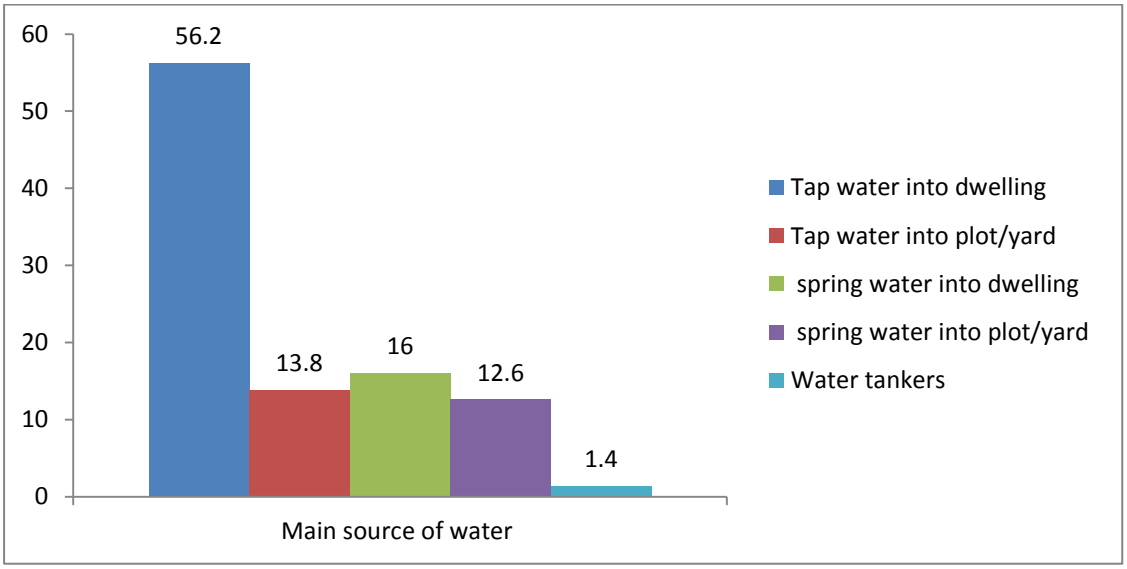
In the individually maintained spring, people have to pay for the water every month to the landlord. This type of spring water is managed individually by the landlord than the community spring which is maintained by the community as a whole. Water tankers from the private vendors are increasing day by day as there is a shortage of water in the town and here, it has been found that household's buys water in two cases: Throughout the year or during the lean period (dry seasons).

Table 22 Main Source of drinking water according to its accessibility

Main source of drinking water	Towns			
	All 3 towns	Darjeeling	Kalimpong	Kurseong
Tap water into dwelling	56.2	36.5	67.3	71.3
Tap water into plot/yard	13.8	15.5	12.0	13.3
Spring water into dwelling	16.0	19.0	16.0	12.0
spring water into plot/yard	12.6	26.0	4.0	3.3
Water tanker	1.4	3.0	.7	-
Total	100	100	100	100

Source: Computed from Primary Survey, 2017-18

Figure 3 Main Source of drinking water according to its accessibility



From the primary survey it is found that about 56 percent household had tap-water into their dwelling, 13 percent had tap-water into their plot/yard, 16 had spring water into their dwelling and 12.6 uses spring water into plot/ yard and 1.4 were using water tankers as their main source of drinking water. Tap water into a dwelling is highest in Kurseong town with 71.3 percent followed by 67. 3 percent and 36.4 percent in the other two towns as shown in Table 22. The most accessible sources one can have among the above are the spring water in distance and water tankers as these sources are available most of the time. The tap water connection takes time especially in Darjeeling as it is given on a seniority basis.[40]

[40] On the basis of date and year of applying for the water connection.

4.2. DETAILS ON FREQUENCY, SUFFICIENCY AND ADDITIONAL REQUIREMENT AND QUALITY OF THE DRINKING WATER IN THE TOWNS

Table 23 Frequency of drinking water received from the main sources

Frequency Received	Towns			
	All 3 towns	Darjeeling	Kalimpong	Kurseong
24 hours	9.8	6.0	16.7	8.0
15-45 minutes a day	28.8	24.0	34.7	29.3
1-2 hour a day	30.6	34.0	13.3	43.3
1-2 hour after every 2/3 days	17.0	16.5	23.3	14.0
As and when required	7.8	14.0	4.0	3.3
Not predictable	5.2	5.5	8.0	2.0
Total	100	100	100	100

Source: Computed from Primary Survey, 2017-18

Figure 4 Frequency of drinking water received from the main sources

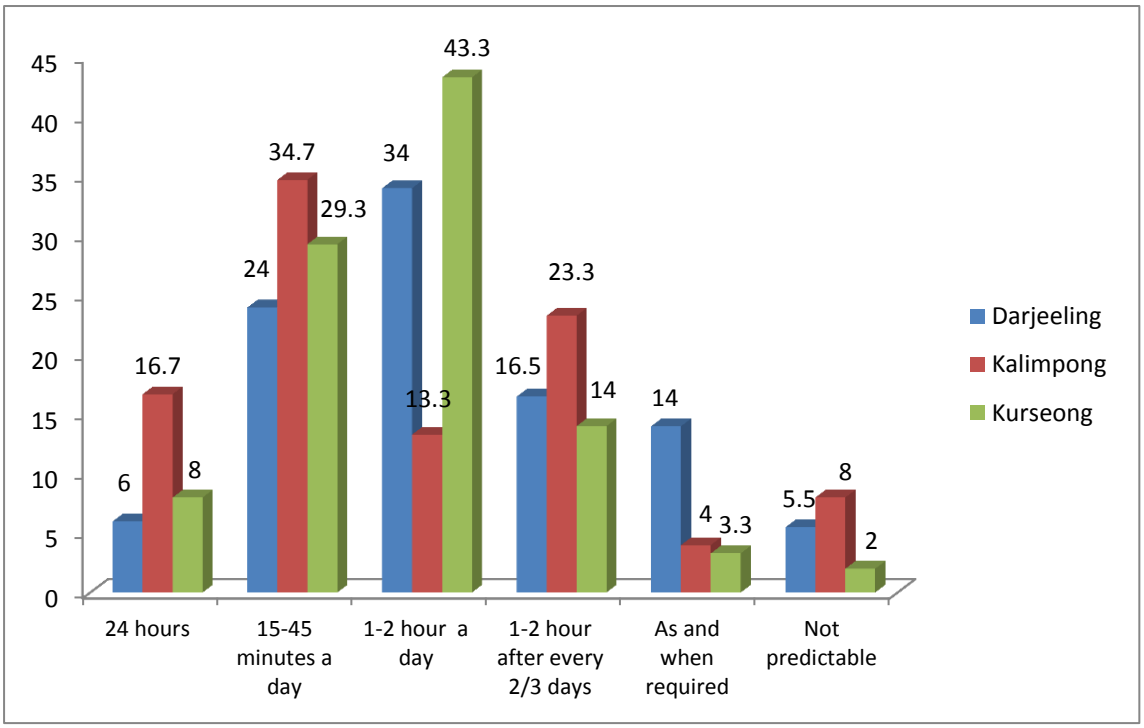


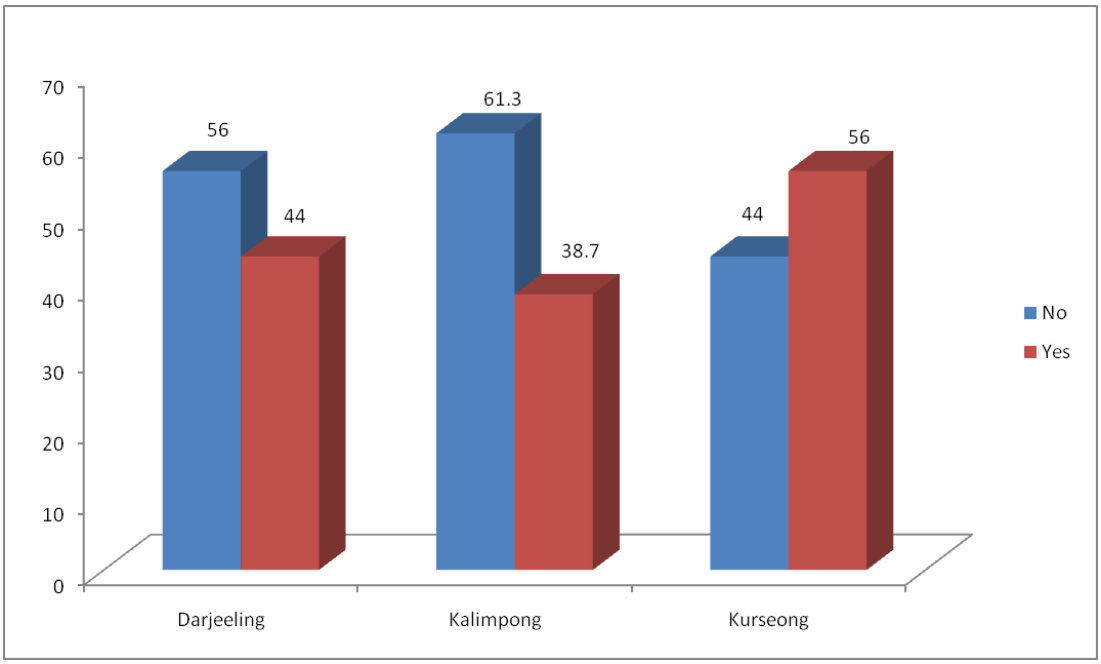
Table 23 shows that about 9.8 percent of households said that they are receiving water for 24 hours these households have the connection of spring water into their dwelling. 28.8 percent of households are receiving water 15-45 minutes a day and about 30.6 percent receives water 1-2 hour a day and 17.0 percent receives water for 1-2 hour after every 2/3 days which is also a tap water connection (dwelling +plot/ yard) and about 7.8 receives water as and when required these are mostly those households who are using spring water into plot/yard and water tankers. About 5.2 percent said that their water supply is not predictable these households are having tap water connection (dwelling +plot/ yard). Amongst the towns, about 16.7 percent of households in Kalimpong town said that they receive the water 24 hours, followed by Kurseong 8.0 and Darjeeling 6.0 respectively. In Kalimpong about 34.7 percent of households said that they receive water 15-45 minutes a day, followed by Kurseong with 29.3 percent and Darjeeling with 24 percent. Households who said that they receive water for 1-2 hours a day is highest in Kurseong town with 43.3 percent followed by Darjeeling with 34 percent and Kalimpong with 13.3 percent. Households who said that they receive water 1-2 hours after every 2-3 days were highest in Kalimpong town with 23.3 percent followed by Darjeeling 16.5 percent and Kurseong 14.0 percent. Households who said that they receive water as and when required is highest in Darjeeling with 14 percent followed by Kalimpong 4 percent and Kurseong 3.3 percent. Households who said that the water they receive is not predictable is highest in Kalimpong town with 8.0 percent followed by Darjeeling 5.5 percent and Kurseong 2.0 percent.

Table 24 Frequency sufficient for the need of the HH from the main sources

Towns	Sufficiency		Numbers	Total
	No	Yes		
All 3 towns	54.0	46.0	500	100
Darjeeling	56.0	44.0	200	100
Kalimpong	61.3	38.7	150	100
Kurseong	44.0	56.0	150	100

Source: Computed from Primary survey, 2017-2018

Figure 5 Frequency sufficient for the need of the HH from the main sources



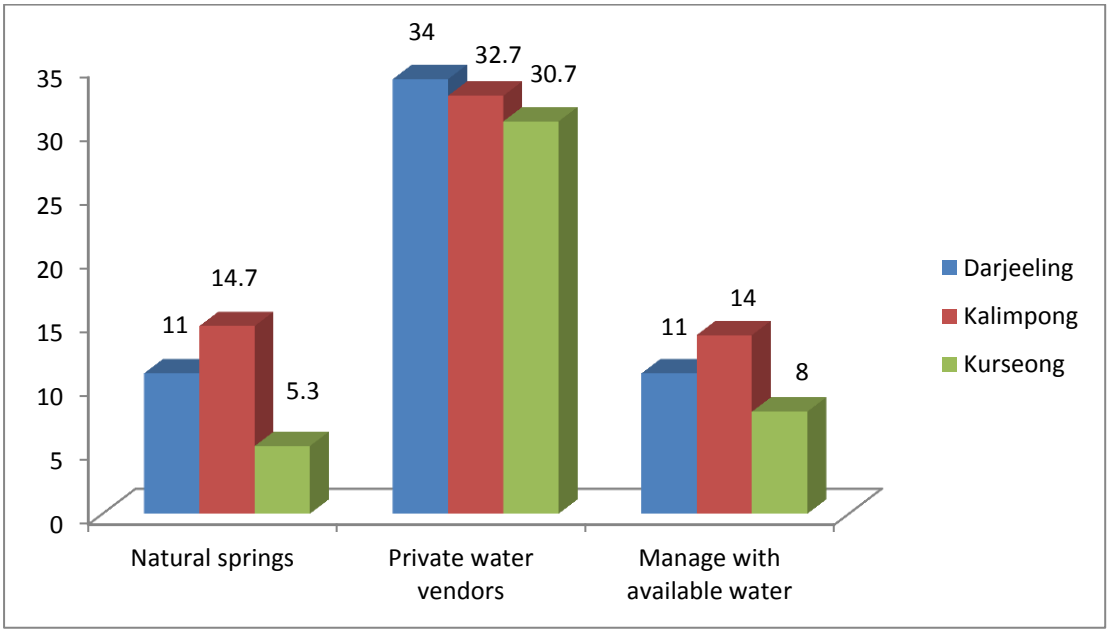
The above table No. 24 shows that if the frequency of the water is sufficient or not, where about 54 percent households said that the frequency of the water is not sufficient compared to the 46.0 percent for whom the frequency of water is sufficient. The sufficiency of the water is due to the small size of the household. However, in Darjeeling, 56.0 percent said that the frequency of water they receive is not enough, the same for the other two towns Kalimpong and Kurseong is 61.3 and 44 percent respectively.

Table 25 Management for additional requirement of water

Towns	Manage			Total
	Natural springs	Private water vendors	Manage with available water	
All 3 towns	10.4	32.6	11.0	54.0
Darjeeling	11.0	34.0	11.0	56.0
Kalimpong	14.7	32.7	14.0	61.3
Kurseong	5.3	30.7	8.0	44.0

Source: Computed from Primary Survey, 2017-18

Figure 6 Management for additional requirement of water



The above table No. 25 shows that around 10.4 percent household manages to get the water from the natural springs near or around the house, and about 32.6 percent households buy water from the private vendor and 11.0 percent household manages with the available water. Regarding Town wise management of additional requirements, in Darjeeling about 11.0 percent use natural springs, 34.0 percent uses the private vendor and 11.0 manages with the available water they have. Likewise, the percentage for the same in Kalimpong town is 14.7, 32.7 and 14 percent each and in the Kurseong town the percentage is 5.3, 30.7 and 8.0 percent respectively.

Table 26 Members who fetch water from the natural springs

Towns	Fetch the water				Total
	Women	Men	Both woman and man	Both women and children	
All 3 towns	6.0	.6	3.2	.6	10.4
Darjeeling	6.5	.5	3.5	.5	11.0
Kalimpong	8.7	.7	4.7	.7	14.7
Kurseong	2.7	.7	1.3	.7	5.3

Source: Computed from Primary Survey, 2017-18

Table 26 shows that out of the 10.4 percent households in all the three towns who use the natural springs about 6.0 percent were women who fetch the water and .6 were the male member 3.2 were both men and women, .6 were both women and children of the household. In Darjeeling town alone about 6.5 percent were found to have been women, .5 were men, 3.5 were both men and women and .5 percent were both women and children who fetched the water from the natural springs. Likewise, in Kalimpong town 8.7 percent of women fetch the water, .7 percent was the man who fetches the water and 4.7 percent were both man and woman who fetch water and .7 percent were both women and children who fetch the water. In Kurseong town, about 2.7 women said that they got to fetch the water, .7 percent was men, 1.3 percents was both men and women and .7 was both women and children.

Table 27 Frequency of purchase from the private water vendor

Towns	Purchase				Total
	Daily	Once a week	Twice a week	Once a month	
All 3 towns	8.6	19.4	2.4	2.2	32.6
Darjeeling	16.0	14.0	2.5	1.5	34.0
Kalimpong	6.7	24.0	.7	1.3	32.7
Kurseong	.7	22.0	4.0	4.0	30.7

Source: Computed from Primary Survey, 2017-18

Figure 7 Frequency of purchase from the private water vendor

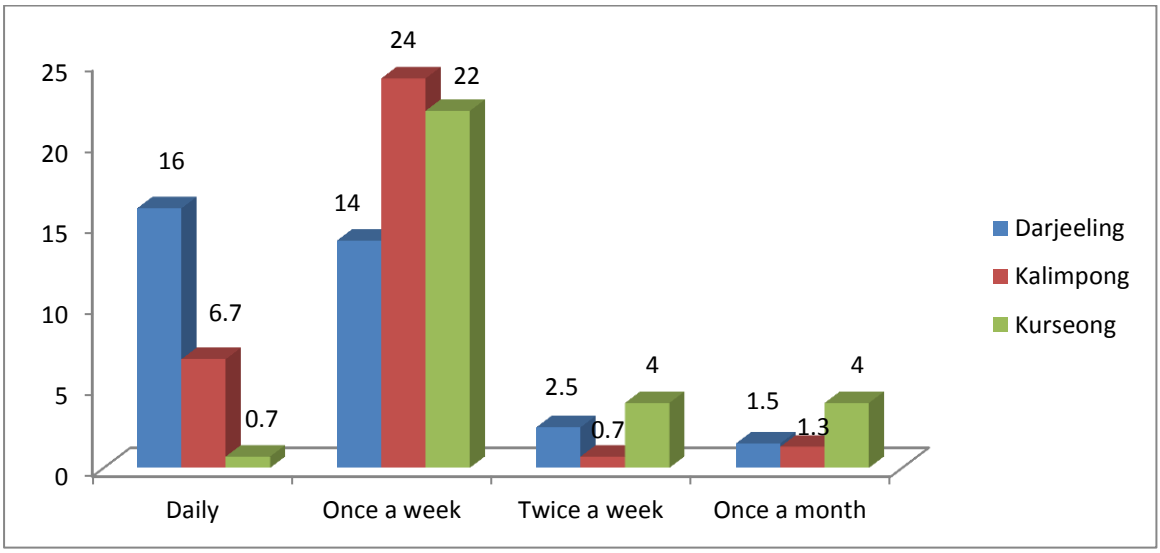


Table 27 shows that in all the three towns out of 32.6 percent households who buy water from the vendor; about 8.6 percent household buys water daily from the vendor, 19.4 percent buys once a week, around 2.4 percent buys twice a week and 2.2 buys once a month. In Darjeeling, about 16.0 households said that they buy the water daily, followed by once a week which is 14 percent, 2.5 percent twice a week and 1.5 percent once a month. In Kalimpong town about 6.7 percent said that they buys the water daily from the vendors, about 24 percent buys once a week, .7 percent buys twice a week and 1.3 buys once a month. Likewise in Kurseong town, .7 percent said that they buys the water daily, 22 percent buys once a week, 4.0 buys twice a week and 4.0 buys once a month.

Table 28 Method of contacting the water vendor

Towns	Contact				Total
	Comes to road	Contact through phone	Vendors live nearby	Vendor is a relative	
All 3 towns	4.0	27.8	.6	.2	32.6
Darjeeling	8.0	24.5	1.0	.5	34.0
Kalimpong	2.7	30.0	-	-	32.7
Kurseong	-	30.0	.7	-	30.7

Source: Computed from Primary Survey, 2017-18

Table 28 shows that in all the towns about 4.0 households contact the vendor when he comes to the road, 27.8 percent contact the vendor through phone, .6 percent contact the vendor who is the next-door neighbor, for .2 percent the vendor is the relatives. Likewise, in Darjeeling town, for about 8 percent households said that the vendors come to the road, 24.5 percent contact through phone, 1 percent said that the vendor lives nearby and about .5 percent the vendor is a relative. In Kalimpong town, about 30 percent of households said that they contact vendor through phone and 2.7 percent said that the vendors come to the road. In Kurseong town, about 30 percent of households said that they contact vendors through the phone and .7 said that the vendor is a relative.

Table 29 Quality of the water bought from the vendor

Towns	Quality			Total
	Good	Bad	Don't Know	
All 3 towns	7.4	6.4	18.8	32.6
Darjeeling	13.0	2.0	19.0	34.0
Kalimpong	4.0	4.7	24.0	32.7
Kurseong	3.3	14.0	13.3	30.7

Source: Computed from Primary Survey, 2017-18

Figure 8 Quality of the water bought from the vendor

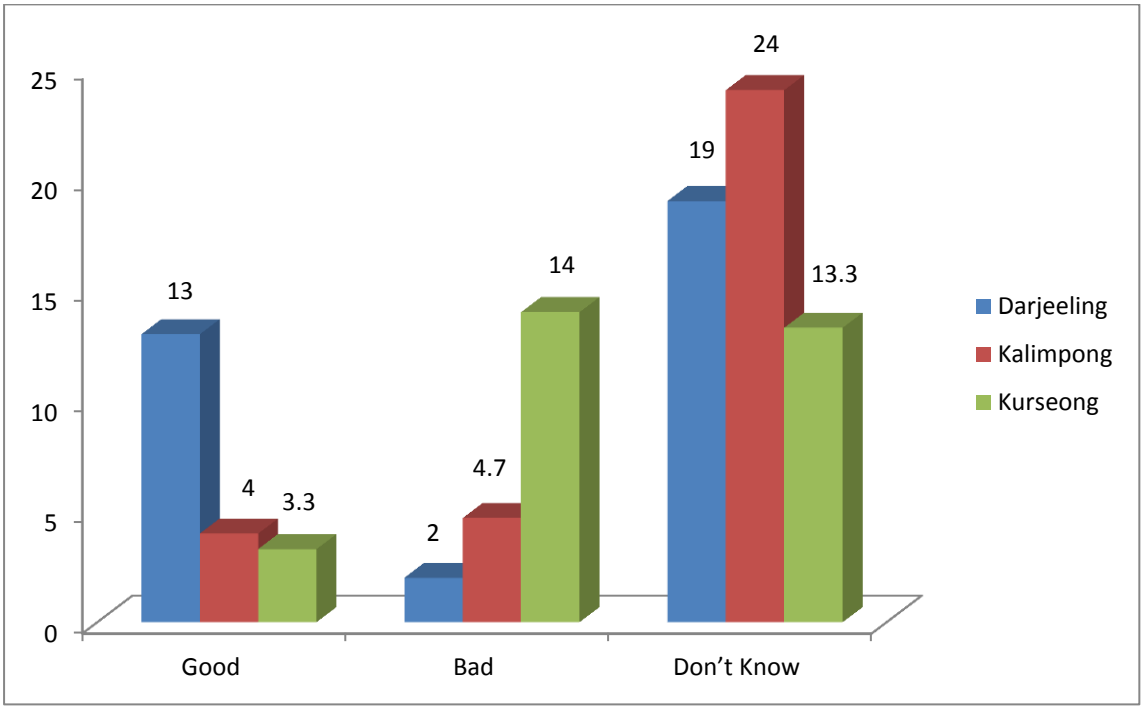


Table 29 gives information about the perceived quality of the water in all the towns combined and individual bought from the vendors where about 7.4 percent respondents said that the quality of the water is good, about 6.4 percent said that the water is bad and 18.8 percent said that they do not know whether it's good or bad. As the water supply from the private vendors is not a new thing in the hills (started on 1980s) and the residents also have proper knowledge about it so they do know from where the water is being taken by the vendors and anyone can see the long queue of vendors on the lower reaches of the hills filling their container (especially the tanker truck) while going towards the town. In Darjeeling town about 13 percent of households said that the quality of the water bought from the vendor is good, 2.0

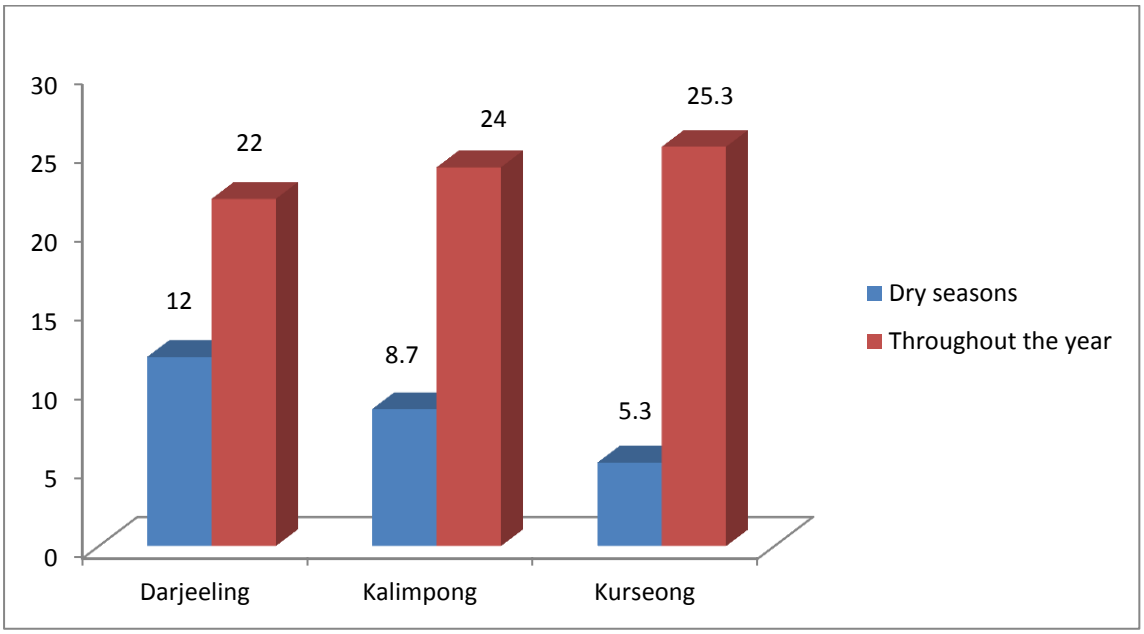
percent said its bad and 19 percent does not know about it. In Kalimpong town, 4.0 said its good, 4.7 percent said it's bad and 24 percent said they don't know. Likewise, in Kurseong town, about 3.3 percent said its good, about 14 percent said its bad and 13.3 said they do not know about it.

Table 30 Purchase applicable for the season to buy from the vendor

Towns	Purchase		Total
	Dry seasons	Throughout the year	
All 3 towns	9.0	23.6	32.6
Darjeeling	12.0	22.0	34.0
Kalimpong	8.7	24.0	32.7
Kurseong	5.3	25.3	30.7

Source: Computed from Primary Survey, 2017-18

Figure 9 Purchase applicable from the vendors



The above Table No. 30 shows the purchase of drinking water applicable from the vendor in the towns combined where about 9.0 percent said that the purchase of water from the vendor is applicable mostly during the dry or lean period which usually starts from December and stays till February and has less rainfall of the year. About 23.6 percent said that the purchase of water is applicable throughout the year irrespective of the season. Some respondents stated that the volume of water they receive does not fulfill their day to day need and also the inconsistent timing of the water makes things

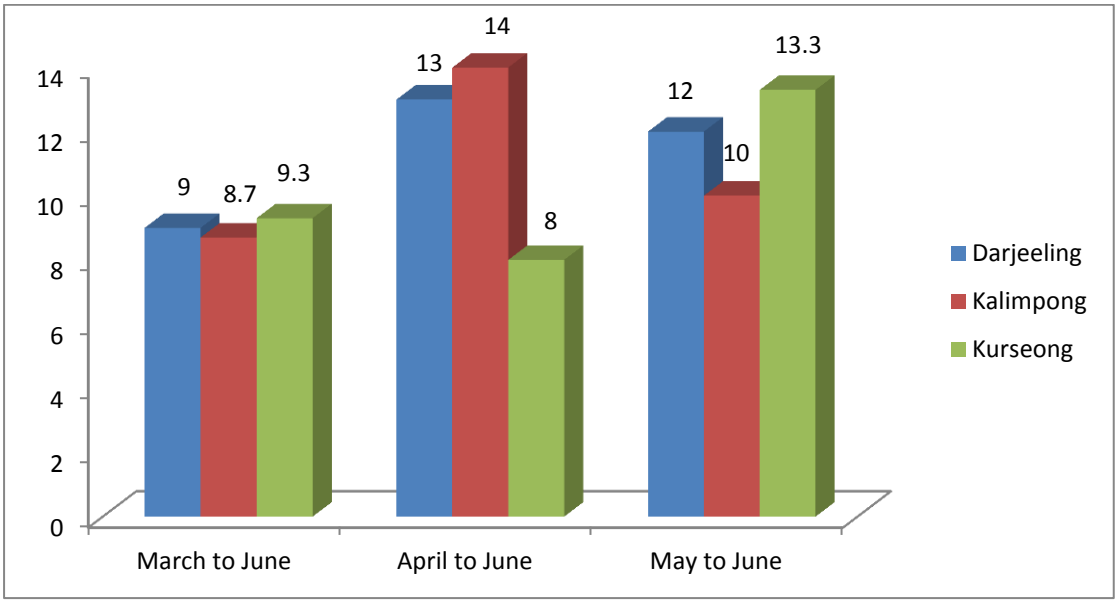
difficult for the residents and they opt to buy water throughout the year. In Darjeeling town, the household who said that they buy throughout the year is 22 percent and that who buys during the dry season is 12 percent. Likewise, in Kalimpong town, about 24 percent of households said that they buy through the year and 8.7 percent buy during the dry season In Kurseong town about 25.3 percent of households said that they buys throughout the year and 5.3 buys during the dry seasons.

Table 31 Months at which the HH bought maximum water from vendor

Towns	Maximum buy (months)			Total
	March to June	April to June	May to June	
All 3 towns	9.0	11.8	11.8	32.6
Darjeeling	9.0	13.0	12.0	34.0
Kalimpong	8.7	14.0	10.0	32.7
Kurseong	9.3	8.0	13.3	30.7

Source: Computed from Primary Survey, 2017-18

Figure 10 Months at which the HH bought maximum water from vendor



The above Table No. 31 gives information about the months at which the household buy maximum water from the vendor about 9.0 percent said they buy most water in March and June, 11.8 percent said they buy most water in April to June, about 11.8

percent buy on most water in May to June. In Darjeeling town, about 9 percent said that they buys in March-June, 13 percent buy in April-June, and 12 percent buy in May-June. In Kalimpong town, about 8.7 percent said that they buy in March-June, 14 percent buy in April-June, and 10 percent buy in May-June. In Kurseong town, 9.3 percent said that they buy in March-June, 8 percent buy in April-June, and 13.3 percent buy in May-June.

Table 32 Application of water saving measure in the HH

Towns	Water saving		Numbers	Total
	No	Yes		
All 3 towns	83.6	16.4	500	100
Darjeeling	81.0	19.0	200	100
Kalimpong	72.0	28.0	150	100
Kurseong	98.7	1.3	150	100

Source: Computed from Primary Survey, 2017-18

Figure 11 Application of water saving measure in the HH

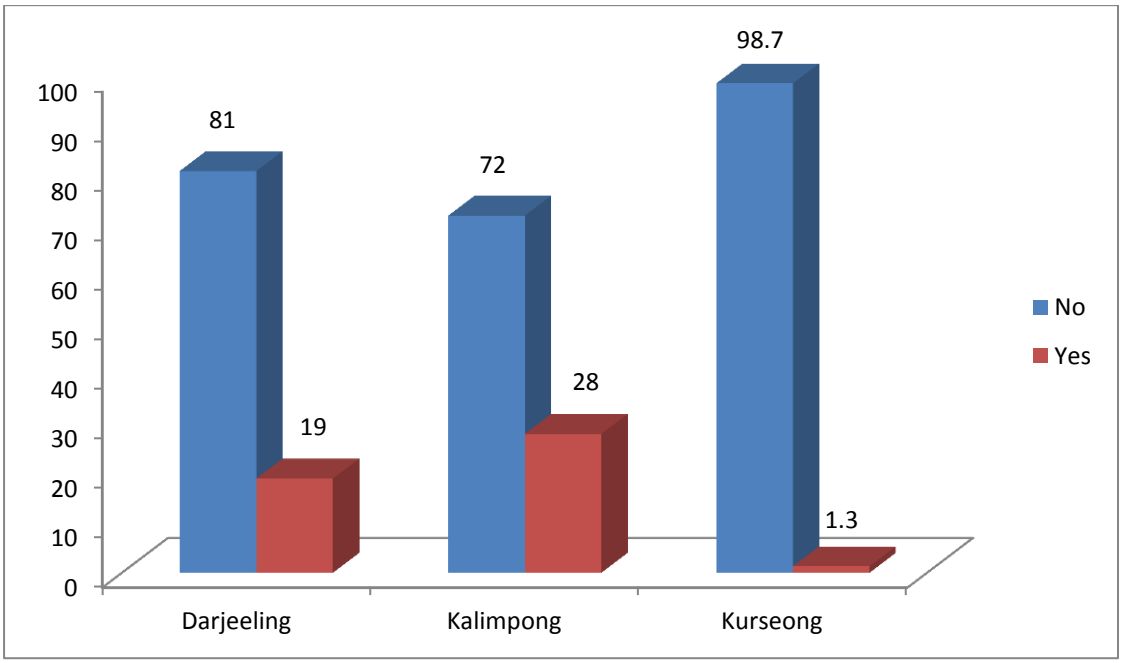


Table 32 shows that about 83.6 percent of households do not save the water and about 16.4 percent of households said that they save the water by using the water used for washing clothes and vegetables and are used to flush the toilet. Most of the

households said: what will they save when the water they receive from the primary source is so meager? Yet many are willing to learn the ways of water-saving and management within their household and community which indicates a need for mass awareness programs for the public. The households are being able to save the rainwater only when it rains after that there's no other option than to use the other alternative methods to acquire the water. In Darjeeling town, about 81 percent of households said that do not save the water and about 19 percent save the water. In Kalimpong town, about 72 percent of households said that do not save the water and 28 percent save the water. In Kurseong town, about 98.7 percent of households said that they do not save the water and only1.3 percent save the water.

Table 33 Shortage of water supply within the HH

Towns	Shortage		Numbers	Total
	No	Yes		
All 3 towns	42.0	58.0	500	100
Darjeeling	44.5	55.5	200	100
Kalimpong	39.3	60.7	150	100
Kurseong	41.3	58.7	150	100

Source: Computed from Primary Survey, 2017-18

Figure 12 Shortage of water supply within the HH

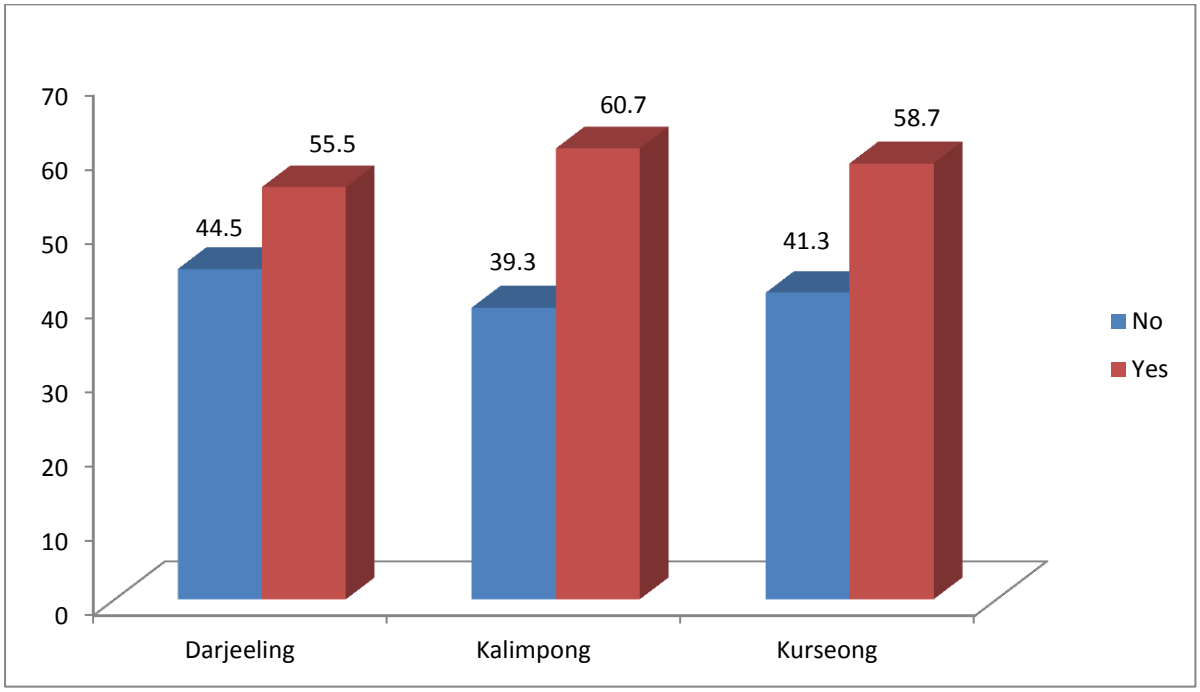


Table 33 shows that about 42 percent said that there is no shortage of water supply in the household while about 58 percent said that there is a shortage of water supply in the household. The household either buys from the vendors or goes to nearby natural spring to manage during the shortage. Some of them manage with the available water they have, some even ask their neighbors during the shortage of water in the house and some even own the private spring source. In Darjeeling town, about 58 percent survey households said that they do have a water shortage in their household and 42 percent households said that do not have water shortage In Kalimpong town, about and 60.7 said that they do have the water shortage and 39.3 percent said that they do not have a water shortage. Likewise in Kurseong town, about 58.7 percent said that they do have a water shortage and 41.3 percent said they do not have water shortage within their households.

Table 34 Whether the Household is satisfied with the drinking water service

Towns	Satisfaction			Number	Total
	Extremely satisfied	Moderately satisfied	Not satisfied		
All 3 towns	31.4	8.2	60.2	500	100
Darjeeling	16.0	19.0	65.0	200	100
Kalimpong	39.3	.7	60.0	150	100
Kurseong	44.0	2.0	54.0	150	100

Source: Computed from Primary Survey, 2017-18

Figure 13 Whether the Household is satisfied with the drinking water service

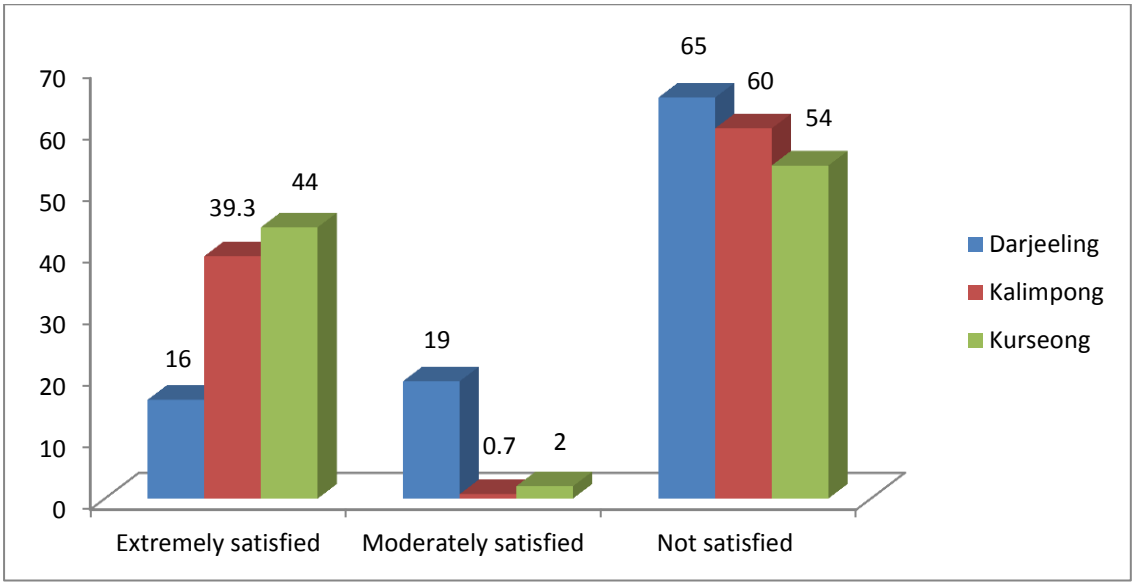


Table 34 shows the satisfaction of the drinking water supply service of the respondent's household, about 31.4 percent said that they are extremely satisfied by their water supply service, around 8.4 said that they are moderately satisfied and about 60.2 percent said that they are not satisfied at all. For those who are extremely satisfied the majority of them receives water either 24 hours or is having a small family. The household receiving 24 hours of water has spring water connected into their dwelling and not municipal tap water. In Darjeeling town, about 16 percent of households said that they are extremely satisfied with the drinking water services in their area and about 19 percent aid that they are moderately satisfied and about 65 percent said that they are not satisfied at all. In Kalimpong town, about 39.3 percent said that they are extremely satisfied, .7 percent said that they are moderately satisfied and about 60 percent aid that they are not satisfied at all. In Kurseong town, about 44 percent said that they are extremely satisfied, 2.0 said that they are moderately satisfied and about 54 percent said that they are not satisfied at all.

Table 35 Reasons for satisfaction

Reasons for Satisfaction	Towns			
	All 3 towns	Darjeeling	Kalimpong	Kurseong
Small family	14.8	5.0	24.0	18.7
Community/self initiative	2.4	6.0	-	-
Landlord takes all responsibility	3.4	1.5	.7	8.7
Stay in government/private quarters	1.4	2.0	-	2.0
Own private spring water source	8.8	.5	14.6	14.0
Spring water nearby	.6	1.0	-	.7
Total	31.4	16.0	39.3	44.0

Source: Computed from Primary Survey, 2017-18

The above Table No. 35 shows the reason for satisfaction of drinking water supply service in the respondent's household, about 14.8 percent said they have a small family, about 2.4 percent said that the community/self has taken initiative on water supply, about 3.4 percent said that the landlord takes all the responsibility, 1.4 said they stay in government/ private quarters, 8.8 percent said that the respondent has own private spring water source which comes into their dwelling, .6 percent said that there is a spring water source nearby where they go and fill the water. In Darjeeling town, about 5.0 percent gave small family as the reason for the satisfaction, 6.0 percent aid community/ self initiative, 1.5 percent said landlord takes all the responsibility, 2.0 said that they stay in government/ private quarters, .5 percent said that they own private spring water source, 1.0 percent said that they have a spring water nearby. In Kalimpong town about 24 percent said that the reason for the satisfaction is because of the small family, .7 percent said that the landlord takes all the responsibility, 14.6 percent said that they own the private spring water. In Kurseong town, about 18.7 said that they have a small family, 8.7 percent said that the landlord takes all the responsibility, 2.0 percent said that they stay in government/ private quarters, 14 percent said that they own private spring water source and .7 percent said that there is spring water nearby.

Table 36 Reasons for dissatisfaction

Reasons for Dissatisfaction	Towns			
	All 3 towns	Darjeeling	Kalimpong	Kurseong
Large family	9.6	5.0	13.3	12.7
No municipal coverage	3.2	4.0	2.7	2.7
Less time to fill the container	6.4	12.0	5.3	-
Municipal water inconsistent	6.0	13.0	2.7	-
Municipal water not reliable	31.6	45.0	28.0	16.7
Municipal water not enough	11.6	5.0	8.7	24.0
Total	68.4	84.0	60.7	56.0

Source: Computed from Primary Survey, 2017-18

The above Table No. 36 gives the reason for being dissatisfied (reason for both moderately satisfied and not satisfied) with respondent's water supply service about 9.6 percent said that they have a large family around 3.2 percent said that there is no municipal water coverage in his/her area, about 6.4 percent said that the time to fill the containers is very less, about 6 percent said that the municipality water is inconsistent, 31.6 percent said municipal water is not reliable, and about 11.6 percent said municipal water is not enough for the household. In Darjeeling town, about 5 percent said that they have a large family, 4 percent said that they have no municipal coverage, 12 percent said that there is less time to fill the container, 13 percent said that the municipal water is inconsistent, 45 percent said that that the municipal water is not reliable, and 5 percent said that the municipal water is not enough. Likewise, in Kalimpong town, about 13.3 said that they have a large family; about 2.7 percent said that there is no municipal coverage; about 5.3 percent said that the time is less to fill the container, 2.7 percent said that the municipal water is inconsistent, 28 percent said that the municipal water is not reliable, and 8.7 percent said that the municipal water is not enough. In Kurseong town, the reason for dissatisfaction is a large family with 12.7 percent, 2.7 percent said that there is no municipal coverage, 16.7 percent said that municipal water is not reliable, and 24 percent said that the municipal water is not enough.

Table 37 Main supplier of water in the respondent's household/area

Management of the water supply	Towns			
	All 3 towns	Darjeeling	Kalimpong	Kurseong
Self	12.4	4.0	18.7	17.3
Municipality	29.0	38.0	24.7	21.3
Landlord	2.8	1.5	-	7.3
Municipality and self	51.6	48.0	56.0	52.0
Landlord and self	1.0	1.5	-	1.3
Landlord and municipality	.8	1.0	.7	.7
Community and self	2.4	6.0	-	-
Total	100	100	100	100

Source: Computed from Primary Survey, 2017-18

The above Table 37 shows the main water supplier in the respondent's house/area. Around 12.4 percent household said that they are themselves responsible for their water supply these households are the one who is getting spring water into a dwelling by paying the money and are not receiving municipal water, around 29 percent household said that responsibility is taken by the municipality itself. Around 2.8 percent household's water supply responsibility is said to have been taken up by the landlord , around 51.6 percent household the responsibility is taken up by both the municipality and the household themselves which is also true in this case because those households are arranging themselves for the additional water as the municipal water is inconsistent and unreliable. 1 percent household's water supply responsibility is taken up by both the landlord and the household themselves, around .8 percent said that the responsibility is taken up by both the landlord and the municipality and around 2.4 percent said that the water supply responsibility is taken up by the community/self (the member of the respondent's household has joined the community). In Darjeeling town, about 48 percent said that the management of the water supply is done by municipality and self, followed by municipality which is 38 percent, community and self which is about 6 percent, self which is 4 percent landlord and landlord and self which is 1.5 percent each and landlord and municipality which is 1 percent. Likewise, in Kalimpong town, about 56 percent said that the management of the water supply is done by municipality and self, followed by the municipality which is 24.7 percent, self this is about 18.7 percent and landlord plus municipality which is about .7 percent. In Kurseong town, about 52 percent said that the management of the water supply is done by municipality and self, followed by the municipality which is 21.3 percent; self-managed which is 17.3 percent, landlord which is 7.3 percent, landlord and self which is 1.3 percent and landlord and municipality which is .7 percent.

Table 38 Part of water supply that needs up gradation

Towns	Aspects					Number	Total
	Quantity	Pressure	Reliability	Municipal coverage	No issues		
All 3 towns	17.6	7.4	41.6	31.8	1.6	500	100
Darjeeling	16.5	11.0	48.0	19.0	5.5	200	100
Kalimpong	22.0	6.7	38.0	30.7	2.7	150	100
Kurseong	14.7	1.3	44.0	37.3	2.7	150	100

Source: Computed from Primary Survey, 2017-2018

A question was put forth on the part of water supply that really needs up gradation out of which about 18 percent said that they want the quantity of the water should be more; about 7.4 said that the pressure of the water should be substantial, 42 percent think that the water should be reliable, 32 said that they need the municipal coverage in their area and about 1.6 said that there's no issue for them as shown in Table 38. The major concern for the people has been the reliability as the water is not reliable for most of the households and some households do not have the municipal coverage and they are either taking spring water into their dwelling or into the distance which makes most of the unsatisfied. Very few people have no issues regarding their water supply and these are the people whose family size is less and those who are staying in the government quarter. An option for the quality has also been put forth in the questionnaire however not a single households came out with the issue of the quality and narrated that the quantity itself is less that's why they are facing the serious problem. In Darjeeling town the highest aspects for the improvement in water supply is reliability which is 48 percent followed by municipal, coverage, quantity and pressure. In Kalimpong town, the highest aspects for the same are on reliability, municipal coverage, quantity and pressure. In Kurseong town, the highest aspect is on reliability, municipal coverage, quantity and pressure.

Table 39 Fights for water

Towns	Fight		Numbers	Total
	No	Yes		
All 3 towns	92.2	7.8	500	100
Darjeeling	95.0	5.0	200	100
Kalimpong	87.3	12.7	150	100
Kurseong	93.3	6.7	150	100

Source: Computed from Primary Survey, 2017-2018

Table 39 gives information about whether the households had any fights for water. The fight out here has been reported especially by those households who use the community natural springs as it is free of cost and can be used by anyone. However, the fights do not become violent because of the intervention of the elders and some mediators and they develop some some mutual understanding and the fights are being solved.

Here, the fight for water is reported more in the Kalimpong town than the other two towns.

The reasons for the fights are as follows:

A) Fights for the queue
B) Fights in home (with the family members)
C) Fights with those who overtake the queue,
D) Fights when people damage the sources
E) Fights when some people take more water
F) Fights when people wash their clothes in the source
G) Fights when someone steals the water from the source
H) Regular fights between the spouses due to the scarcity of the water.

Quality of the drinking water in Darjeeling Hills- According to the CGWB until now the presence of Arsenic and Fluoride has not been reported and the groundwater resources and quality of the water have also not been calculated. But the presence of higher Electrical Conductivity (EC), Total Dissolved Solids (TDS), Total Hardness, Bicarbonate (HCO3) in the spring water and higher iron in the bore well water has

been reported in the neighboring Himalayan state of Sikkim where the groundwater (springs) occurs under unconfined condition (CGWB & Gupta, 2014) and which is also an central geological part of Darjeeling Himalayas (Basu, 2013). In the Himalayan region the water is reported to be good and drinkable (CGWB & Gupta, 2014). The iron is said to be the secondary contaminant and are not found to be harmful to health but a substance of reddish-brown are found to be developed in the tanks of lavatory which can also block the water systems (McFarland & Dozier, 2004) No guideline has been planned so far on the health due to iron contamination. (WHO, 2003). In the Darjeeling hill towns, almost all the households reported that they treat the water and their ways of treatment are shown below:

Table 40 Ways of treating the water within the households

Towns	Boil	Strain it through the cloth & boil	Let the dust settle & boil	Filter + Boil	Total
All 3 towns	41.2	30.8	16.2	11.8	100
Darjeeling	24.5	45.0	7.5	23.0	100
Kalimpong	49.3	21.3	20.7	8.7	100
Kurseong	51.3	19.3	21.3	8.0	100

Source: Computed from Primary survey, 2017-18

Table 40 shows that the majority of the people treat their water in a very traditional way and the most common method of treating the water is to simply boil it (41.2 percent) however some household first strain the water through the cloth and boil (30.8 percent), some at first let the dust settle and boil (16.2) and some also do filter and boil (11.8 percent). Some households reported that the color of their water is muddy especially during the monsoon season. Some also reported that there was an incident where a dead body was discovered in the Senchal Lake (major municipal water supply) in Darjeeling and the residents later got to know about it. One 50 year old resident in Darjeeling town:

'हामीले त त्यो पानी खायौ नि थाहै नपाई हुन त पानी उमालेर खाको थियौ र पनि पछि चाल पाऊदा सिक सिक लाग्यो'

(**Translation**: We had drank that water and we didn't know about it however most of us boil the water but when we came to know about it, we felt very bad)

Again, a 50 year old Woman from ganesh gram in Darjeeling town narrates:

'हाम्रो त घरमा फिल्टर छैन त्यसकारण हामी त खादा अनि सिरक को खोल ले पानी चलेर उमालछौ क़ल मा कुनै लुगा नलगाई पानी थाप्दैनव'

(**Translation**: We don't have filter at home so we filter our water through Khada[41] and Sirak ko Khol[42] and boil it. We do not take water directly without using these clothes)

Sectary of the Branch committee Darjeeling (from the opposition party in 2017) located near chowk bazaar informs:

पैला त म्यूनिसपेलटीको पानीमा फिज्ज़ उठ्थियो कोक जस्तै त्यसको मतलब थियो कि त्यो पानी चाही उपचार गरिएको हो तर ऐले त्यो सब सिस्टमहरु हराएर गयो आजकल त पानीमा ब्लीचिंग मात्रै हाल्छ फेरी अर्को प्रश्न के उठ्छ भन्दा त्यो डिपॉर्ट्मन्टबाट ब्लीचिंग पनि टाइममा हल्दैछ कि हालेको छैन

(**Translation**: Earlier the water used to be fizzy like a coke which means that it was treated. However this system has been vanished; nowadays they only bleach the water. Yet, the question out here is whether the department is putting bleaching powder in correct time or not)

In all the above mentioned towns the common method of treating the water is boiling, followed by straining the water with the cloth and boiling, let the dust settle and boil and filter plus boiling. Though the question was asked related to drinking water and health not a single household reported about having health issues within their households. One 45 year old respondent in Kalimpong town Relli Road states:

[41] Khada is a traditional ceremonial scarf in Tibetan and Mongolian culture. It is known with variety of names like Khata, Khadag or Hada

[42] Sirak ko khol meaning Quilt covering or bed covering. It is generally used for many domestic purposes when the cover becomes old and ripped off.

हामीलाई त पानी कम्ति पाकोमा गुनासो छ, त्यसर्थ पानी मैला भन्दा पनि कम्ति पौछौ त्यहि सबै भन्दा ठुलो समस्या हो हाम्रो

(**Translation**: We have grievances over the quantity of the water; more than the bad water we receive less water which is a big problem for us)

Another 30 Year old respondent from Ghoom said:

'बिमार त हुन्छौ हामी तर खासै पानीलेनै हो भनेरचै भन्नु सक्दैनौ, अरु कारण ले पनि हुनु सक्छ

(**Translation**: We often get health problems however we cannot exactly say that it's because of the water. There may be other reasons for it)

Again, another 47 year old respondent in Kurseong town narrates:

'हामी त सधै पानी उमालेर खान्छौ सालैभरि, उमल्दा खेरि किटानुहरु मर्छन् अनि पानी खाने योग्य हुन्छ'

(**Translation**: We always boil the water throughout the year, it is to make sure that the bacteria has died and it's safe to consume)

A 53 year old respondent from Kurseong town informs:

ऐलेसम्म त खै त्यस्तो बिमार भाको चाल पाईन पानी खाएर

(**Translation**: So far I never felt I got sick because of consuming the water) laughs the respondent

However, many people did complaint about the water being muddy during rainy season yet they boil it to make sure it's safe to drink. They also mentioned that the kids become vulnerable during this time.

4.3. DETAILS OF EXPENDITURE ON WATER AND EXTRA MONEY PAID FOR ANY SERVICES RELATED TO DRINKING WATER BY THE HOUSEHOLD IN THE LAST ONE YEAR AND WILLINGNESS TO PAY FOR BETTER ACCESSIBILITY

Questions were asked on total expenditure on water and whether the households had to pay some extra money besides the main expenditures which have been explained in details in the tables below

Table 41 Amount paid to get the accessibility of the water by the households (from main source)

Amount paid to access the water supply (in Rs.)	Towns			
	All 3 towns	Darjeeling	Kalimpong	Kurseong
Do not pay	25.8	41.5	16.0	14.7
<200	.2	-	-	.7
201-400	52.4	8.5	82.7	80.7
401-600	20.2	46.5	1.3	4.0
601-800	1.0	2.5	-	-
>800	.4	.1	-	-
Total	100	100	100	100

Source: Computed from the primary survey, 2017-2018

The above table 41 shows that the majority of the households are paying the amount between 201-400 Rupees which is 52.4 percent. The households who do not pay the amount are 25.8 percent these are the households who are using the public hydrant installed by the municipality/PHED and those who take water from the faraway spring. About 20.2 percent household's gives between 401-600 Rupees to access the water these are the one who is mostly taking water from the private spring source. It should be noted that the municipal officers said in their interview that they take the sum of 300-500 Rupees per year. Kurseong is the only town where they collect the property tax and not the water tax. "*Those households who pay the quarterly property tax of above 338 Rupees are eligible to get the water connection*" said the Kurseong municipal engineer. In Darjeeling town the highest amount paid is between 401-600

rupees (46.5 percent), in Kalimpong the highest amount paid is between 201-400 rupees (82.7 percent), likewise in Kurseong about 80.7 percent paid the highest amount between 201-400 rupees.

Table 42 Time Period of the payment done by the Household to get the accessibility

Time period of the payment	Towns			
	All 3 towns	Darjeeling	Kalimpong	Kurseong
Daily	1.4	3.0	.7	-
Monthly	16.6	19.0	16.0	14.0
Half yearly	21.4	-	-	71.3
Yearly	34.8	36.5	67.3	-
Total	74.2	58.5	84.0	85.3

Source: Computed from the primary survey, 2017-2018

Table 42 gives the information on the the time period of the payment done by the household to get the accessibility whereby daily payment is done by around 1.4 percent (those who use water tankers), monthly which is 16.6 percent (those using the private spring water source), half-yearly 21.4 percent and yearly 34.8 percent (those who use the municipal water source).

The method of payment of the money generally has to be done in person (going to the respective offices) and through banking (especially in Kalimpong town). The majority of the households said that the rate of water price is normal according to what they receive. Many people are willing to pay the price to get the proper accessibility of the water in their houses.

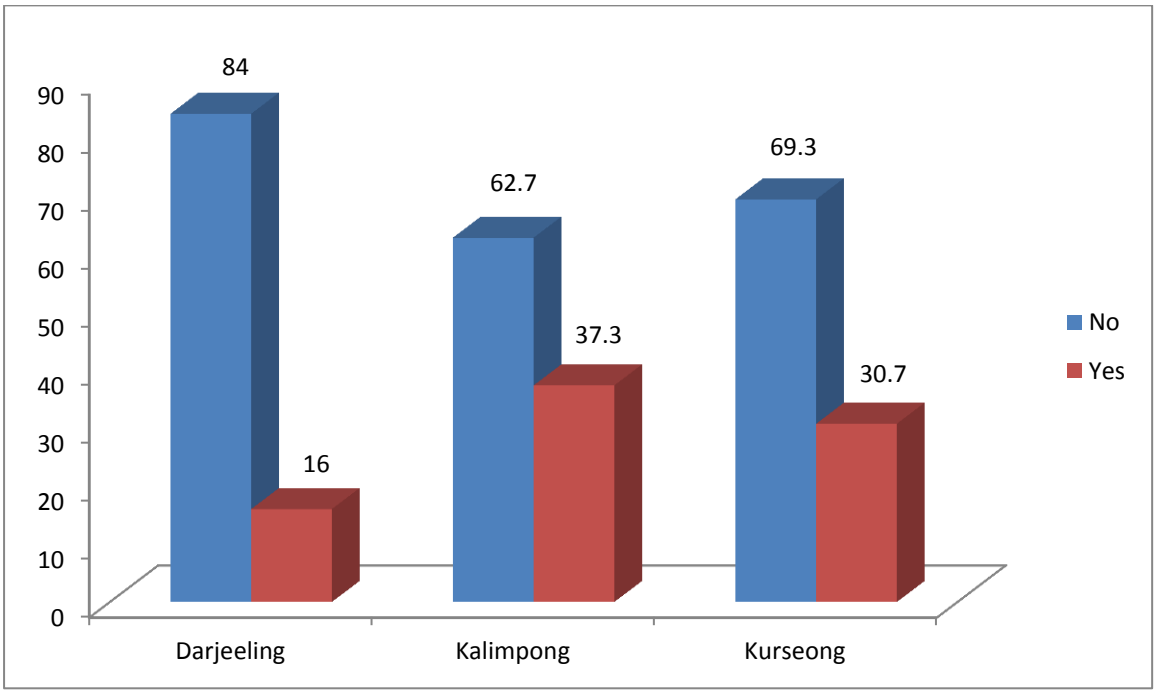
After the pilot survey, it has come to light that many people were paying extra money for the services so a question was put forth to ask about it in detail.

Table 43 Whether the HH has paid any extra money for any services related to drinking water

Towns	No	Yes	Total
All 3 towns	76.6	23.4	100
Darjeeling	84.0	16.0	100
Kalimpong	62.7	37.3	100
Kurseong	69.3	30.7	100

Source: Computed from primary survey, 2017-2018

Figure 14 Whether the HH has paid any extra money for any services related to drinking water



As shown in Table 43 about 23 percent of households in all the towns said that they did pay some extra money for the drinking water services in the last one year out of which 16 percent were from Darjeeling, 37.3 were from Kalimpong and 30.7 were from Kurseong town.

Table 44 Purpose for which that extra money was paid

Towns	Purpose			Total
	To get a new connection	To finish repair work of water supply	To get the new pipes	
All 3 towns	3.8	12.0	7.6	23.4
Darjeeling	3.0	10.5	2.5	16.0
Kalimpong	2.0	17.3	18.0	37.3
Kurseong	8.7	16.7	5.3	30.7

Source: Computed from Primary Survey, 2017-2018

Table 44 shows that out of 23 percent who paid extra money in all the towns 3.8 out of which 3.8 percent paid to get a new connection, 12 percent paid to finish repair work of water supply and 7.6 percent paid to get the new pipes. In Darjeeling town 3.0 paid to get a new connection, 10.5 paid to finish repair work of water supply, 2.5

paid to get the new pipes. In Kalimpong town, the percentage for the same is 2.0, 17.3 and 18.0. Likewise in Kurseong town, it is 8.7, 16.7 and 5.3 percent respectively.

Table 45 Amount of extra money paid by the Household

Towns	Price (in Rs.)				Total
	<300	300-600	600-2000	>2000	
All 3 towns	3.4	8.2	7.6	4.2	23.4
Darjeeling	3.0	4.5	5.5	3.0	16.0
Kalimpong	4.0	16.0	16.0	1.3	37.3
Kurseong	3.3	16.7	1.3	9.3	30.7

Source: Computed from Primary Survey, 2017-2018

Table 45 shows that in all the towns about 3.4 percent of households said that they paid below Rs. 300, 8.2 percent said they paid between Rs. 300-600, 7.6 percent said they paid between 600-2000 and 4.2 percent paid above 2000 Rupees. The percentage for the same in Darjeeling town about 5.5 paid about Rs. 600-2000 followed by the others, in Kalimpong town about 16 percent paid between 300-600 Rs and between 600-2000 followed by the others, In Kurseong town about 16.7 percent paid between 300-600 Rupees followed by the others.

Table 46 Whether that extra money was demanded or willingly paid

Towns	Demanded	Willingly paid	Total
All 3 towns	7.0	16.4	23.4
Darjeeling	10.0	6.0	16.0
Kalimpong	8.0	29.3	37.3
Kurseong	8.0	22.7	30.7

Source: Computed from Primary Survey, 2017-18

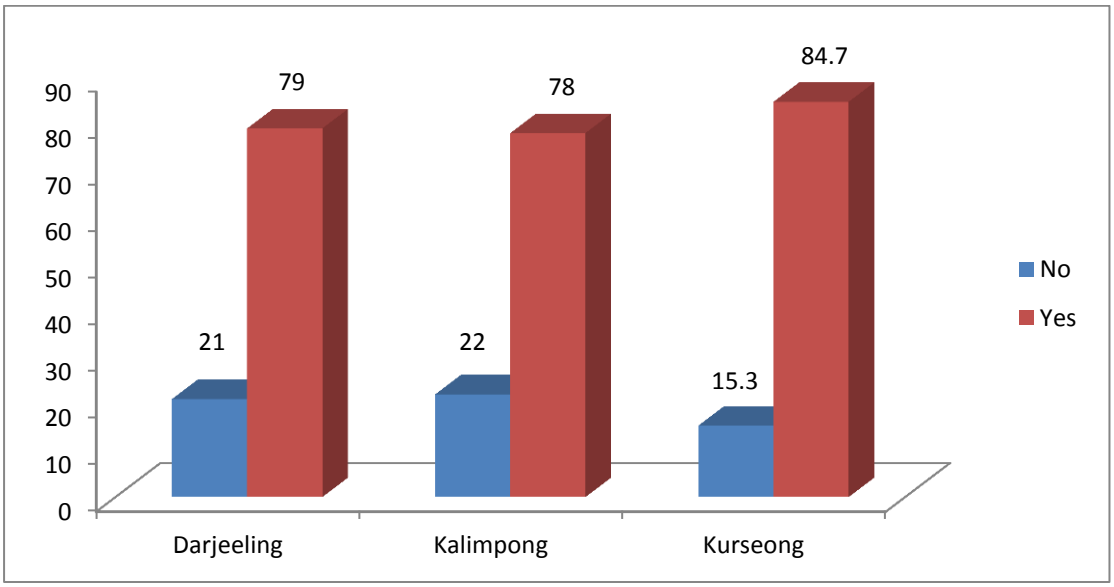
A question was put forth whether that extra money which the household paid was demanded or willingly paid and is shown in Table 46 whereby 7 percent said it was demanded and 16 percent said that they willingly paid on their own in all the towns. Whereas in Darjeeling town the percentage for the same is 10 and 6, in Kalimpong town it is 8 and 29.3 percent, Likewise in Kurseong town, it is 8 and 22.7 percent. Besides all of them said that the work was done after the payment was done.

Table 47 Willingness to pay for better accessibility of water

Towns	No	Yes	Total
All 3 towns	19.6	80.4	100
Darjeeling	21.0	79.0	100
Kalimpong	22.0	78.0	100
Kurseong	15.3	84.7	100

Source: Computed from Primary Survey, 2017-2018

Figure 15 Willingness to pay for better accessibility of water



As shown in Table 47 most of the household is willing to pay for the better accessibility of the water about 80.4 percent households are willing to pay in all the 3 towns about 19.6 percent are not willing to pay the reason they said was because of the small family the water they are receiving is enough for them, some mentioned that they could not afford to pay more. The figure for the same in Darjeeling is 79 percent, in Kalimpong its 78 percent and in Kurseong its 84.7 percent respectively.

4.4. DEMAND AND SUPPLY OF DRINKING WATER AND ITS CONSUMPTION PATTERN IN THE HILL TOWN

Criteria for calculating Water Demand in the town

The water demand is calculated through various guidelines like UDFPI, WHO, CPHEEO, etc. Water consumption as per WHO recommendation is 70 liters/ day or 15.5 gallons/day. As per the CPHEEO manual 2.2.8.3 where the town provided with

piped water supply but without sewerage system, the water supply should be considered 70 liters/day. This applies to the Darjeeling Hill towns because sewer lines are laid mostly on steep slopes and the problem arises of high velocity of sewage flow which avoids the possibility of siltation at any stage (Kalimpong PHED, 2014).

Table 48 Criteria for calculating water demand in the town

Aspect	Size of town		
	Small (<50,000)	Medium (>50,000)	Large and Metro (>10 lakh)
Domestic Absolute Min.	70 lpcd	70-100 lpcd	135 lpcd, it can be reduced upto 70 lpcd
Domestic Desirable	100 lpcd	135-150 lpcd	150-200 lpcd

Source: Kurseong Municipality[43], 2011-12

Table 48 gives information on the criteria of calculating the water demand of the town. The towns mainly follow the CPHEEO manual. However, it is to be noted that each department calculates the water demand accordingly. E.g. in Darjeeling and Kalimpong the water demand is calculated at 15.5 gallons per head per day, whereas in Kurseong it is calculated as 20 gallons per head per day.

Table 49 Water demand in the towns of Darjeeling Hill as per 2011 census population

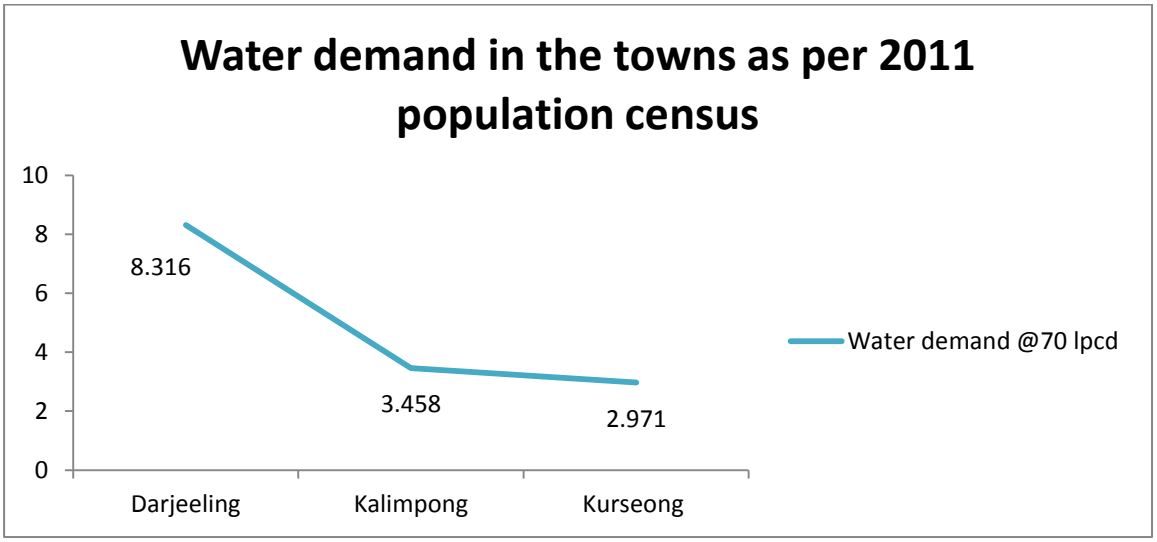
Name of the Town	Total population of town (2011)	No. of Households with piped water connection	Water demand @70 lpcd (into* total population of the town)	Water supply to Public*
Darjeeling	118805	5000	8316350 LD=8.316 MLD	637500 Gallons/day
Kalimpong	49403	7306	3458210 LD= 3.458 MLD	800000 Gallons/day
Kurseong	42446	3452	2971220 LD= 2.971 MLD	2,89,750 Gallons/day

Source: Computed from census of India 2011 and calculated acc to CPHEEO/WHO manual and PHED DPR

*Water is supplied by the authorities however it is not supplied every day to the town, it is supplied every alternative or 2/3 days gap

[43] Retrieved on 3/11/2016 from their official website http://www.kurseongmunicipality.org/water-supply.php

Figure 16 Water Demand in the towns as per 2011 population census



Source: Primary survey, 2017-2018

Table 49 shows the water demand of the Darjeeling hill towns as per 2011 census. According to the current (2011 population), the daily water demand of the Darjeeling town is 8.316 MLD and the other two towns are 3.458 MLD and 2.971 MLD respectively.

The authorities calculate the water demand taking all the population of town rather than the no. of households with piped water connection.

Table 50 Water demand from 2011 to 2047 year

Name of the town	Year 2011		Year 2032		Year 2047	
	Population	Water Demand# (in MLD)	Projected population*	Water demand (in MLD)	Projected population	Water demand (in MLD)
Darjeeling	118805	8.316	160197	11.213	194971	13.647
Kalimpong	49403	3.458	65,348	4.574	77,783	5.445
Kurseong	42446	2.971	56846	3.979	67,776	4.744

Source: PHED &Municipality office, 2017-2018 *obtained by Arithmetic increase, #@70 lpcd Geometric increase, Incremental increase

Table 50 gives the information of water demand from the year 2011 to 2047. The projected population is calculated by the authorities mainly till 2047 based on the water project which they have proposed. According to the projected population, the

water demand will increase mostly in Darjeeling Town followed by Kalimpong and Kurseong. According to Table 58, the water demand will rise by 2047 with the rising population. The water demand in the Darjeeling town will rise to 13.647 MLD by 2047 followed by Kalimpong which is 5.445 MLD and Kurseong with 4.744 MLD. The water is expected to rise in the coming years.

Table 51 Highest water consumption by households per day in the towns

Towns	Drinking	Cooking	Washing utensils	Washing clothes	Bathing	Cleaning	Sanitation	Total
All 3 towns	3.92	4.62	8.68	32.11	37.98	2.56	10.13	100
Darjeeling	3.90	4.60	8.69	32.08	37.95	2.61	10.17	100
Kalimpong	3.98	3.00	4.56	36.21	43.03	1.04	8.18	100
Kurseong	3.94	3.29	4.57	36.16	41.98	1.87	8.19	100

Source: computed from Primary survey, 2017-2018

Table 51 shows the highest consumption of water for various water-related activities. The water-related activities like bathing and washing clothes consume the highest amount of water percent. The third highest consumption is done sanitation which is 10.13 in all the towns and 10.17, 8.18 and 8.19 in the individual towns. Washing utensils become second-highest consumption with 8.68 in all the 3 towns and 8.69, 4.56 and 4.57 in the individual towns. Sanitation and washing utensils are done daily (at least 3 times a day) and require a good amount of water in the household. It is to be noted that the household responded on the water-related activities according to their size of the household (minimum 2, maximum 17, mean 5) whereas; the water supply is given to at least 5 people per house as per the authorities.

Table 52 Per capita water consumption (in liters/capita/day) in the towns

Towns	**< 70***	**70-95**	**95-120**	**120-145**	**145-170**	**170-195**	**> 195**	**Total**
All 3 towns	20.8	24.4	25.2	16.0	6.0	4.2	3.4	100
Darjeeling	24.0	24.0	19.5	17.0	6.0	3.5	6.0	100
Kalimpong	14.0	20.0	26.0	19.3	9.3	8.0	3.3	100
Kurseong	23.3	29.3	30.0	8.0	2.7	2.0	4.7	100

Source: Computed from the primary Survey, 2017-18 *According to CPHEEO/WHO Standard 70 lpcd

Per capita, water consumption was calculated as per CPHEEO and WHO standard. Table 52 shows that the per capita water consumption in all the towns is very less above 120 lpcd and there is not much variation in the pattern of consumption above 120 liters in all the towns. The benefit of concentrating on household water use is that compared to the other spheres of resources it is not much controlled by financial concerns (Berk et al; 1981 as cited in (Hamilton, 1983). According to Hamilton, those households which have higher use of water are very much conscious about their negligent wastage that could be easily lessened. On the other hand, the household having low use of water have a lesser chance for reductions though they have a remarkable accomplishment in terms of percentage use. Water-related activities in the households are inclined by different opportunities, capabilities, and motivations (Fielding et al., 2012; Michie et al., 2011 as cited in (Addo, et al., 2018) and for the successful planning and policy on water conservation it is equally important to have the information of both the attitudes towards these water-related activities and its consumption (Addo, et.al., 2018).

Table 53 Water consumption according to the household size (in %)

Water consumption in the Household (liters)	Size of the Household		
	Small	Medium	Large
< 70	20.8	0.0	0.0
70- 95	19.0	5.4	0.0
95-120	9.4	15.2	0.6
120-145	3.0	11.6	1.4
145-170	0.4	4.4	1.2
170-195	0.0	2.2	2.0
> 195	0.0	0.6	2.8

Source: Computed from the Primary data 2017-2018

Water consumption is mostly affected by the household size which has been shown in Table 53. While interviewing the Sub assistant engineer in Kurseong it became clear that the authorities provide water to 5 people per house. However, during the household survey, the household complaint that the water they receive from the authorities does not even cover the 5 people because the demand is more on especially washing and bathing leaving the other water-related activities at bay. It is seen that the

household having small size consumes less than <70 liters of water. As the size of the household is getting larger than the water consumption also gets increased. A 40 year old female respondent narrates:

'हामी ३ जना मात्रै छौ त्यसमा पनि एकजना (छोरा) बाहिर पर्नु गयेको छ यता पानीको दु:ख छ त्यैसैकारण हामी बेसी पानी चलौदैनौ अनि सानो परिवार भाको कारणले पानी त्यति लाग्दैन'

(**Translation**: We are a family of 3 out of which one (son) has gone out to study, as there is water problem out here we don't use much water and also because of small family not much water is needed)

Contrastingly, the 55 year old female respondent having large family narrates her ordeal:

हामी ठुलो जान छौ (१४ जाना) पानी कति लाग्छ होला तपाई सोची हालनुहोस यता पानीको धेरै दू:ख छ अनि म्यूनिसपेलटीको पानीले पुगदैन हामीलाई त्यसकारण हामी पानी किन्नु बाध्य छौ

(**Translation**: We are a family of 14 people you can imagine the demand of water, as there is lots of water problem out here and since the municipal water is not sufficient for us hence we often have to buy it)

4.5. RAIN WATER HARVESTING IN THE TOWNS OF DARJEELING HILLS-

A question was put forth about the collection of rain water or roof top water by the households the details of which have been given below:

Table 54 Whether the Households collect the rain water or roof top water

Towns	No	Yes	Total
All 3 towns	43.6	56.4	100
Darjeeling	40.0	60.0	100
Kalimpong	45.3	54.7	100
Kurseong	46.7	53.3	100

Source: Computed from the primary survey, 2017-2018

Table 54 shows that in all the 3 towns about 56.4 percent collects the rainwater for the need of the households like washing utensils and clothes and other household activities. Amongst the towns, Darjeeling has the highest rainwater collection of about 60 percent followed by Kalimpong and Kurseong town with 54.7 and 53.3 percent respectively. Some households do not collect the rainwater/ rooftop water (locally known as बर्खाको पानी, छानाको पानी, मगारोको पानी) and seem to throw away.

Image 7 Rain water Harvesting in the towns of Darjeeling Hills

a) Rainwater collection

b) Rainwater dispersion

Source: Primary survey, 2017-2018

4.6. PERCEPTION OF DRINKING WATER SUPPLY IN THE TOWNS

Several questions were put forth regarding the perception of drinking water supply service from the individual households as well. The level of awareness and interest has also been taken into consideration. Perception of drinking water was taken to understand how people feel about the condition of their drinking water.

Table 55 Perception of the Drinking water by the households

Perception on Purity of drinking water supply		
Categories	Number	Percentage
Excellent	146	29.2
Very Good	323	64.6
Good	31	6.2
Total	500	100
Perception on color of drinking water supply		
Excellent	86	17.2
Very Good	336	67.2
Good	78	15.6
Total	500	100
Perception on taste of drinking water supply		
Excellent	46	9.2
Very Good	256	51.2
Good	198	39.6
Total	500	100
Perception on pressure of drinking water supply		
Excellent	33	6.6
Very Good	81	16.2
Good	78	15.6
Bad	248	49.6
Very Bad	60	12.0
Total	500	100

Source: Computed from Primary Survey, 2017-2018

There is a difference between the condition of drinking water and its perception; thus perception does not outline the condition of drinking water (Poonia, 2015). Here, in Table 55 about 65 percent feel that the purity of the drinking water supply in their home/ area is very good and about 29 percent think that it is excellent a majority of which are using spring water. About 67 percent feel that the color of their drinking water is very good and 17 percent feel that it is excellent. 51 percent feel that the taste

of their drinking water is very good and 39 percent feel it's excellent. About 49 percent said that the pressure of water supply in their home/area is bad a majority of the perception comes from the households having municipal water supply especially from those who take tap water from plot/yard. The respondent's opine that as many households take water from there so because of the bad pressure and limited time to fill the container the water is not enough and also there is a long queue. The majority who feels that the condition of the drinking water supply is excellent is the one using the spring water either in their dwelling or outside the dwelling.

4.7. DETERMINANTS OF DRINKING WATER IN THE TOWNS OF DARJEELING HILLS

4.7.1. Socio- Economic and Demographic factors affecting accessibility in the towns of Darjeeling Hills

The multinomial logistic (MNL) regression model has been used to examine the main sources of drinking water and the factors affecting them. "Since there are more than two categories of dependent variable which is sources of drinking water and includes no natural ordering which signifies that the household has this options in terms of access to drinking water hence this model is found to be relevant" (Amponsah, Aidam, & Senadza, 2009). There are four sets of sources available to the households namely: tap water into dwelling, tap water into plot/compound, and spring water into dwelling, spring water in distance and water tankers which is above two categories of the dependent variable. Thus MNL can be used and the data have adequate cases that are suitable for the justification towards variable assumption (N=500).

The model for Multi-nominal logistic regression is given as follows:

$$Log\left(\frac{\Pr(Y=k)}{\Pr(Y=k')}\right) = \beta_0 + \beta_1 X_1 + \beta_2 X_2 + \beta_3 X_3 + \cdots + \beta_k X_k + \in_{ij}$$

Where "k" is the identified category (i.e. main sources of drinking water other than a reference) and k' is the reference category. X's are various explanatory variables that can be either categorized or continuous nature. β's are the regression coefficient associated with each explanatory variable.

The multinomial logistic regression is often regarded as a desirable analysis since it does not affect normality, linearity, and homoscedasticity. MLR has a hypothesis such

as the assumption of independence among the dependent variable choices (Starkweather & Moske, 2011). For MNL, seven explanatory **socio-economic and demographic** variables have been taken into consideration like the monthly income of the household, social group, HH size, age of the HH head, Sex of the HH head, education of the HH head, clean toilet facility and Distance to the source of water and residence.

Table 56 Results of the Multinomial Logistic Regression

Variables	Sources of Drinking water					
	Tap water into dwelling		Tap water into plot/yard		Spring water into dwelling	
Monthly income						
<11500 ®						
11501-15000	-1.714	(.180)	.288	(1.333)	-1.462	(.232)
15001-22000	-2.450	(.086)**	-.693	(.500)	-2.303	(.100)**
>22000	4.097	(.017)***	.100	(1.105)	3.682	(.025)***
Social Groups						
ST ®						
SC	-1.199	(.302)*	-.282	(.754)	-.857	(.424)
OBC	-1.656	(.191)*	-.589	(.555)	-.967	(.380)
Others	1.119	(.327)**	.082	(1.086)	-.591	(.554)
HH size						
Small ®						
Medium	-.360	(.698)	.294	(1.341)	-.221	(.801)
Large	.009	(1.009)	.777	(2.174)	-.140	(.870)
Age of the HH head						
<35 ®						
36-41	-.123	(.885)	-.588	(.556)	-.693	(.500)
42-48	.192	(1.212)	-.288	(.750)	-.814	(.443)
>49	-.327	(.721)	-.208	(.812)	-1.181	(.307)
>55	.038	(1.038)	.580	(1.786)	-1.048	(.351)
Sex of the HH head (1=male)	.286	(1.331)	.105	(1.111)	.268	(1.308)
Education of the HH head (1= literate)	-770	(.463*)	.506	(1.658)	-1.325	(.266)
Clean Toilet facility (1=yes)	-2.035	(.131)*	1.638	(5.147)**	-2.929	(.053)***
Distance to source of water (1= more than 15 mnts)	1.919	(6.815)***	-1.057	(.347)*	-.003	(.997)
Sample Size (n) 500 Pseudo R Square= .501 LR Chi square2= 300.248						

Source: Computed from primary data, 2017-2018 P-value: ***<0.001, ** <0.05 and * <0.1

(Spring water into plot/ yard and water tankers is the base outcome)

Table 56 presents the evaluation of the accessibility of sources of drinking water and the factors affecting them using Multinomial regression. Household monthly income, education of the hh head, social groups, clean toilet facility and distance to sources are found to have a significant relationship with the choice of drinking water sources (TW into dwelling) and in some (SW into dwelling). Significant relationship between income and access to safe piped water has been found in studies by (Bardasi & Wodon, 2008), (Asante, 2003), (Iskandarani, 2002), (Osei, 2005) , (Amponsah, Aidam, & Senadza, 2009), (Nauges & Strand, 2007), (Sattar & Ahmad, 2007), (Haq, Mustafa, & Ahmad, 2007)and (Rauf, Bakhsh, Hassan, Nadeem, & Kamran, 2015). According to the above table, the household income which is proxy for the ability to pay is a significant predictor for tap water into dwelling and spring water into dwelling. Income increases access to tap water into dwelling and spring water into dwelling by .98 and .97 percentage points. The value of access to piped water is low in low-income groups; due to the high costs associated with installing new piped connections (Choumert et. al 2014). Education has a significant impact on hh likelihood of drinking water and have access to information regarding quality drinking water and such individuals are more concerned about the health impacts of using water derived from tap water (Rauf, Bakhsh, Hassan, Nadeem, & Kamran, 2015). The distance was only significant for the household with access to piped water in residence. Thus longer the distance to a particular source of drinking water, the lower will be the demand for the same (Amponsah et al 2009). (Persson, 2002) Found that time cost is an important determinant of household choice of the drinking water source. Amponsah et al (2009) who found that the distance to sources and residence is consistently and inversely related to the source of drinking water.

Factors like sex of the HH head, age of the HH head, and HH size are found to have an insignificant relationship with the sources of water. The reasons could be that the availability of water is fixed which means that despite the age, sex or HH size; the households have no option but to choose the water source which is available in their area. The municipal water is given on a seniority basis which takes time, so the decision of taking the water from any source does not matter with the age, sex or the size of the household or household head. Sex of the hh head insignificant- nucleated family and the male member do ask their female counterpart before making any decisions but men do have most of the say. Some also had a female-headed household

like the widowed mother of the family, widowed wife and those who have separated/divorced from her husband. Water costs are usually a negligible fraction of household expense so even the sharp rise in the rates may have little effect on its consumption (Hamilton, 1983). The household having no clean toilet facility are more likely to take the water from unsafe sources. The town suffers from poor sanitation condition and about 22% of populations do not have latrine facilities. The public toilets constantly get blockage due to lack of water and disposal of paper is a common phenomenon that is not repaired or regularly checked leading to unusable conditions and unhealthy hygiene (Rai, 2018).

4.7.2. Behavioral Factors involved in drinking water in the towns of Darjeeling Hills

Behavioral factors involved in drinking water like Interest in information related to water conservation and management, interest in attending workshop/ volunteer in water management. The behavioral dimension is most interesting since it involves changes in daily habits that are not visible to neighbors or susceptible to municipal decrees (Hamilton 1983). Behavior is conceptualized as a series of interactions that influence each condition and thus becomes a part of an interacting system involving all conditions i.e. Capability, opportunity and Motivation (Michie et al., 2011 as cited in (Addo, et al., 2018)

Table 57 Behavioral factors involved in drinking water in Darjeeling Hills

Sources of drinking water	Interest in information related to water conservation and management		
	No	Yes	Total
Tap water into dwelling	13	268	281
Tap water into plot/yard	32	37	69
Spring water into dwelling	19	61	80
Spring water into plot/yard	14	49	63
Water tankers	3	4	7
Total	81	419	500

Source: Computed from Primary survey, 2017-2018

The above table 57 shows the interest of the households regarding information related to water conservation and management within their houses. The majority of the people seem to be interested in the information irrespective of their main sources of drinking water.

Table 58 Interest in attending workshop or volunteer in water conservation and management in the area

Sources of drinking water	Interest in attending workshop/ volunteer in water conservation and management		
	No	Yes	Total
Tap water into dwelling	146	135	281
Tap water into plot/yard	9	60	69
Spring water into dwelling	64	16	80
Spring water into plot/yard	31	32	63
Water tankers	3	4	7
Total	253	247	500

Source: Computed from Primary survey, 2017-2018

Table 58 shows the interest of the households in attending workshop/volunteer in water management in their area. It has been found those who have easy accessibility have a different set of behavior towards their drinking water. The probable explanation for this outcome is because those who have easy access to the tap water and spring water into dwelling are less interested in adopting water-saving measures and attending workshop or volunteering in water management within their households and their area. Another reason is that they can have easy access to private water vendors. Even if they are running short out of the water they can easily buy water from the vendors and as for the spring water into dwelling some of them also have 24 hours running water which is more than sufficient for them and are least bothered to save the water or volunteer for water management. The unwillingness & unawareness of the locals to adapt to new ways to preserve a better life for their future generations have had adverse effects on the natural mechanism of the hills (Rai, 2018). However, the relationship between attitudes and behaviors are highly vulnerable to the

respondent's effort to present a consistent and favorable impression of themselves (Schuman and Johnson, 1976 as cited in (Hamilton, 1983). Most people have little awareness of the amount of water they use or of where the greatest waste might be occurring. As found in the survey the municipal water is given on a seniority basis which takes time so the decision of taking the water from any source does not matter with the age, sex or the size of the household or household head but it is more of a need base thing. (Chakraborty, 2018) mentions that the "*Men monopolize the control of the water sources, the supply and commercialization of water*" While during the survey it is found that most of the family was nucleated and the male member do ask their female counterpart before making any decisions which allow them to take part in decision making regarding the choice of water equally like their male counterpart but men do have most of the say. Some also had a female-headed household like the widowed mother of the family, widowed wife and those who have separated/divorced from her husband. If the volume of water is not sufficient from the primary source than the households resort to the secondary and more accessible sources like water vendors; which is why a separate chapter on water vendors has been done. One of the respondents narrated about the disparity on drinking water by the local people. A 49 year old Bihari woman narrates:

मेरो माईता कलिम्पोंग (कन्चन सिनेमा हल) को छेवमा छ त्यहाँनिर एउटा पुब्लिक कल छ तर मेरो आमा बुहारीहरुलाई एक थोपा पानी थाप्नु दिदैनन् तिनीहरुलाई हेपछन्

(**Translation**: My parent's home in Kalimpong (near Kanchan cinema hall) there's a public tap however my mom and sister in law's are not allowed to fill a single drop, they are being dominated)

The said women have been married in Darjeeling and narrate how her parent is being dominated by the locals of her area. She said she gets angry however her parents don't say anything about this issue. The other local people wants to take the water first and her family is often told to take the water from somewhere else adds the woman. Many similar incidents of disparity and domination have been also been reported considerably by Chakraborty (2018) in his article.

Furthermore, another different incident related to the water has also been reported by the respondent whereby a 35 year old woman in Darjeeling town (ropeway area) narrates her ordeal:

भर्खरै मैले मेरो नानी गुमौनु पर्यो (अबोर्शन) पानी भरेर सीडीबाट लेउदै गर्दा चिप्लेर लडे

(**Translation**: Recently I lost my child (abortion) because I slipped in the stairs while carrying the water)

The women mentioned that her household gets water from the spring source which is located below (15-20 minutes) from her house. One has to climb through a lengthy stairs while carrying the water in that stairs she felled down and had her abortion. She mentioned that her husband goes to work and there's only her old father in law at home so she often carry the water irrespective of her condition.

4.8. CONCLUSION The drinking water supply system in Darjeeling is quite complex. There are three available sources of water and 5 different approaches to access these sources. There is not just the municipal supply in the towns there are other sources as well from which households are accessing the equally important water. It is found that the accessibility also depends on the household ability to buy the water be it municipal tap water or the private vendors. The easiest accessed source has become the private vendors which act as the supplementary or secondary source because of the unreliable nature of the primary source. There are also certain households who manage with whatever water they are getting. The gap of the water received from the municipality/PHED ranges from 15 minutes to 2 hours after every 2/3 day's gap which is making most of the households to buy water leading them to have extra expenditure on the water. The rich can buy from the vendors but the question is about the poorer section of the society who cannot afford which push them to either manage with whatever is available or ask the neighbors for extra water. Some do not even have the municipal water coverage which leads them to depend on the spring water and water tankers. Some households enjoy a 24/7 running spring water as they have a connection from the private spring water

supplier some even own this spring water a well and these households are least interested in water management or doing workshop/volunteer or being a part of the managing water for the sustainable future. It is quite disheartening during the primary survey that some of the households believe that everything depends on the present, not the future.

CHAPTER 5

COMMUNITY RESILIENCE TO DRINKING WATER, THEIR PARTICIPATION DURING SHORTAGES AND THE MANAGEMENT OF SPRING IN THE TOWNS OF DARJEELING HILLS

5. INTRODUCTION

The community management portrays the individual's right to have water and cooperative rights of water works. When certain individual holds the right to water in their hands then they also take specific rights and duties along with it. If any water works are established then the individual will also take the responsibility of renovation and conservation of the water. However those individual rights will only become significant if it is accepted by the communities since there will be a universal law for everyone (Ftaïta, 2011). If the local communities are given to manage their own water then the water can be yield more rather than its misuse. Hence there is a need to develop a local organization whereby the authority can be given to the people to manage the water (Narain, 2006). (Whaley & Cleaver, 2017) Suggests that the focus should be shifted towards the situational related planning of water management and several features needed for it to function appropriately.

The communities often known as '*samaj*' are formed with mutual understanding to tackle situations like socio-economic, cultural or environmental. The community or *samaj* in the hills are closely knitted as they treat each other with great understanding and they know what kind of problems are occurring in the individual households. Therefore, it is not difficult for the *samaj* to gather around and find the resolutions. Different areas have different *samaj* with a particular number of households and are pretty much flexible if some households in their area want to join in. The households and its members will be the part of the *samaj* however it is not compulsory for every member of the households to be the part of the *samaj*. The *samaj* which is formed to protect the environment comes under one common purpose which is linked with their very survival like the forest, water, wildlife, etc. Protection of these resources means not just the survival of the members of the *samaj* but also preventing their depletion

for the use of the future beneficiary. However, to what extent these resources can be sustained depends on the attitude of the *samaj* and its members who are protecting them. The communities have always been a part and parcel of the environment as both of them depend on each other. This chapter talks about the necessity for the formation of the *samaj*, their resilience to the problem, their participation and the management of the spring resources and the problems they are facing in safeguarding these resources.

5.1. STUDY ABOUT SPRINGS IN DARJEELING HILL TOWNS

When the ground water comes out naturally on the earth's surface either by gravity and artesian pressure it is known as spring. Mostly the springs are found in the lower elevation of the hills because of permeable soils and splintered rocks that allow water to flow onto the ground surface. Spring is defined as that one where the flow of water is continuous and which has a flow rates of at least a five-liter per minute. The spring can be useful for the people living in the lower altitudes however it can also be tapped for those who are living in higher altitudes as well but this proves the very costly affair.

There are three types of spring available in the Darjeeling Hills which are gravity springs, depression springs, and contact springs, however, fractured springs are also found in the crystalline metamorphic represented by Daling formation and Darjeeling Gneiss. It is very difficult to get the spring water as they are not found everywhere but if it is present then the supply of water is possible however its discharge depends upon the seasons. As of now ground water resources have not been calculated in the hills (CGWB, 2014).

Table 59 Water supply from springs during lean and non lean period in towns of Darjeeling hills

Darjeeling Town		Kalimpong Town	Kurseong Town
Lean	Non lean	Lean	Lean
3.24 MLD*	8.18 MLD	2.27 MLD	2.04 MLD

Source: CGWB, 2014 *Million Liters per Day

Mostly there are perennial springs in the hill towns like Kurseong and in Kalimpong town major supply of water is done from springs especially during the lean period which caters the need of half of the demand. Toxic elements like Arsenic and Fluoride has not been reported from the hills so far. Springs forms the main source for drinking and other purposes. However, the surface runoff exceeds the permeation of water like the other Himalayan state. The groundwater cannot be developed in the hills because there is no useful terrain platform and accessibility. There is a scarcity of the springs because of numerous reasons like population growth, human interference on various land use and irregularity of the climate; hence to tackle with this situation spring shed development is a must. As the catchment area of the spring is gradually degrading the spring water which results in either drying up of the spring or losing their sustainability. Therefore, it is necessary to have community participation in the Himalayan states for various factors like to identify the water sources, to design their water supply system, operation, and maintenance of spring sources. The development of the springs is less costly compared to dug wells and tube wells. Yet, it is important to test the quality and quantity of spring water before it is being developed since they are liable to get contaminated and seasonal variation in their flow rate. Protection of both spring and its quality from contamination is necessary for the proper spring development, as well as improving access to the water for all its intended uses (CGWB, 2014).

Spring water or '*Dhara*' or '*Umreko pani*' forms an important part of the life of the residents of the hilly areas. They are considered as a life support system of the people and most of which is maintained by the group of people who are locally known as *samaj* (community), which is often said to have informal non-government rules outside of municipal responsibility (Drew and Rai, 2016, p. 329). The responsibilities of the *samaj* include managing the area surrounding the spring, constructing reserve tanks, and setting the rules of access collectively, and monthly contribution (Boer et al, 2011 as Cited in (Shah & Badiger, 2018). According to NITI AYOG, the Himalayan springs are drying because of "increasing demand for water, ecological degradation of the mountain areas, and unsustainable land use and the sign of depleting aquifers as seen in the state of Sikkim" (Pandey, 2018). However, it is not an easy task to maintain the spring as its volume changes with the season giving hard times for the community to manage the water during those seasons. This chapter

deals with the details about the community resilience to drinking water and the management of the spring and their ways of dealing with the shortage of drinking water in the three towns of the Darjeeling hills considering the fact that most of this *samaj* (households) are not covered under the municipality water supply as the authorities think that they at least have a source to use.

5.2. COMMUNITY PATICIPATION- A Focus Group Discussion (FGD) has been conducted with the communities who are involved in the spring water management and is adopting various ways to access, protect and manage the spring water for drinking and domestic purpose within the town. Selection of the community is done by asking a question in the household questionnaire 'if the respondent is a community member and whether his/her community is involved in water management?' After getting the answer the community was selected for conducting the FGD by meeting and taking permission from the community president. The respondent consists of 6 males and 6 females from the community members who are free and available at the time of the discussion. However, the name of the community members and ward number has not been disclosed anywhere to protect the identity of the community and its members. The field notes and audio and video have been taken and are taken for the entire session of FGD.

5.3. DARJEELING TOWN COMMUNITY

5.3.1. Formation of the Community - The community was formed on 21st July 1992 with only 10 households within the Darjeeling municipality area. The community has taken tremendous steps to obtain the drinking water for themselves as they do not have the coverage of municipal water supply. The community has used traditionally as well as modern technology to get the water for their members and also to 30 non-community members in a nearby area. The brainchild behind this was the former 3 members of the community member 1 (concept initiated), member 2 (donor of the source) but the actual project started during 2006. Firstly 10 households organized this water project on a trial basis and later 20 more households joined them and for this project, they collected 10,000 rupees each from the households. Now there are 92 households as of today and including 4 new additional households during the field survey which makes total 96 households. The community says that the project which their fathers have initiated was possible because there is coordination within the

community and its members and also believes that a community has to be economically strong through the collection of money and more so with a blend of self-consciousness among the community which is an integral part any successful community. Their work has been appreciated by the MLA of the town calling them as the "model samaj" of the town.

5.3.2. Source of Drinking water- That there are altogether 3 sources from which they get the water of where 2 sources were donated by the president's father (who was once the member of the samaj) and 1 source was bought in 4 lakh rupees from the landlord who is in the police force. Earlier the landlord demanded 12 lakh but they were able to bargain at 4 lakh rupees on one condition that the samaj will provide a water connection free of cost to him. That money (4 lakh rupees) was born by the community members itself some amount was taken from the bank and some collected from the households.

5.3.3. Principle members of the community- The samaj consists of the President followed by the Vice President, the Secretary, and the Cashier. The samaj now has 3 committees namely-

1) The General committee- holds meeting every month about the social problems

2) The *Mandir* Committee – which looks after the welfare of the *Mandir* (temple of Hindu god and goddesses which is built within the samaj area)

3) The Water Committee- Looks after the water connection, distribution, and maintenance

The Water Committee has three selected members with President, Secretary, and Cashier. They have also appointed two linemen to look after the water on a paid basis where one member is also the electrician and the lineman. There are also two emergency plumbers who work free of cost for the welfare of the *samaj*. For the maintenance of the Tank, the *samaj* has appointed a member who also does repairing works for the tanks without any charges.

Table 60 Socio-economic characteristics of the Respondents of the community in Darjeeling Town

Serial No. of the Respondent	Sex	Age	Social Category	Education	Occupation	Marital Status
1	Male	41	General	10	Self employed (keeps PG)	Married
2	Male	60	ST	9	Rtd. Govt. Employee	Married
3	Male	54	OBC	Higher Secondary	Govt. Employee	Married
4	Male	42	OBC	B.sc (Graduate)	Ex Army	Married
5	Male	62	General	8	Self Employed	Married
6	Male	65	SC	3	Electrician	Married
7	Female	50	ST	8	Housewife	Married
8	Female	38	ST	10	Housewife	Married
9	Female	36	General	B.sc (graduate)	Runs shop	Married
10	Female	41	ST	10	Housewife	Married
11	Female	42	General	Higher Secondary	Housewife	Married
12	Female	40	ST	7	Housewife	Married

Source: Primary Survey, April 2017

5.3.4. Management of drinking water from the source- Before the *samaj* was formed almost all the households used to consume the water from the source in a place called '*Bhaley Dhunga*' [44]but as the number of households started increasing around the source the source started getting polluted and the water became unfit for consumption. Looking at the situation the donor of the land where the spring water was emerging thought of donating two sources to the newly formed *samaj* at that

[44] Situated far away from the community house holds

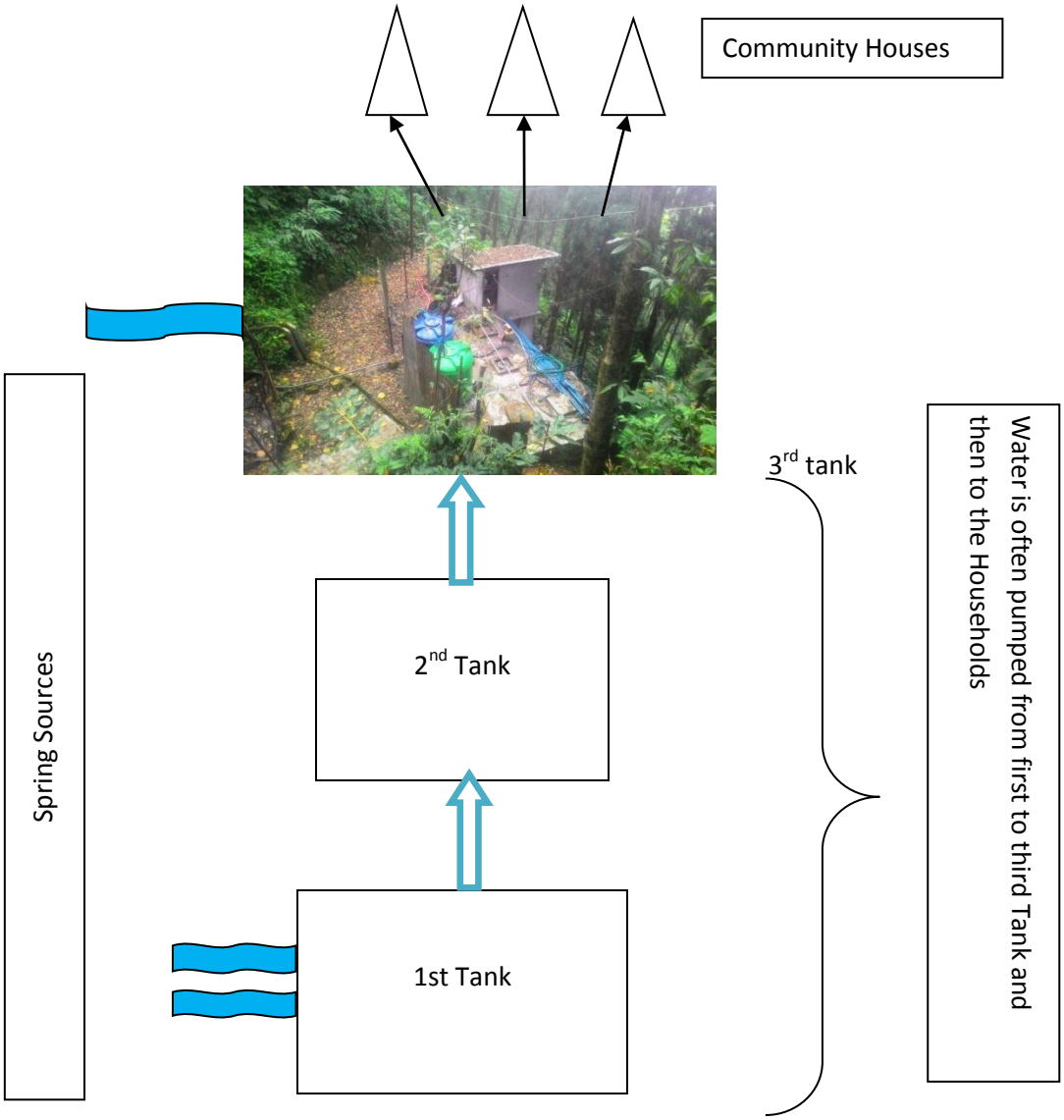
time. The *samaj* then bought one source from another landlord as soon as they get the sources they started building tanks and applied for the electricity to run the water pumps. As the tank was built they started their distribution and the lineman's wakes up at around 2:30 to 3 am to run those pumps even being in the danger of getting attacked by leopards and bears they do their work efficiently without fail and they are often considered as a "Horse of the Community" as they often have to run from one tank to another in order to look after the pumps and the tanks. Now there are three tanks to draw the water from the source to the destination the source is downwards and the houses are upwards because of the physical landscape of the hills most of the sources are found downwards. There are five pumps (3 working and 2 standbys) to draw the water from one tank to another. The first tank which is feeded by two sources of water is very far than expected and is located in the deep jungle where the leopard has also been spotted by the lineman that is why only the lineman is the frequent visitor to the source and also as there is no proper road to reach the source they often chop the creepers and plants and make their way to reach the spot. The second tank is located in a midway between the first and the third tank as they did not have a proper road to reach the second tank from the first tank (especially to transport the building materials of the tank) they have to get the NOC from the municipality to build both the road and the tank which was permitted in 2006. Finally, the third tank was a bit upward than the second tank where there is also a third source of water a spring locally known as '*Dhara*' or '*Umreko pani*' which also feeds the third tank. Because of the presence of trees around that source they have covered the source to avoid the leaves which often fall and blocks the pipes. The area where the spring water is originated has a shady area "*Chiseni*" and the spring shed area known as '*Mon*' or '*Sim*' has a presence of the trees and creepers and plants. For the member of the *samaj* one connection of water is given and a total of 50 liters of water per day is given to them for which they collected 250 rupees per month. As of now, they are distributing 200 liters to 96 households. They also provide water to almost 30 households of the nearby area who are the non-*samaj* members. However, the *samaj* from that nearby area is also coming with the same kind of water project as them. The nearby *samaj* has got inspiration from the samaj says the President of the *samaj* and he feels happy that his *samaj* is setting an example for the other *samaj* to end not only the social problems but also the basic necessity like water problem. samaj often buys the motor pumps from Kirloskar Company opposite Taraknath Hotel in Siliguri. The one pump runs 3 kilometers per hour which is equal to 36,000 for a single phase. Respondent 4 said that initially, the *samaj* laid down the plastic pipes which were

time and again destroyed by some people or sometimes naturally it got broken which was later replaced by the iron pipes. The salary for the lineman which they have kept themselves is being borne out by the *samaj* itself through the monthly collection. Some households have one or more than one connection for which they collect 250 per month per connection. They generate the water bill every 3 months and looking at the average money from the bill they collect the money, the bill also mentions about the electricity bill generated by the water pumps. There are certain households above the main road who doesn't have any sources of the water and they are not part of the *samaj* but the *samaj* provides them with the drinking water especially during the dry season but for the sake of humanity. The *samaj* is giving the water to at least 30 non-community households who give the fee of 50 paisa per liter which is far cheaper than the *samaj* households itself and they all are happy with the *samaj* and their service.

The non-*samaj* households were selected by the founders themselves based on water deficit households, which was later registered by the contemporary *samaj* members (registered as those non-*samaj* households who can take the water) and the *samaj* decided not to extend the households beyond that. The *samaj* has set a rule for the non-*samaj* households which mention that they cannot keep the tenants and paying guests and they have to follow that rule to get the water. The capacity of the water tank is 6000 liter (including 3 tanks) which is fed by both perennial and non-perennial springs. During the rainy season there is a bounty of water but September onwards there is a huge crisis that hardly fills these 6000 liters tank. The water is not provided for 24 hours especially during the dry seasons they release the water every morning for 2-3 hours and they give 150-215 liters (depends on the distance of the household) to all the members. But if the households need more water (especially during occasions like marriage, death and social gatherings) they can buy the same at rupees 300 per 1000 liter but there's a system to get that extra water. The system is often known as the chit system, the person has to pay the money to the cashier of the water committee and has to take a token from him, again he has to show that token to the lineman then the lineman will release the water to that particular household. This provision is for the additional requirement of the water to the *samaj* members and not for the non-*samaj* members. Respondent 1 said that the *samaj* often maintains the audit report; first, the cashier will give all his reports but if any member is not satisfied with his report he can complain to the president of the *samaj*. As mentioned earlier the lineman who is engaged in the water management receives the salary but along with that they also receive a 10% commission from the community from the

chit money. Till now no households have complained about the water even if they are getting 150 liters a day.

Figure 17 Illustration showing the management of drinking water along the source by the community in Darjeeling town



5.3.5. The Problem of water management- The source of the water is reliable and has not dried up till now but the samaj worries about the future saying that there is a possibility of drying up of the source by natural climatic factors. However, the samaj is also worried about the increasing number of houses above the spring water where people often tend to throw their garbages which will ultimately affect the spring

water. In the mountains, the spring water is often considered as holy and scared which is meant to be protected from any anthropogenic activities. To protect it many people often build the temple around the sources or at least keep the poster/images of the Hindu god and goddesses so that no human can interfere in the source this has been the main driving force for the community which depends on the spring water source. Earlier the samaj was also giving water to the private vendors (tanker trucks) as well but now because of the crisis of the water and the increasing expenditures (in water and electricity bill) they have stopped doing so. To maintain it efficiently they have eliminated all the weak points says one of the members.

5.3.6. Approach to any Government authorities- The samaj did not approach any government departments and officials because they thought that they are enough for such kind of project and did not expect any help from those departments as well. Till now the condition of the samaj is fine and they say that the circumstances have not come for them to go and ask for the help as the members itself are conscious and can do proper management and all the members, as well as non members, are happy and self content so why should the samaj contact any third party says the samaj members.

5.3.7. The role of women in water management- The role of the women is often marginalized whenever it comes to water management. Here in this samaj, the male members are often active in the water management then the women. Women respondent no. 7 said that the role of women is often big when it comes to household chores from the kitchen works to children to husband and in-laws; the only role they could play is that they can reduce the water use within the households. Women respondent 8 said that out of all the female members in the samaj she is the only woman who took the responsibility of collecting the money from all the members who say that it is difficult to maintain the time for this work especially to attend the meetings. The women folk seems to be heavily dependent on the male members of the samaj no matter how educated they are. Women respondent 9 said that the men can take a good decision when it comes to the matter outside houses. Women respondent 4 said that the samaj should choose more female representatives and should make them aware of the role of the women in the water management which is also been pointed out by Drew and Rai (2016) that there is more room to expand the women's voices in policy decisions. Women respondent 10 said that the samaj members do call

all the women members and do ask about their viewpoint before giving their decision. Respondent 11 said that the women can control the use of the water within the household as they are the one who uses the water in the larger quantity than the other members of the family. The women respondent 12 says that they feel lucky that their society is both equal in terms of male and female which gives enough women empowerment then the rest of the country but they couldn't give much of their role in water management as they are scientifically and technologically more behind then the menfolk of the society at large so a women need to upgrade herself in terms of this for a better water management.

5.3.8. Suggestion to the other communities- Till now there has been no dispute regarding the drinking water in their samaj because it has been distributed equally to all its members. The samaj advice the other samaj to not to be dependent on the government instead be self-dependent and self-conscious which will lead to the end of the corruption. The chit system in the samaj is the best solution to get the water and beat the corruption; if any household is taking the water without the chit then the samaj will cease the water distribution to that household without any prior notice. If any persons except the designated workers will go and try to get the water connection illegally from the tank then his connection will also be ceased. Respondent 2 said that the following criteria will make any samaj better and self-sufficient if they follow these rules- maintaining discipline is the first most important criteria for the samaj to manage the water, then there has to be elimination of the corruption which will save the money for the management, the community has to be economically strong, there has to be hard work through coordination in the community, truthfulness regarding the collection and maintenance of the money by the elected members of the community and of course self-consciousness amongst the people. Respondent 3 said most of the community depends on the government, even if the government has helped the community because of the lack of discipline and corruption those communities have not been successful in what they had aspired to do so. Most of the community water projects are not successful if there is no self-consciousness, if any person in the community has better knowledge about anything then all the members should listen to that person.

Respondent 4 said that the community should not expect things from the government, they should be self-sufficient. Most of the government officials are busy in managing the boards and distributing the money (boards have been created by the state government according to the ethnic category of the people e.g. Tamang board, Bhutia board, Lepcha board, Chettri board, Kami, Damai, Sarki board, etc). This is the reason why the samaj has not sought the governments help as these officials always seem to be busy maintaining the boards as mentioned above. The government officials will only visit them and become happy with their work but they have not lent any monetary help. Even the MLA of the town had come to visit them and gave a positive reaction saying that he too will adopt the same method in his residential area but he never mentioned the monetary help to the community. Respondent 5 said that if the government would have given metal pipes and materials to build the tanks then the community could have born all the other additional cost but it could not happen. The community has even submitted the data on electricity and water use to the government authority that's why the authorities also know about how efficiently the community is working. Because of the coordination amongst the community members, all the materials necessary for the water management comes swiftly without any hindrance. According to respondent 6, the community believes that maybe some communities are unsuccessful because of the lack of coordination. The plumber in the mount valley samaj will do his work efficiently even if he is busy, this may not be the case of the other communities where the plumber would deny saying he is busy which ultimately lets to the distrust within the community members. There are many situations where there is a power failure or the pumps are not working (being used for 10-11 years) or the problems in the pipe itself but they could sort out these problems through the coordination. There is a great role of the elected community elected to handle the manpower handling within the community.

Respondent 1 narrates that because of the water crisis within the community and the carrying capacity of the tanks; the community itself has not yet planned how to distribute/sell the water to the non-community members. However, if any new non-community households wanted to buy the water from them they have not denied as of now and are willing to give them the water but they have to pay the money and take the chit and they have to pay 500 rupees. But now the community cannot give water to any new households because the sources are drying up day by day also the sources

keep shifting due to natural disasters like landslides and earthquakes. One of the sources which they have bought in 4 lakh rupees if in the future it will shift to another place then the community has to spend the double amount to buy the same source generated in a different area in which it has shifted. The samaj worries whether their future generations will be able to continue what their fathers and they have started. The samaj has not yet got any responsible and faithful person who could take over this responsibility in the future which has become a worrisome matter for the samaj itself. Kids these days are involved more into electronic gadgets and social networks they will hardly take the responsibility says the samaj president.

5.4. KALIMPONG TOWN COMMUNITY

5.4.1. Formation of the Community- The community is located at the heart of the town and has a long history as it was formed in 1996 by one of the former members but the club got disqualified as it used to function irregularly. The present community was formed only for the sake of service to the spring "dhara" and they have has completely renovated the dhara and its surrounding area by constructing 2 new tanks, placing tiles all over the walls as it was facing a seepage and construction of the temple plus the youth members cleans the dhara every weekends all this without any help from the government authorities. The water from the spring is free for all to use.

5.4.2. Source of Drinking water- The spring or Dhara which they are maintaining right now used to be the both for the animal (earlier the tiger was spotted drinking water from the spring) and humans which were constructed in 1922 the purpose was to provide the water for the traders who used to come to the town via trade route of Kalimpong and Tibet also mentions by (Joshi D. , 2015). The spring and the land where it emerged was donated by the owner because the animal was spotted drinking water from that spring and he donated not just for the animal but also for the traders and other common people to drink as well however, it was given verbally and nothing is written which has created a series of problem every year between the owners current family and community people. The owner of the land was a Bihari merchant who was settled in the town during the British era now his lineage is still residing in the Town. However, the community members claim that owner's great-grandsons and their wives claim to take the land time and again which has become a headache for the community. During the FGD with the community members, it has come to the notice

that the owner's grandchildren want to sell that land to people from Siliguri in Rupees 39 lakh to make a three-star hotel. The area of the land where the spring has emerged is around 85-90 decimal and the owner donated this land to the people along with the Sai mandir (Sai temple).

5.4.3. Principle member of the community- The spring is regularly monitored and maintained by the Youths and they clean the spring every Sunday with its members. There are 70 to 80 members who consist of the youth as well as the elders of the samaj. The samaj is headed by the President, Vice President, Secretary, and the Treasurer who works together.

Table 61 Socio-economic characteristics of the Respondents in the Kalimpong Town

Serial No. of the Respondent	Sex	Age	Social Category	Education	Occupation	Marital Status
1	Male	40	OBC	10	Business	Married
2	Male	34	OBC	10	Business	Married
3	Male	56	OBC	9	Business/ contractor	Married
4	Male	57	ST	10	Business	Married
5	Male	34	SC	10	Business	Married
6	Male	19	OBC	12	Student	Unmarried
7	Female	47	OBC	10	House Wife	Married
8	Female	30	OBC	12	House Wife	Married
9	Female	25	OBC	12	Business	Unmarried
10	Female	31	OBC	9	House Wife	Married
11	Female	45	OBC	8	House Wife	Married
12	Female	30	OBC	9	House Wife	Married

Source: Primary survey, January 2018

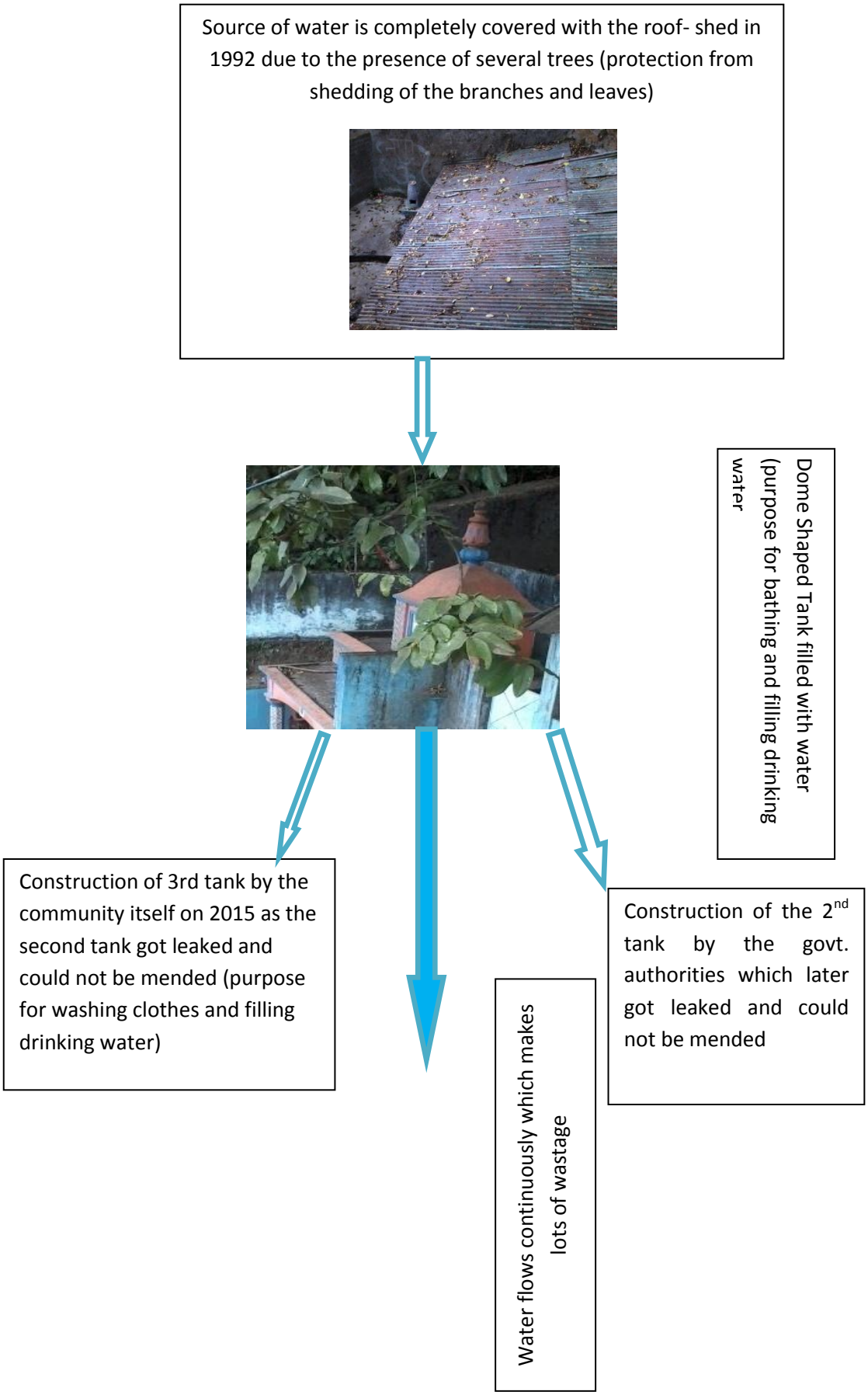
5.4.4. Management of drinking water from the source- The community has renovated the spring and its surrounding area by their own money and materials. The community did not ask money to anyone they collected among themselves and gradually all the nearby people started to help them with money, materials and

physical labor. The works of the community were also appreciated by the local media as well. There are several springs within the municipal area of the town like *bhotay dhara* but this is a historic spring and it is such a spring which is used by half of the population of the town says the president of the community. Every evening there are lots of private vehicles which come to take the water; people also take water in two-wheelers like scooter and bikes. The water is given for free to all and the cost of its maintenance is taken up by the community itself. The condition of the spring and its surrounding area has gone pathetic with each passing year as the spring feeds almost half of the town population it was important to save the source says the president of the community. It was in the year 2013 where the priority for the renovation of the spring was given by the community. The success was due to the strong will of the youths of the community and the understanding of the community to protect the source of the water. The volume of the water was gigantic but as the year passes by the volume reduces considerably, the community members stopped people to wash clothes by the 1st tank as they have installed new tiles and they fear that the people will break the tiles. The community has installed the images of several gods and goddesses near the source so that no human could interfere with the source and pollute it. Historically there was a community in 1963 which was looking after the spring was meant only for the people around that place i.e. ward number where the spring lies. It was very a popular samaj which was not only for the maintenance of the dhara but for all the social activities as well and it comprises of only the people from that place. However, the samaj got dissolved after some time and again a new samaj was formed in 1996 by the previous president of the samaj but he went overseas to work so again the samaj got dissolved. So the current samaj was formed in 2013 by the youths of the community, the spring was open and there were no rules and regulations to maintain that spring and there used to be regular fights for water as some people used to wash clothes for hours and not giving chance for the other people to use. Earlier the residents of the place used to celebrate "chat pooja[45]" in the spring which created a grave concern for the community members about the spring. The spring was in a dilapidated condition so the current samaj decided to renovate it. In 1922 the dome-shaped tank was built by the donor of the land (two Bihari brothers). Later the roof shed was placed by the MLA fund and the compound was secured with

[45] A Bihari festival of worshipping the setting sun it's basically a tradition followed by the Hindu Bihari community only, Note: Not all Hindu community celebrate this festival

barbed wires. The land consists of 2 plots one for spring and one for mandir, however, the latter got burned for some unknown reasons. Many incidents happen every year to get hold of the plot where the spring has emerged, for example in 1994 there was plan to make a police quarter in the plot for which the labors had already started digging the plot both for which the samaj protested against it and it was one person who fought with the contractor who took the charge of digging the plot without the consent of the community people, being scared the contractor withdrew from the plot. Later, the daughter in law of the owner (Nepali by the origin and married to Bihari) tried to sell the land to some people from Siliguri in rupees 39 lakh as there was a plan to make a three-star hotel in the plot because of the running water from the dhara. The front portion of the land was of another person and the back portion of the plot is of the two brothers who donated that plot (donor of the land and spring water). 3 brokers came to measure the plot but looking at them measuring the plot the people of that place came to protest after which they could not carry forward the measurements but the deal of Rupees 39 lakh was already made by the landlords. The people who supported the community were commissioner and the lawyer. The community built a wooden hanuman *mandir* (temple) within a fortnight to save the plot and did the opening of the temple the next day. The community complained about the deal with the land reform department, SDO office, and various other government offices saying that the current owner of the land cannot sell the land without the consent of the community. However, the owner puts the case on one of the respondents and his father who served tea and biscuit when the *mandir* was being made and also to the two pundits. The owner (daughter in law of the donor in whose name the land has been transferred now) must have thought that the Biharis can be dominated but they were not successful says the respondent no. 3. Many people tried to lure the community members through bribes, for example, a person from the owners side met the respondent 3 near the post office said “brother I will give you 2 lakh rupees and you should sign in the NG stamp saying that the owner will take the land and the community has no objection in that”.

Figure 18 Illustration showing the management of drinking water along the source by the community in Kalimpong Town



5.4.5. Problems of water management- People who come to take bath near the spring shed throw the shampoo sachet and such in the spring for which the community has to clean the spring shed area every weekend. The community did hang up the notice but every time they hung up somebody tears it which reflects how ignorant a person can become. However, the spring is in great danger as many illegal buildings are being constructed on the upper reaches of the spring. The community had to fight with the people not to throw anything and make the source pollute. However, the people residing upwards have already installed their toilet pipes and during the water test, some bacteria were also found which has become a hurdle for the community. Even after asking them to remove the pipes several times the people have not removed the pipe because of which the community fears that the source will get polluted more in the coming future. Earlier the source was open but in 1992 the previous community members placed the roof shed as there were many trees, now the existing community fears that the shed is too old and if any tree or branches falls directly in the spring it might be a big problem they even thought that the spring will disappear. The community plans to replace the roof shed by them only like the way they made the tank. The first dome-shaped tank was built by the previous community members and the later community made two more tanks. The source of the water has a copper pipe and the spring was renovated by the community on February 1st, 2015. The second tank constructed by the government authorities got leaked though it was a big tank the tank looks bigger from the outside but inside only half of the tank is made the other half is a wall says the community members. The main problem of the community has been the land dispute where the spring has emerged which seems to remain unsolved and the community has to fight with the donor's grandchildren now and then as they come up with many plans to sell the land without the consent of the community members.

5.4.6. Approach to any government authorities- The samaj had approached the government authorities like municipality, S.D.O office several times as the authorities did not take any actions they did the whole renovation of the spring by themselves.

5.4.7. Role of women in water management- The samaj has many female members but not as active as their male counterparts. However, they also join every meeting and give their valuable suggestions. The male member is the most active and cleans the spring shed area every weekend and stops people to pollute the source.

महिलाहरुले बेसी पानी चलौछन् पुरुषले भन्दा त्यासर्थ महिलाहरु आफै आफ्नो पानीको प्रयोगमा सचेत हुनुपर्छ अनि अरुलाई पनि सचेत बनावनु पर्छ

(**Translation**: Women use more water than men therefore women should themselves be aware of their uses and make others aware as well) says one member 47 year old female member

However there has been no awareness program till now within the samaj or the individual households till now.

5.4.8. Suggestion to the other communities- The samaj suggests the other communities have integrated the purpose of managing the water and the watershed area. They suggest that the only way to deal with the water problem is to keep their water resource safe and clean by dividing the responsibility to do so between the community members and should also contribute monetarily if a certain situation arises. The samaj explains that the resource is not for any individual but the entire community so all the members should equally take part in safeguarding it.

5.5. KURSEONG TOWN COMMUNITY

5.5.1. Formation of the Community- The community was formed in 1998 and is situated in the heart of the Kurseong town. There is no coverage of municipal water supply in the households of that ward. The samaj was formed to solve the socio-economic problem, however, because of the water problem are now taking up the causes of the water as well and plans to build a tank and also restore the existing spring.

5.5.2. Source of drinking water- The samaj has got the source of water from the nearby water source which lies on the property of the tea garden. However, the samaj also maintains the natural spring which falls under their area. To save that existing spring they have to build a temple so that no anthropogenic activities could hamper or pollute the spring. The spring is a non-perennial type whose volume decreases during the dry periods and increases during the rainy season so there is a dearth of water in the community during the lean periods. One of the greatest benefits this community is the location of the source of the water (which lies in the upland channel and the

houses are downwards, therefore, there is no need of water pumps to draw the water from the tank to the households, unlike the samaj of Darjeeling they had to pay the electricity bill along with the water bill. The community has no financial support from anywhere and they believe that they are still not aware of the practical field of water management.

5.5.3. Principle member of the community- The samaj consists of the President, Vice President, Secretary, and the Cashier. The president of the samaj is female and her role is to make sure that all the members cooperate and the smooth functioning of the samaj and its members.

Table 62 Socio-economic characteristics of the Respondents in the Kurseong Town

Serial No. of the Respondent	Sex	Age	Social Category	Education	Occupation	Marital Status
1	Male	54	ST	12	Gym Trainer	Unmarried
2	Male	41	General	10	Unemployed	Unmarried
3	Male	62		Graduate	Retd. Land Reform Department	Married
4	Male	73	ST	4	Ex BSF	Married
5	Male	45	General	Graduate	INCA Culural Department	Married
6	Male	40	General	M.sc Agriculture	MHA Agriculture Department	Married
7	Female	48	ST	12	Social Worker	Unmarried
8	Female	54	ST	10	Housewife	Married
9	Female	55	General	5	Housewife	Married
10	Female	38	ST	8	Unemployed	Unmarried
11	Female	73	ST	Primary	Ex employee GDA Hospital	Married
12	Female	37	General	8	Private Business	Married

Source: Primary survey, May 2017

5.5.4. Management of the drinking water from the source- The community faces water problems because they do not have a municipal water supply. The samaj has gone to the authorities many times however the authorities directly showed them that there's no water. The authorities tell them to adjust as they have a source of water. So, the samaj did not want to persuade the authorities again and again. Though one of the members said he pays a municipal tax of 756 rupees per year they do not provide water. The members said that they have a source which will be only enough for 10 houses; however, there are more than 30 households because of this there is a dearth of water. Since there are unity and harmony in the samaj everyone is getting water without getting into any dispute. The problem is water is all over however most of them receive water timely but here in hills, it is no like that said the members. The samaj depends on the water source which falls on the private land of the tea garden where they could not build the tank and also the fear that someday if the tea garden stops the water then there's no way out from them. Earlier there were few people in the ward and the water sufficient for all; later because of the growing population, it is difficult to provide the water to every household said one member. 4/5 households each share the water from the source within the samaj and sometimes if there is extra they also give to other non-samaj households as well. The samaj also knows that some higher officials and chairman of the town had gone to Sweden for a water project[46]. The samaj is hopeful that this project will be successful in the future as the authorities have assured them. However one educated member age 40 said this project has been implemented way back and so many years have gone but nothing fruitful has come out from that project and questions why it could not be successful? Time and again samaj held a meeting to have a permanent solution of water from the source and have a plan to build a tank within their ward if the tea garden is not giving NOC so that everyone can get water from there also the non-samaj households. The members alleged that there is the construction of the road right from the water source which will hamper the source and the samaj protested saying either the road should be constructed from above or below and not from where there is a source of water. Samaj has a fear that their spring water source is drying up day by day and said that 'our people' can go to Sikkim to learn the techniques to revive the springs. The samaj also intends to plant the trees once in a year in and around the source so that it can be preserved. One of the samaj members thinks that because of not being educated enough they do not have much awareness of water management. The samaj thinks that compared to the British era or even their immediate Bengali community the

[46] Indo- Swiss water project- the details of this project can be found in chapter 7

Nepalis community is way back. Some members alleged that the illegal tappings of water across the town mean that water is being sold and the money is being taken monthly. The samaj gives a hint of corruption in the water sector. The samaj members feel that sometimes they get scared because some of them are uneducated and those who are educated do not speak anything. One should not get scared to do good work says one of the members of the samaj. The samaj said that the main problem right now is drinking water and the samaj has decided to protest to the new upcoming chairman[47]. The samaj will also conduct a healthy discussion on water management and will take the educated youth of the community to ask the chairman why there is so much dearth of water in the town.

हामी मर्नलाई पनि तयार छौ यदि त्यसले केहि असल कुरा हुन्छ भने

(**Translation**: We are ready to die if something good will come out of it, said a 48-year-old social worker of the samaj)

There is a lack of consciousness among the people said one of the members because people throw their garbage everywhere hence it not only blocks the drainage but also pollute the water sources[48]. Further, they have one non-perennial source of spring water where they have constructed the temple to protect it from any anthropogenic activities. The samaj said earlier they kept the image of gods and goddess but later somehow they collected the money amongst themselves and build the temple.

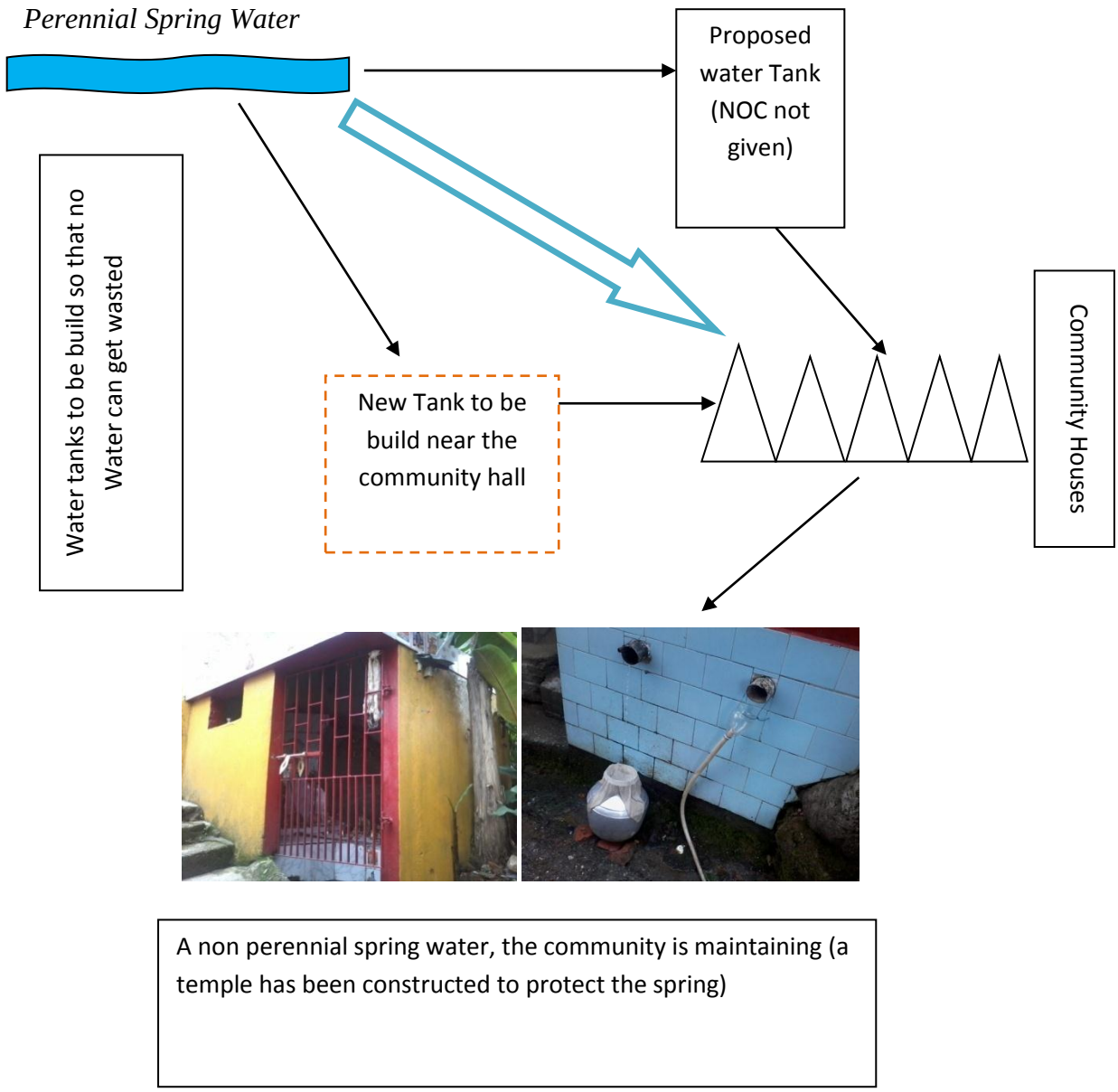
यदि कसैले मन्दिर वा भगवानको नक्शा राखेको देख्यो भने त्यो जागामा हस्तक्षेप गर्दैन त्यही कारण हो यो सबै गर्नु को

(**Translation**: Whenever someone sees the temple or the image of gods and goddesses kept then that person doesn't want to interfere in that area that is the idea of behind all this) says one 73 years old lady. However, the samaj still takes water from the spring and cleans the spring every weekend.

[47] The FGD was conducted around the time of municipal election 2017 where new chairman is supposed to get elected.

[48] The entire municipal town of Darjeeling faces a severe problem of waste management. One can spot the garbage's thrown in the jhoras and nallas of the town as well.

Figure 19 Illustration showing the management of drinking water along the source by the community in Kurseong town



5.5.5. Problems of water management- Since there is a spring water source which falls on the land owned by the tea garden, the samaj wanted to build the tank near it, so that no water could get wasted but the tea estates did not give the NOC to the community to build the tank in their land because of which they are planning to build the tank near their community hall. Now the samaj tends to build the water tank near their community hall.

5.5.6. Approach to any government authorities- Since there is no municipal water coverage the samaj has applied many times to the municipality for the household connection. While no such positive result came from the authorities, the members assume that the reason why they are left out is perhaps because of the water source which falls in the private land of the tea garden. The only thing the government authorities did is that they talked with the tea garden authority to give the NOC to samaj to build the tank which was rejected by the latter. However, the samaj is all the more thankful that at least they are receiving the water and they are sharing it amongst themselves without any disputes till now. "It is better to have something rather to not have anything," says one 62-year-old male member of the samaj.

5.5.7. The role of women in water management- The president of the samaj is a female so the samaj feels blessed as she shoulders many responsibilities however they also feel that they do not have proper knowledge in terms of water management. The woman folk wants to learn the techniques of water management if someone is ready to teach them. Nevertheless, the women will also shoulder up with men to talk with any higher authorities and to get access to the water sources and its management.

Women are often withhold to make decision on significant subject like water resource management hence it is important to ensure that they are equal participant by breaking their cultural barriers (Michael, 1998). However, throughout the conversation with the women folk of all the interviewed *samaj* it has been found that the women are much more hesitant to talk as they think it is the job of a man to manage the water resources and their own role is much more inclined towards the domestic chores. This kind of feeling can only be removed through the awareness programme and also citing some prominent women in water resource management from around the world to make them realize that they are not insignificant when it comes to any kind of natural resources management. Their role and contribution can only be accomplished through the awareness programme.

5.5.8. Suggestion to the other communities- The samaj said that if they are conscious enough then they can save their source by putting most of the effort on its management. The samaj also said that there is no use in talking with the authorities about the water problem; the samaj should be better equipped and knowledgeable in terms of water management. There are many problems but one should solve it through

unity and harmony within them. If some of the houses are getting enough water then they can also share it with the others and it should not only have to be from their community it can be shared with anyone who is in dire need of water.

5.6. CONCLUSION- The chapter provides insight on how the communities or *samaj* have come up with their solutions for drinking water management in their area. The community water management is not a new concept in the hills however the sources which they used to maintain are always wasted as they are not stored. However, as the community is feeling that their sources are getting depleted day by day they are now more into saving the water. Most of these communities are financially dependent on its members to execute their plan. Waiting for the government departments is quite bothersome for the *samaj* hence; they decide to shoulder the burden by themselves through money or physical labor. The community uses both traditional and modern methods to maintain their only source of drinking water. The *samaj* has their problem when it comes to managing the spring yet the *samaj* is hopeful that one day they will one day overcome the problem. Even after having the spring as a blessing for the *samaj* it is rather difficult to maintain it, as all that the *samaj* needs are the common motive of the members to manage it which somehow differs from individual to individual. So, unity is an integral part of this *samaj* who not just manages the water but also protects it from getting polluted.

CHAPTER 6

DRINKING WATER POLICIES AND PROJECTS INITIATED IN THE DARJEELING HILLS AND FURTHER IMPROVEMENTS

6. INTRODUCTION- Whatever Drinking water policies/projects in the towns have been initiated is based upon the river water and not the springs. There are some policies regarding the spring water which have been initiated for the Indian Himalayas especially the rural areas. The rural areas are also hit hard by the drying up of the springs however the same goes in the urban area of the hills. The spring water management has been initiated either by the state government, central government or NGO's. In the rural areas, the spring shed management is done by including it on the MGNREGA scheme however no such plan has been initiated to save the springs in the urban areas. There are no separate water policies/projects for the hills like national water policy in India as such. The problem of the hills is not equivalent to the problem of the other parts of India. Each town has its water projects initiated in their respective area but somehow all the projects have not been completed due to various reasons. These projects are rather a big river project which is often looked separately by the PHED who proposed the details of the project; the finance needed and so on. However, besides the bigger water projects, many smaller water projects and rejuvenation works are also being proposed and initiated by municipality/ PHED. It might be a smaller project but the amount proposed and received is not smaller at all. These projects are supposed to end the water problems of the hilly town and people have waited enough for its result and some have even lost hope. One of the other problems lurks into the projects which are delaying it. Therefore a careful analysis has been done in this chapter to understand the drinking water policies/ projects in the Darjeeling hills with special focus on the urban water projects.

6.1. DRINKING WATER POLICIES FOR THE INDIAN HIMALAYAS-

The Indian Himalayas are facing a serious problem like drying up of the springs which are the primary source of drinking water for the rural households and to some extent in the urban households as well especially those who stay in and around the

springs. There is a continuous decline in the spring discharge due to several natural and anthropogenic factors like rising temperature, rise in rainfall intensity, the decline in the winter rain, encroachment in the spring shed areas,

6.1.1. Hill Areas Development Programme (HADP

The Government of India, Planning commission prepared a report on problems of Hilly habitation covered by HADP and WGDP[49] in April 2008. The report gives details of the action of HADP/WGDP during the 10th five-year plan. The programme aims to involve the people and to meet their requirements by improving the land and water resource management. It also promotes the development of the socio-economic situation, infrastructure and maintains the ecosystem of the HADP/WGDP regions. The areas covered in HADP are-

1) "Two hill districts of Assam- North Cachar and Karbi Anglong
2) Eight hill districts of Uttar Pradesh
3) Major parts of Darjeeling District of West Bengal
4) Nilgiris district of Tamil Nadu
5) 132 talukas of WGDP"

Throughout the 10th plan, the importance is given to the watershed augmentation and protection of the environment of the hilly areas of Assam and West Bengal. The said plan gives significance to the following: drinking water and rural electrification, road and communication, health, education, tourism and outlay for DGHC comprising department of lines and hill affairs, SPA, CSS. The plan is of INR 440.99 crore. The report suggests for the rainwater harvesting system to bring down the water crisis as the hill areas are dealing with the severe crisis of drinking water. The system is of INR 10 crore yearly. The programme mainly concentrates on the growth of the watershed area with the help of the people. The success of the programme depends upon the involvement of the Panchayati Raj[50], Local leaders and academician's apart from the NGO's and the state government is intended for the inclusion of the said (Planning Commission GoI, 2008). Appendix V gives detail about allowance and expenditure of HADP.

[49] Western Ghats Development Programme
[50] Local self- government in India introduced by the constitutional amendment in 1992

6.1.2. Inventory and Revival of springs in Himalayas for Water Security

To revive the springs of the Himalayas a government policy commission named NITI AYOG prepared a report. The report concentrated mainly on the three aspects of the springs: rejuvenation, restoration, and management. The report was submitted on the Month of December 2017. It was part of the project named 'Sustainable Development of Mountains of Indian Himalayan Region'. On 2nd June 2017, the AYOG established 5 working groups including Department of land resources GoI, MoEF, CGWB, RMDD government of Sikkim, ACWADAM Pune and ICIMOD Kathmandu.

"There are 4-5 broad objectives put forth by the Ayog which is

1) To take stock of the magnitude of the problem (drying of springs, quality of water from springs)

2) To review the policies across IHR and to ascertain the adequacy and gaps

3) To review existing initiatives and best practices of inventorization and revival of the spring across IHR

4) To ascertain the extent of learning from all best practices and stepwise methodologies to integrate and strengthen the spring related work

5) Additionally, to access the challenges faced by the existing initiatives and suggest policies and practices in all terms long, medium and short"

There are 7 chapters in the project along with the details of special case studies plus stories of achievements (NITI Ayog, 2017).

6.2. DRINKING WATER POLICIES FOR THE HILLY AREAS OF WEST BENGAL

6.2.1. Spring shed Development Plan

West Bengal has adopted its neighbor Sikkim's model of convergence with MGNREGA for springshed development in 4 districts of Darjeeling, Kalimpong, Jalpaiguri, and Alipurduar. This model was coordinated by an NGO called PRASARI in collaboration with the ACWADAM where this model has been implemented on 35

springs across the above-mentioned districts and over the next 3 years aims to implement on more than 500 springs" (NITI Ayog, 2017). The model is a good initiative on the part of the state however because the model is for the rural areas which means the springs falling under the town areas will be left out.

6.2.2. Rain Water Harvesting and Sustainable Water Supply to the Hilly Areas in Darjeeling as an Adaptive Measure to Potential Climate Change Impacts: CPGD WEST BENGAL 2016-2019

This project is mainly for the BPL cardholders within the Darjeeling municipality area. The main objective of this project is "1) to identify the households having BPL cardholders where the options of rainwater harvesting is essential 2) to develop the project plan for installation of the rainwater harvesting and storage from a GPS based survey 3) building capacity to cope up with climate stress by awareness generation and training 4) a condition for hygiene and acute need for water supply 5) developing and maintaining project monitoring and evaluation protocol and system to ensure long term sustainability of the project". The project is designed for the town whereby it aims to give access to 50 liters of water for a minimum of 45 days. Besides, the project also aims for 1000 liter rooftop water storage for at least 3000 BPL houses, and 10,000 liters capacity community water storage for 200 BPL houses. About 3200 BPL households have been chosen for this project and the construction of a rainwater harvesting systems is also done for the same. The municipality will choose the households for this purpose. For the initiation of this project, a cost of INR 24.24 crore been proposed. The project is guided by numerous indicators like

" a) Sensitivity Indicators- This indicator mainly display the level of influence attributed to the climate change

b) Exposure Indicators- This will display the difference in climatic issues like temperature, rainfall, runoffs, etc

c) Adaptive Capacity Indicators- This will display the coping mechanism of the people because of the climate change, their socio-economic situations, their approach to several new technologies" (CPGDWB, 2010) 2010.

6.2.3. NATIONAL MISSION ON HIMALAYAN STUDIES (NMHS) - Innovative and Sustainable Decision Support System for Drinking Water Security in Indian Himalayan Region of Sikkim and West Bengal

The project was initiated by the NIT Sikkim for 3 years and the total cost is about INR 49, 30,200. The project was proposed in 2018 but the location of the project has remained vacant till now. There are "5 main objectives for this project which are:

1) To assess the quality and quantity of water resources in the districts of south Sikkim and Darjeeling
2) To establish drinking water security through a participatory approach
3) To estimate the cost of drinking water in the region
4) To build a decision support system to support water demand
5) To devise a long term policy framework integrating all the stakeholders"

This project is mainly on behalf of Sikkim (*Ravangla*) and Darjeeling incorporating rural households. The wider theme of the project is Water Resource Management under NMHS (NMHS, 2018) 2018.

6.3. DRINKING WATER PROJECTS IN DARJEELING HILLS

As such there are no separate drinking water policies in the hills however, countless projects are being proposed, implemented and some are yet to be approved by the state/central government. These projects are rather a spring shed development projects in rural areas or several small and big water projects in urban areas like Balason, Neora, etc. Even the spring shed development project has not been fully-fledged like that of Sikkim as west Bengal is looking after the 4 districts which are rather absurd as there are so the question there is a countless number of springs in the hills will the state authorities able to cover all the springs under MGNREGA? How many villages will they be able to cover? It is not possible to save the entire springs in all the villages? Prior choosing to save the springs did they survey the area like that of the Sikkim? What Sikkim has can be applied however they have studied their area very well and have surveyed the area with their best possible team and found out the areas where the springs are drying. Between 1962-2001 seven big and small water projects were initiated by the government of West Bengal in Darjeeling namely Bokshi Jhora project, Rambi Khola project, Rungdung Khola project, Khong Khola project, Sinchel lake, and distribution system renovation project but all of them remain unsuccessful

except the first one (Ghatani, 2015). One rainwater harvesting project is also been initiated by the government of WB CPGD 2016-2019 for the Darjeeling hill town mentioned in detail above.

6.3.1. Water Supply Augmentation Project INR 750 Crore

There is a series of new project estimated to be Rs. 750 crore. This project was proposed by the GTA who put forward to elucidate the water problems in the hill towns. The hill towns include Darjeeling, Kalimpong and Kurseong whereupon a detailed project report was made. This report incorporates a Rs. 105 crore *Srikhola* project where the water is being drawn from the river with the same name. The water will be transported to the town and also 2 villages through pipeline where will provide water of 2 MGD. Besides, the report also incorporates a project of Rs. 144 crore meant to renovate the water supply system and to build 3 more storage tanks meant for Kurseong. Furthermore, the water projects for the villages in Mirik and Kurseong has also been taken into account in this report (The Indian Express., 2018).

6.3.2. Balasun River Project Darjeeling

The very popular and controversial Balason river project was founded in 2005 which is said to be the biggest project for the Darjeeling town. The project was supposed to end the water scarcity however; it was delayed due to the denial of the army to place the pipes along their area (Sunam, 2013). "Balasun River is located next to Khaprail (Darjeeling district) and is located in Bengal, India. The River has a length of 25.34 kilometers. The foundation of Balasun project had been laid on 19th February 2006, by the CM of Bengal at that time and it is supposed to end the problem of the drinking water in Darjeeling town. Meant to be completed by 2009 and the amount of 55.86 crores will draw the water from the river and fill the lakes (*Senchal* north and south) where they collectively store 33 MGD of water. Yet again, the lake water will be drawn to the reservoirs tanks in the town from where the municipality will distribute the water. The two lakes at senchal will probably obtain about 2 MGD of water from the river. Owing to the political instability and denial from the army to place the pipes along their area are said to have interrupted the project work according to the state's P.H.E. Department" (Indian Gorkha, 2014). "The completion of the Balasun project is not the only solution to the longstanding drinking water crisis in Darjeeling but also several issues like illegal connection, unmanaged pipelines and an increasingly great number of water mafias in the town are of pivotal concern for the municipality. The

project includes revamping all old pipelines with big pipelines replacing single pipes. Tanks will be constructed in all the 32 wards of Darjeeling; the project is awaiting the center's nod. The people will have to pay according to the meters, ought to be fitted in these tanks. The civic officials are confident that the water from the Balasun River will reach homes by the next dry season" (The Statesman, 2013). According to a municipal officer Darjeeling needs at least 20 lakh G/D of water to satisfy the demand. The project is supposed to draw the water for 16 hours a day via 2 pumping stations (Chettri, 2014).

The Balason water project is said to fail the expectation of the town to provide the water. There is a list of factors that have affected this project as pointed out by the municipal authorities like the old water distribution system and the absence of water storage. However, as per the party leaders, it is the cost of the electricity bill to draw water from the Balason River to the town which is said to be 10 crore rupees per year which the previous board did not want to pay.

The Secretary of the Branch Committee[51] (Opposition Party 2017) informs:

करिब ४०-६० लाख गल्लोंस् बालासन् को पानी सेनचल लेकमा तन्निंदैछ अहिले तरैपनि मान्छेले समयमा पानी पाउनु सकेको छैन

(**Translation**: About 40-60 lakh Gallons of Balason River water is being pumped in the Senchal Lake as for now, however people are not getting water timely)

He also informs that the money that has been sanctioned for the water has not been utilized by the GTA in a proper manner and the people are receiving water after every 3-4 days gap. Additionally he blames that the Balason water in the lake gets theft during the night. The PHE department made a tank below *Mahakal Tham* but that tank is not in function. They laid the pipes as well which is also not in function. The present board (2017) has given maximum number of water connection source at Rs. 162 which is not supposed to be given and the papers are also not up to date. He also opines that:

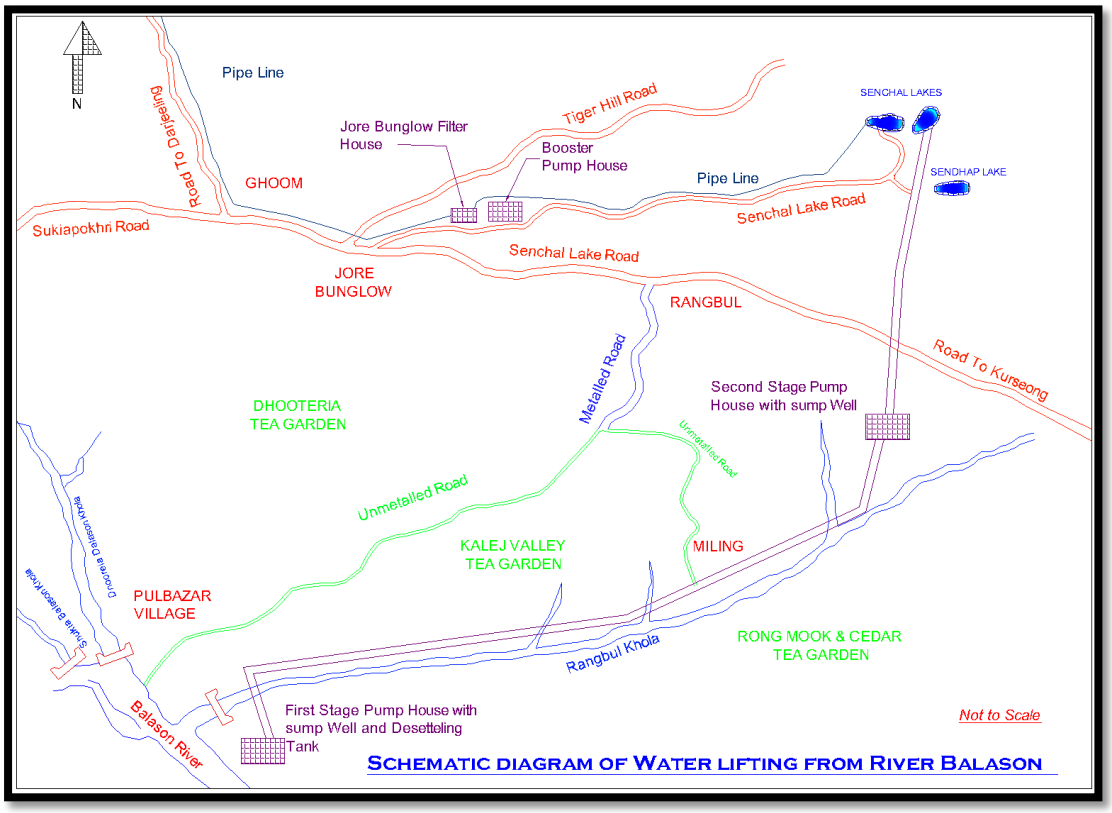
पानीको कनेक्शन त अफिशॅएल ढंगमा दिनु पर्ने हो अधिकारीहरुले तर आजकल वर्तमान राजनीतिक पार्टीका नेताहरुको स्वीकृतिले दिनछन् किनभने तिनीहरुलाई वोट बैंकको खाचो छ

[51] Interview scheduled on 27th April 2017 in the party office in Darjeeling town

(**Translation**: The water connection is supposed to be given officially by the Municipal authorities; however, it is now given with the approval of the present governing political parties because they need the vote bank)

The municipality has not provided water in the needy areas under their jurisdiction but has provided water outside municipal area says the secretary.

Figure 20 Schematic Diagram of Water Lifting from River Balason, Darjeeling



Source: Darjeeling Municipality office, April 2017

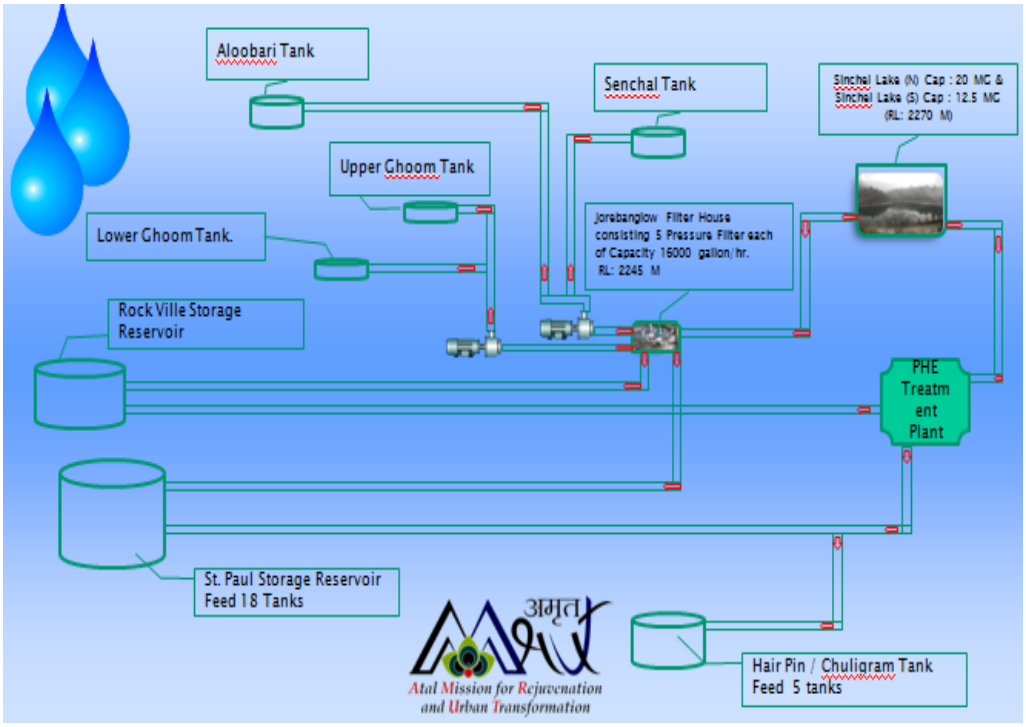
6.3.3. AMRUT Drinking Water Supply Project, Darjeeling Town

A new water supply scheme for Darjeeling Municipality called AMRUT[52]. has been initiated in 2015 which will continue till 2020. The main priority under this scheme has been given to the water supply along with the number of issues like sewerage, transports and recreational centers. The cost of the project work is around INR 20484.71 and the fund is supposed to be bear by Government of India, Government of West Bengal and Urban Local Bodies the scheme is supposed to end the water

[52] Atal Mission for Rejuvenation and Urban Transformation

problem in the town. A service level improvement plan (SLIP) has been prepared by all 54 AMRUT towns in West Bengal, from the SLIPs city-wise project were prioritized and aggravated into State Annual Action Plan (SAAP) for 2015-16 recommending water supply schemes for 10 towns including Darjeeling. SAAP for 2015-16 was approved by MoUD GOI in the apex meeting dated 26.11.2015. As per the SAAP approval, Darjeeling town has been selected for the water supply project as a single scheme as per Central Allocation for 2015-16. The objective of the project for the town has been to supply potable water for the town and the command area has been sub-divided into 30 zones. Total beneficiaries of the scheme are said to be 1, 94, 971 for the design year 2047 AD.

Figure 21 Proposed Water Supply System for Darjeeling Town under AMRUT



Source: Darjeeling Municipality Office, April 2017

However, the waterworks engineer has already revealed that the new project AMRUT will be more costly than the bottled water because the annual management cost of this project is 4.35 crore. The DPR or detailed project report has been prepared in consultation with the municipal authorities and this DPR has been made as per AMRUT guidelines. The DPR reveals that the annual operation and maintenance cost will be 138.93 lakh which will be met by the revenue generated by the Darjeeling

Municipality through commercial selling of water and other mechanisms in consultation with the state government.

Some salient features of the AMRUT water supply project for Darjeeling Town according to the DPR -

1) Design period for service reservoir- These are designed for 15 years. Locations of the reservoir are mainly guided by the factor such as availability of land and on topography /contour of the area. To rationalize the whole system of distribution, 30 (thirty) numbers of service reservoir has been proposed in addition to the existing service reservoir for 30 (thirty) zones.

2) Design period for the pipeline- The system is planned for 30 years. The system is designed using computerized software and using "Hazen William's Formula using 'C' value 140 for D.I. Pipe". Since the system is not designed for direct pumping, no balancing tanks are provided at the end of the system.

3) Pumping to service reservoir- 23 hours

4) Pumping from service reservoir to distribution- 24 hours

5) Per capita basic demand- 135 lpcd

6) Daily water demand –

   - The base year (2017)- 4.94 MGD
   - Intermediate year (2032)- 6.07 MGD
   - Final year (2047)- 7.35 MGD" (Darjeeling Municipality Office, 2017)

The details about the physical and financial progress under AMRUT and status of fund release and resource mobilization has been given in Appendix VII and VII.

The laying of the DI pipe (Ductile Iron) for AMRUT mission was initiated and claims the accessibility of the water by the residents of all 32 wards in the next 2 years by Darjeeling Municipality. This initiation has been published by The Himalayan Beacon channel on YouTube on 30th August 2018. "The contracts for the work have been taken up by 5 different companies from the national level," said the new chairman of

Darjeeling municipality on her interview to the channel mentioned above. The chairman also revealed that the project was earlier than 99 crores which have now become a 205 crore project (The Himalayan Beacon, 2018).

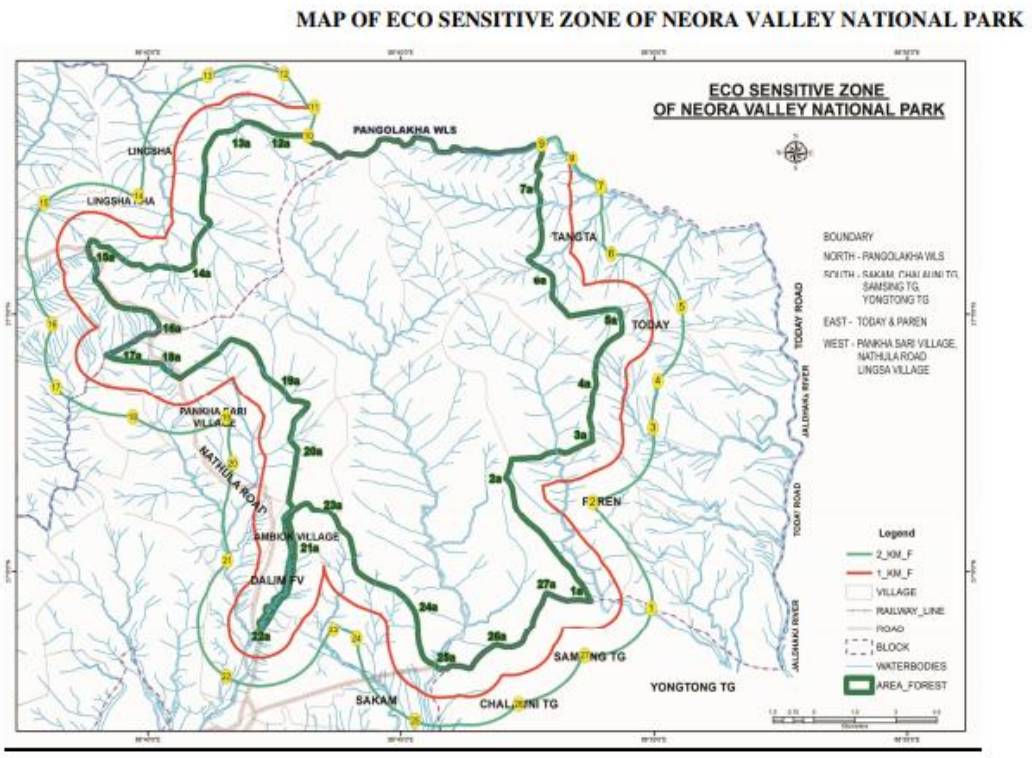
The municipal chairman herself reveals that this project is not about drawing water from the new source but is about the rejuvenation of the existing distribution system of the water. Secondly, according to the DPR on AMRUT by Darjeeling Municipality mentions that after the implementation of the project the Municipality will be able to supply arsenic-free potable water to the entire municipal areas of the town. However the question is does Darjeeling even have an arsenic problem in their drinking water? Because according to the CGWB there are 8 arsenic affected districts in West Bengal which is Bardhaman, Hoogly, Howrah, Malda, Murshidabad, Nadia, North 24 Parganas, and South 24 Parganas. Thirdly, the DPR also mentions that the municipality will generate the annual maintenance cost by commercial selling of water which means that this commercial selling will be at higher cost than the general cost because as per the engineer the cost of water is 300 rupees per year and also if they think that they have enough water for commercial selling than why don't they target on universal coverage of water in the entire town? There are wards which still don't get the municipal water; there are public standpipes which remains dry throughout the year why don't they look after this matter instead of selling the water commercially? Commercial selling would be done to either hotel who are the biggest consumers and also to those who can afford to buy but what about those who cannot buy? Will they be covered under this scheme as they are also equally paying all the municipal taxes? It has been found out in the primary survey that the water is not reliable at all and also the residents are receiving water after every 3-4 day's gap this is the reason why people rely on the alternative source like private vendors.

6.3.4. Neora Valley River Project, Kalimpong

Before 1995 the drinking water in the town was initiated through the Relli-Thokchuk area however as the population started increasing and also because of the presence of the army the Neora water project was initiated as the previous source could not cater the demand of both the public and army. Rising from the North Bengal Dooars to a height of over 7,000 feet in the eastern Himalayas is a little-known valley called Neora and the Neora River which originate in the mountains between Bhutan and Sikkim India. The Neora River had a 22 crore rupees drinking water project which is not free from the controversy over the West Bengal Government's plans for drinking

water. However, when the Government revealed its final plans, duly approved by the Central Environment Department, even the most strident critics of the project fell silent. 1982- An expedition to the Neora valley sponsored by the Himalayan Club and the World Wildlife Fund, sighted the rare species of plants and animals. The late Prime Minister Indira Gandhi's intervention in December 1980 stalled the project and the Government was asked to prepare an alternative scheme in the area since both Kalimpong town and its adjoining army cantonments faced an acute shortage of drinking water. The Neora Valley Project was designed to supply 1.5 MGD of water in contrast to the existing supply of only 0.4 million gallons. Curiously, the Government took almost two-and-a-half years to submit a detailed alternative scheme for pumping water to Kalimpong from the Teesta. Degradation of a largely intact ecosystem only two streams in the valley - Neora Khola and Dhaula Khola - would be tapped in the upper reaches by constructing weirs. To ensure that the PHED sticks to the approved plans, a special committee has been set up" (Banerjie, 2013). Further, there lies a tea garden exactly at the location where water is being pumped as they extensively apply the pesticides. The company which has undertaken this project is from Hyderabad called Ramsky Infrastructure Private Limited but the work was not been genuinely examined and the project was collapsed because of bad performance (The Telegraph, 2009). However, as the water is highly meant for the army cantonment the project gets the nod. The district water analysis laboratory under neora khola water supply and maintenance P.H.E.D was inaugurated on 17th May 2008 by Engineer in Chief Shri Prabir Kumar Dutta. Neora valley comes under the eco-sensitive zone and is spread over the catchment of Neora River which forms the major source of drinking water to the Kalimpong. According to MoEF there are at least "680 species of angiosperms, 23 species of pteridophytes, 31 species of mammals, 200 species of birds, 276 species of insects, 38 invertebrates and more than 40 species of floras in the Neora Valley" for which it is termed as eco-sensitive zone from ecological, environmental and biodiversity point of view. It was declared as an eco-sensitive zone by the central government according to EPA and EPR 1986 (MoEF, 2017). According to the PHED Engineer, the wildlife department once did not permit to initiate this water project. However, the defense also picked up the issue of water crisis as they were also facing the water problem in the town. So, because of the defense, the project got approved. The environment minister and defense minister sat for the meeting and decided to initiate the much-awaited 'Neora Khola water project'.

Map 2 Map of Eco Sensitive Zone of Neora Valley National Park



Source: MoEF, September 2017

Earlier the Neora office was based on Siliguri which was later moved to Kalimpong. The Neora water travels 72 km to reach the town so if something happens along the way nothing can be done as there is not a single team to do the fact-finding or fault-finding of this problem. There is few staff that looks after this pipeline however it's not possible for them to guard the entire 72 km stretched pipeline. In a place called *Sangsay* there is a V notch where the water often comes at 12-16 inches, however, from that V notch to the *Delo* reservoir the water reduces to 5-8 inches the reason that the siphon which draws the water is severely defective. The siphon couldn't draw the water hence the water is returned back and instead flows in a place called *Bakshim Khola*. The actual size of the pipe is 20 inches however the water that flows till *Sangsay* area is 16 inches which again reduces to 6 as mentioned above. The department is, however, building a tank of 92 lakh rupees which is not necessary as there is no water rather the department should be focusing on how to enhance the source of the water suggests one politician[53].

[53] Field interview- Information obtained from political party leader on 30th March 2017, Kalimpong

6.3.5. Augmentation Scheme from *Utissey* River, Kalimpong

The most recent is the new water project and renovation plan which has been proposed for the town. This new project for water supply is from the river called '*Uttisey*' which is beyond Neora Valley near Bhutan border. The size of the River Uttisey is smaller than that of the Neora River. However, even if the water from this river is drawn the major setback is that the distribution system of the town which is collapsing as pointed out by the PHED. The water is said to be brought to the town through the piped system parallelly to Neora. The water will feed Delo Lake and there will be no branching from there. The total expenditure will be above 300 crore rupees. The department has put forth the new distribution system where the old pipes will be abandoned and new pipes will be laid, as the old one has got brittle and out of use. The zonal tanks will also come the under new distribution system. The department has proposed this new water project and has been sent to the Kolkata they will decide the initiation of the projects the department can only wait for the nod of the project from the state.

6.3.6. New Water Treatment Plant For Kalimpong Municipal Town

According to the PHED in the period of monsoon with the heavy shower frequent landslides takes place and it often cuts off the main supply line. During this season the surface water from the *jhoras* brings lots of clays and silts and as there is no running treatment plant, the GTA took the initiative to build a new treatment plant. This initiative is said to be integrated with the main scheme. A DPR has been made however the cost of the project is much more than that of the AMRUT project in Darjeeling.

Table 63 Total Cost Summary of the Project

SL No.	Description of work	Amount (Rs)
1	Civil Cost summary	11629071.93
2	Electrical Cost summary	523685.20
3	Electromechanical cost summary	116460000.00
Total		23798757.13
3% consultancy fees for Survey, Design, Drawing and Preparation of DPR		7,13,962.71
3% contingencies		7,13,962.71
Grand Total		2,52,26,683

*Rates as per current WB, PWD Scheme/CPWD Scheme and present market rates

**Statutory fees and utility connection charges will be as per actual

Source: PHED Office Kalimpong, February 2016

Civil structure work includes:

- Retaining wall
- A masonry boundary wall with barb wire fencing
- site dressing
- pavement
- surface drainage
- Water Treatment plant shed

Electromechanical work includes:

- Sedimentation tank with Alum doing (for de siltation)
- Pressure Sand Filter with feed pump (for filtration)
- Chlorination (for disinfection)

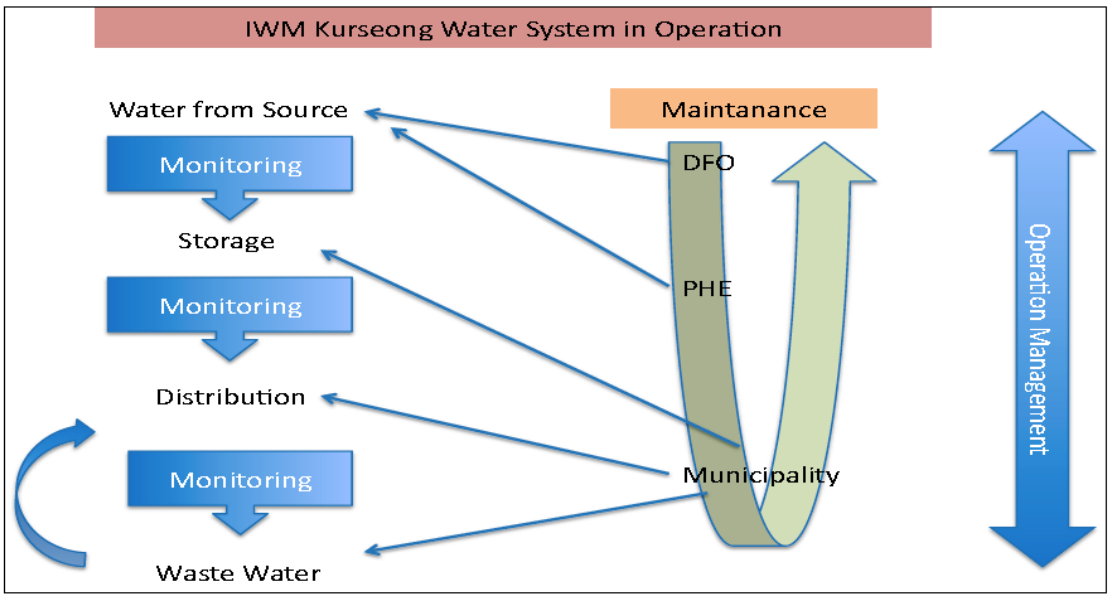
The land below the delo civil drinking water lake (capacity 4 million Gallon) has been selected for the proposed construction of treatment plant which lies under the jurisdiction of PHED and there is a defunct filter house in the proposed site. The PHED opines that for the last few decades the impounding lake has not been cleaned or dredged. Almost half of the lake has been filled with silts which have drastically reduced the effective capacity of the lake. Besides, there is no proper arrangement of de siltation and disinfection. As per the provision of the CEEPHO manual for water

supply, the supply level for the urban area is to be considered as 135 lpcd. However, for hill towns, the source of water supply is only rainwater collected from *Jhoras* and streams in the surrounding areas. In hilly terrain like Kalimpong, the sewer lines are mostly laid on steep slopes where there is a problem of high velocity of sewage flow which avoids the possibility of siltation at any stage. Therefore in consideration of the ground reality and the other reasons the service level for water supply for Kalimpong town has been considered as 70 lpcd (Kalimpong PHED, 2014).

6.3.7. Integrated Water Management (IWM) *Indo-Swedish* Project, Kurseong

This project was formulated when Mr. Sanjay Prasad of the Kurseong Municipality met Mr. Lindblom from Sweden in the fall of 2007 where he mentioned about the deteriorating water supply in the region. A proposal was made by Mr. Lindbloms Company 'Artamusto; in 2008 for the agreement but as there was of the paucity of the funds and the indecisive attitude of the politicians it could not be continued. Later, a necessity was felt to revive the local conditions with new ideas. Hence both the municipality and the company agreed to develop a project of sustainable water management. It is decided that both of them would request for the finances concerning the expenditure on the infrastructure in the municipality (Kurseong Municipality, 2014).

Figure 22 Integrated Water Management Kurseong: Water System in Operation



Source: Observation Report, Kurseong Municipality SIDA 2011

There were four phases of the project which were aimed to be completed by 2020.

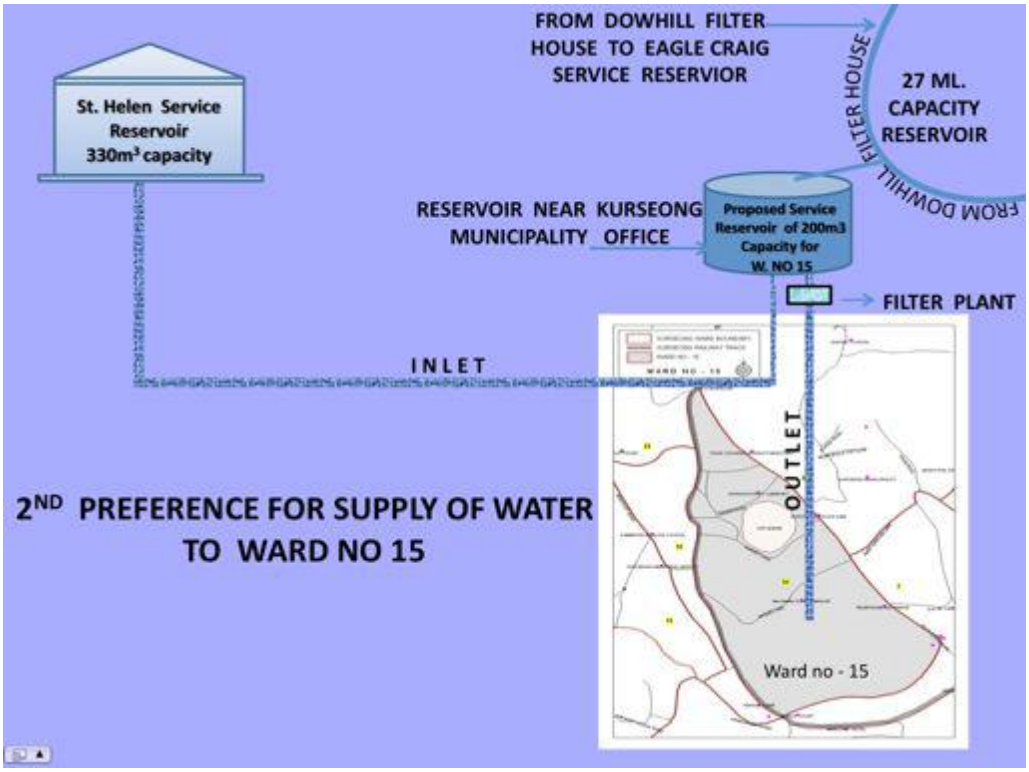
“The first part of the project was to yield the following 4 results:

A) A vision for future sustainable water management
B) A strategy and action plan for sustainable water management
C) Methods to raise public awareness and acceptance
D) Measures for poverty reduction in the region”

This ongoing project had planned the right to have clean water to the municipality and proceed to a company called Artamus. In the year 2009, the project gets a nod and funding was provided by the SIDA. An observation report was prepared with the help of a team of experts in April 2011 focusing on the water supply system of the town. The report mainly focuses on subtle issues and plans to have a partnership with many sectors, developing competence and resolving the disputes. Yet, as the project advanced many issues will get included such as the authority of the womenfolk, poverty reduction, etc. There are many collaborators for this project like PHED, NGO’s, municipalities, tea gardens, and education departments. One ward of the town (Ward No. 20) will be used on a trial basis for phase 2 of the project. The success of the trial will be reproduced for the rest of the wards in the municipality. Similarly, arrangements will be done for giving training and communication along with the trial and plans will be made to acquire the sources of funding. Phase 3 involves obtaining the project comprehensively while Phase 4 involves the production and installation of a new advanced water supply system (Kurseong Municipality, 2014). Although this project looks promising from the municipal aspect the project could not be continued due to political unrest. Hence, both the municipality and the residents have to face confront issues of water and a proficient water supply system (Lepcha, 2013). Even after having the project the town still suffers from the water scarcity, the demand-supply gap seems wider, especially during the lean periods. The reasons have been given according to the filed report as to why in the observation report for planning funding is necessary to examine the management of water in the town. Those reasons for the decay in the water supply are uncontrolled tapping and water losses through leaks, no metering system, an unclear economic organization for water utilities, landslides, issue of water quality, no wastewater treatment plant (KurseongMunicipality) which is found to be true during the primary field survey.

For this project, ward no. 15 was chosen as a pilot and a thorough survey of the households has been conducted. Later, the planning and execution of the work have been done. The lesson from the pilot in ward no. 15 is said to later provide the feedback to the remaining 19 wards. The project aims to meet three requirements of quality, quantity, and accessibility (IWMKurseong). However, nothing has been mentioned by the municipal engineers during an interview whether the pilot was a success or not.

Figure 23 A plan to set up the pilot in Ward No. 15 under IWM Indo-Swiss Project



Source: 2nd SHG Meeting Report, IWM Kurseong 2013

However, according to Mr. Prem[54]prominent party members of the Kurseong town, the municipality had received more than 1 crore rupees from Sweden government for water supply scheme and a small water reservoir and a pipeline from municipal primary school to ward number 15 has been provided but there was no water in that line. Upon enquiring municipality said that they had received 220 Swedish Kroner which is equivalent to 13 lakh rupees. Besides, no fund was utilized for water tank

[54] Name changed on request. Interviewed held on May 2017

and pipeline and no E-tender was done by the authorities as the funds were utilized for several works like survey, field visits, mapping, conference, stakeholder meetings with the representative of Sweden.

6.3.8. Comprehensive Drinking Water Supply Scheme for Kurseong Municipal Town

A new project has been proposed by PHED GTA called "Comprehensive Drinking water supply Scheme for Kurseong Municipal Town". The engineer said that the Kurseong town has no bigger water projects like Balason and Neora however the amount they have proposed is more than that of the Balason itself. The PHED engineer told in his interview that the total cost of the project is 130 crore however the exact amount of the project is 144, 50, 46,238 rupees. 80% of the grant is from the GoI and 20% is given by the GoWB/GTA. The project is supposed to be completed within 24 months as the scheduled task begins. The project has three broad objectives 1) water and health 2) convenience and 3) affordability. The need for the project mentioned as in DPR is to investigate why water scarcity has happened? What is its effect and how can it be solved?.The designs for the project are made following the CPHEEO manual on water supply and treatment. The DPR on this scheme mentions that the town is facing a major scarcity in the supply of potable water however during an interview the engineers told that the town has no such severe issue as water scarcity. The department has proposed the impounding lake whereby the water during the 8 months (water surplus months like March to October) can be stored in this lake and can be used the same during the dry months (November o February). The capacity of the impounding reservoir has been worked out as 100ml. The entire distribution shall be divided into several zones that are independent of one another. Each zone will have a required number of ground reservoirs corresponding to the population serving in that zone. The new distribution system will be laid along the main road with an 80 mm diameter of pipelines. The project also proposes the use of the water meter which will be provided to each domestic connection and water tax will be collected accordingly.

Designing of water treatment plant

Gravity main ⇨ Filter feed pump ⇨ Online Alum Dosing System ⇨ ⇨ Pressure Multimedia Filter ⇨ Activated Carbon Filter ⇨ Electro Chlorinator Zonal Main Reservoir

Source: PHED office Kurseong, May 2017

Table 64 Financial analysis of the project

Feature	Specification
Project cost	1445046238.00
Grant from GOI (80%)	1156036991
Grant from GoWB (20%)	289009248
Debt (0%)	0
Construction period	24 months
Operation period	30 years
Cumulative cash balance status*	740 lakh at the end of 30th operating year
FIRR**	27.41
EIRR***	19.894

Source: PHED office Kurseong, May 2017

*including operating revenue & expenses, no debt servicing and revolving fund contribution

**Financial Internal Rate of Return

*** Economic Internal Rate of Return

The project mentions the need for artificial storages (impounding reservoir), details of catchment chamber design, sedimentation tank design, water treatment plant, filtration system, main reservoir and zonal reservoir, water meter, valves, public private-partnership, community participation, etc.

6.4. MAIN PROBLEMS OF THESE POLICIES/ PROJECTS-

1) Most of these policies are based on Big River water very little focus has been given on policies to save the spring water.

2) Several multiple hybrid projects have been initiated in the towns

3) Older projects have been left midway

4) Some of these new projects are yet to be approved by the state/central government

5) Some projects talk about commercial selling of the water. Instead of commercially selling the focus should be on universal coverage of water in the entire towns as some wards do not have a municipal coverage of water.

6) Some projects get nod even after the wildlife organization said that there is an endangered species of flora and fauna.

One 50 year old community member from Darjeeling says:

यहाँ कुनै ठुलो नदिको प्रोजैक्टको खाचो छैन गाड़ीले पानी बोकेर लेवदैछ भन्नुको मतलब हो कि कतै नजिकै पानीको श्रोत छ ति श्रोतहरुलाई टैप्इन्ग गरेर ल्याएर पुरा सहरलाई सजिलै संगले बाटन सकिन्छ

(**Translation**: There's no need for the big river projects for the towns, the fact that the private vendors are getting the water proves that there is water available nearby, those sources could have been tapped and water could have been easily provided to the town)

They are familiar with the area and the situation regarding the water in the town. Therefore, inclusion of their knowledge is an important aspect in water management which somehow has been lacked in the projects. The water projects are not only costlier but are also very farthest from the town whereby many leakages and illegal tappings are prominent along the way which has become a cumbersome task even for the authorities to deal with.

6.5. IMPROVEMENTS NEEDED IN THE POLICIES: A WAY FORWARD FOR THE FUTURE

1) The greatest problem of the Darjeeling hills is the dichotomous nature of the waterworks department. This department should be under the state government and not the local autonomous body as there is ample evidence of

artificial water crisis and dishonesty and hooliganism which have kept almost all the officials, engineers and the common people mum over the matters of water corruption.

2) Another major problem regarding the drinking water is the proposals of too many projects which remain incomplete one of the better solutions to successfully implement these policies is that complete the older one and propose the new one. It is seen that the older projects are left in a midway because of the budget problem and instead the proposal of the new one is done.

3) The responsible department should keep track of the budget that is coming for the particular purpose to make sure that the budget is used only for that purpose. How much amount is received and where it has been used should be made transparent to the public so that they can understand what is happening under this project since most of the common folks do not have any idea what is happening under this project. This will also help curb the corruption going on in the name of the project.

4) A Geo-spatial database should be created on the total available land and water resources for further assessment. The major problem like deforestation can be traced and reforestation can be done in the degraded areas. This should also include the disaster mitigation approaches since the region is in the earthquake-prone zone which hampers the water supply.

5) One of the major setbacks of the waterworks department is the use of modern techniques especially PHED offices. Most of these offices are worn down and they only have records on their archives they do not have any website so that they can store their data and make available to the public. Since the world has gone digital these offices are still working on their handwritten archives, therefore, installations of computers and modern techniques and hiring modern GIS experts can help track the water and land resources.

6) The involvement of the communities is a must to successfully implementing these projects. It is often seen that the communities are often left out whenever such big projects come to the surface. Involving the community means

blending of traditional methods with modern practices whereby both the parties can learn from each other and help restore and rebuild the water conservation and management techniques.

7) Using the eco-friendly techniques of soil and water conservation with the help of the local communities is a must for the hilly area.

8) Some communities are looking after the spring shed area, the state and the local authorities should track these communities and help them in the development of the spring catchment area. Most of these communities had met with the officials however they lost hope from them since the authorities could not help them.

9) Spring is the main source of drinking water for the majority of the hill folks more projects should be proposed to save the only resources which are losing its volume day by day. Taking the example of the immediate neighbor Sikkim or training with them is not a loss but will benefit in restoring and rejuvenating of the springs.

10) It has been found that most of the perennial spring waters got wasted in the hilly areas however it can be collected by building the tanks whereby it can be used for different household needs and can relieve the residents to a certain extent.

11) Drying up of the springs are the most common problem of the entire Himalayan region it can be revived by thoroughly studying the hydrogeology of the area and the water can be recharged in those areas. Mapping of the spring is compulsory for its location so that it can get necessary attention for its recharge and rejuvenation.

12) Rooftop water harvesting is done on a small scale by most of the households in the hills it should be further promoted on a large scale. Residents of some water surplus areas seem to have been throwing this roof top water they should also be made aware of the importance of the water in the long run.

13) Water can be reused into several ways e.g. the water used for washing clothes and vegetables or utensils can be used to flush the toilets since flushing requires lots of water.

14) It has been found that the people are very much willing to learn the new techniques of water management on par with traditional techniques; therefore, mass awareness program can be done on this issue with the help of local Government and Non-governmental organizations.

15) Institutions like schools and colleges can play a better role to make aware to the people about the importance of land, water and forest conservation and management. Posters can also be put on public spaces to make them aware of this issue.

16) Private water vendors have become one of the power markets in the water sector. The distribution with the help of these vendors is temporary solutions the authorities should find a permanent solution to tackle the water problem with the help of several stakeholders like the think tanks, policymakers, engineers who have a greater knowledge about the Himalayas.

17) The evil effect of privatization of water has been seen in the towns as it suffers from the unequal distribution of water for which legal action should be taken by the authorities.

18) The restoration of the age-old pipes and construction of the water storages has to be done full-fledged and not on a piecemeal basis.

19) There is a need to harness the local water resources than the costlier pumping of the river. As pointed out by many of the local residents of the towns there is water sources nearby than what is the point of pumping the water from deep down the valley. Again, many perennial water sources are getting wasted this in turn could be saved and provided for the people.

6.6. Conclusion- This chapter deals with the details of drinking water policies in the hilly areas with special focus on the town. Even after initiating so many water policies and projects for the hills yet, no such progress has been seen so far on the

water sector which should have been included as a separate policy targeting this particular sector only. So far the hill has a bigger river project however several households that depend on the spring water as well. Spring plays an important role in the hilly area as the majority of the households still depend on that. Hence, a separate policy for the spring water should be given more focus as these are less cost effective and where the local communities can also be included for their knowledge in saving these valuable resources. However, the problem of the spring is that the springs in the town area is either the community spring or the individual spring which can be included in the policies but some households have drawn water from the individual springs from the nearby places which do not come under town area and these sources are difficult to trace and difficult to take under any policies as well. These springs have emerged on some individual lands and it depends on the landlord whether he will sell that spring water to the people individually or he will donate for the people as community spring. Most of the households (during the household survey) hesitated to show the spring from where they get their water and some landlord refused to answer the queries as most of them take money from the customer who takes the spring water from their land. One such incident in Kurseong happened where the landlord (on whose land the spring has emerged) refused to talk and became aggressive when asked about it. These private spring owners should also be approached and ask to extend their helping hand not just to save this local resources but also to make them realize that they are also a part of the water management and conservation of the town. No matter how many small and big water policies and projects have been initiated have a major setback and most of the engineers agreed that this major setback is because of the lack of money/ funds for the projects. Besides being dichotomous, each department comes up with their plan and proposes the project but they do include each other in their project.

CHAPTER 7

CONCLUSION

The main objective of the study is to examine the availability and accessibility of the drinking water in the towns of Darjeeling hills. From the primary data, it can be seen that there is a very limited option available for the people of the hills regarding their drinking water and their accessibility is far more complex with too many water providers. The issues of water mafia were also got highlighted during the primary survey and the fear that lurks behind the issues of water mafia. The pressure mounted on the local administration has also been felt while interviewing the officials and their attempts to curb the water mafia which has somehow failed. The role of the private vendors on water supply, their types and their advantage and disadvantages of doing this business has also been discussed. The importance of the community who are struggling to save their only resources i.e. spring and their management of water during the shortages and their upcoming challenges are also been emphasized about the problems of the community. The policies and projects that have been or are being introduced are seen to be focused more on big rivers and less so on the springs which have always been the boon for the hilly residents. Besides the primary data suggests that there is a vast disparity in terms of accessibility of the drinking water in the hill towns and many factors have been responsible for that.

India faces a grave water crisis and its growing population, overused groundwater, depleting water sources and low monsoon rains are said to be the evil perils of this situation and the Himalayas are also not free from those perils. Population growth, the influx of rural migrants to the towns, floating population like tourists, drying water sources, changing climates has put pressure on its natural resources. The most unlikely situation of the Himalaya is that the down land areas face flood while the upland areas face a crisis where all the rainwater goes down with gravity and drawing up of the water from the river below becomes costlier. The changing climate also adds havoc especially for the springs which could not gets recharged and the result there is a grave water crisis during the dry periods. The water scarcity in Darjeeling may not have hit the national media however has always been a general topic in the local media. The water issues in Darjeeling Towns is difficult to understand as it is quite complex with too many water providers. Besides the illegal tapping, leakages,

corruption, privatization has created the nuisances in the daily lives of the residents rich and poor alike. The local authorities cite that the absence of water storages, small conduit, primitive water supply system, population explosion, migration to towns, depletion of sources of water, increase in water demand and finance has been a pressing issue of water management in the towns. The politicians, however, remark that there is water mafia within the department, the department remarks that the water mafia has a strong connection with the politicians so the blame game continues and the result is that the water crisis remains unsolved. A typical blame game should be stopped and both the authorities and the politicians and civil citizens should come together to end this crisis. The water mafia has created the nuisance in the water supply of the town which needs to be handled more strictly by the local authorities. The politicians themselves should also be strict regarding these issues. However only time will tell where this complex issue of water will proceed soon.

The matter of private vendors has remained as a water mafia in the eyes of many. Their booming business has said to be started from the 1980s since then the vendors have seen and felt the fluctuation in their water selling business. Many authors have blamed them as the water mafia because they are said to create a crisis like situation by forcing the residents to buy from them. However, in the interviews, they have mentioned that it's not an easy task to make the money as they have to stand in a queue in the water sources, have to spend many sleepless nights and also have to face many problems from the administrative and non-administrative authorities and individuals. They have a clear indication of the accusation made by the people about them making money out of this business. For those who can afford, these vendors have become blessings in their life as they can contact and gets the water any time and any day but for those who cannot afford will either go to fetch water from the natural springs or either ask the neighbors for additional water or manage with whatever they get. The local administration is also seen distributing the water to the residents through these local vendors especially during the time of crisis. However, this can only be a temporary solution and the department seriously needs to think about the long term solution.

It has been found during the primary survey that there are many water providers in the town and not just the municipal supply. There are other sources as well from which

households are accessing the water. Some private spring owners sell their water source to those who can pay the rent however those who cannot struggle every day to access the water. It is found that the accessibility also depends on the household ability to buy the water be it municipal tap water or the private vendors. The easiest accessed source has become the private vendors which act as the supplementary or secondary source because of the unreliable nature of the primary source. The variation of the water the households receive from the municipal authorities are from 15 minutes to 2 hours after every 2/3 days gap which compels most of the households to buy water leading them to have extra expenditure on it. However, the struggle is for those who cannot afford to buy which push them to either manage with whatever is available or ask the neighbors for extra water as for those who can afford vendors become their savior. Some households enjoy a 24/7 running spring water as they have a connection from the private spring water supplier some even own this spring water as well. It is rather disheartening to found during the primary survey that some of the households do not believe in the word called sustainability for them everything depends on the present, not the future. It has also been found that some of the common people do not even know the reason behind the water problem in their area.

As for the communities (*samaj)* they have come up with their solutions for drinking water management in their area. The community water management is not a new concept in the hills however the sources which they used to maintain are always wasted as they are not stored and there is no way one could stop the spring from where they have appeared. At present their concern for their only resources which is depleting day by day is transparent in their action to save it. However, due to the lack of their expertise on water management all they could do is to manage it traditionally by placing the images of gods and goddesses or by building a temple to keep the anthropogenic activities at bay. It has also been found that most of these communities are financially independent and waiting for the government action is quite bothersome for them so the members of the community collect money or workers amongst themselves whichever is possible. The community is quite skeptical about their future as they said that there is no responsible person to carry on what they have started, in spite of that they are hopeful that one day they will one day overcome this problem. The role of the women of the *samaj* in water management is not perceived as such; as they reveal that they are pretty much caught up within their domestic affairs and

hardly have any time to contribute towards the management. Women also think that they are mediocre when it comes to planning and management and think that the men folk are skilled for this job. Nonetheless, they do join the monthly meetings, give valuable suggestions and monetary contribution for the cause but somehow is shadowing their important role in the water management.

The drinking water policies/ projects in the Darjeeling hills need further improvements for better management of the water in the Hills. These policies and projects are supposed to end the water problems of the hilly town and people have waited enough for its result and some have even lost hope. One of the other problems lurks into the projects which are delaying it. Although there are many small and big projects yet there is no such progress in the water sector and it is evident from the severity of the water scarcity escalating each year in the Hills. The gravity of the water scarcity is felt by both those who rely upon municipal sources and who rely on natural spring sources, as the first is facing the institutional problem and the latter is facing a natural climatic problem. The river projects are being discussed and debated many times by the authorities and many DPR's have been made for that purpose and some of which have already got approved and some are still waiting for the approval. On the contrary, the spring projects are a pristine concept that will take time to develop although the government is making efforts to save the spring. There is still hope that the springs can be saved as they form a major source of water for many hilly residents. Inevitably, the situation of water problems is found to be same in all the studied towns. There's not much difference in management of water as well. All the towns face water scarcity due to socio-economic, behavioral and institutional and natural factors.

The most significant step to deal with the water crisis is to end the blame game i.e. the responsible authorities should stop accusing each other and take responsibility of their tasks. However, the responsibility not only lies in the hands of the authorities but also in the local residents. Some of the officials informed that the residents only come to the office and create ruckus when there is no water especially during dry period otherwise they don't even bother to come and find out the reason for the water scarcity. Besides, people have also started making houses in and around the public hydrant informed the authorities however one can only wonder because the

permission to build those houses should be passed down via these authorities only. Another matter that has come to light after discussing with the communities is the encroachment of the people in and around the spring shed area. This illegal encroachment has endangered the springs and its development as they tend to throw their garbage where there is the presence spring. It has also been found that people who use the springs also predisposed the terrible habit of throwing the trash like empty shampoo sachets, soap covers and also their sanitary clothes etc. When the community put up the notice to stop such precarious behavior of the people they instead found out the notice to be torn apart the other day. All these exhibits the behavior and the attitude of the people towards the resources which they are using free of charge. On the contrary the individual spring owners are also found in all the towns but they were rather aggressive when attempt was made to take their interview and discuss how they function. These spring owners either sell this spring water or give free of cost to those whom they are acquainted with. Another problem is the transparency of the data relating to the water and water projects in the towns. During the interview with the many political leaders showed the RTI data regarding the water, water projects and its costs and utility of that money. Although it is evident that it will be used during the voting period to accuse the governing party who is holding the responsible department. However, it shows that there is no transparency of the data on water and water projects and it is available only when one does an RTI against it. All these matter has crippled the water problem and the responsible department which is already facing the degradation of infrastructure to cope up with it.

As evident from the analysis of all the chapters and from the primary survey it has been found that the water crisis deepens during the summer months when there is less rainfall (dry period) however the situation further aggravates due to number of factors like lack of investment in good infrastructure or technology for water management, illegal tapping, leakages, corruption, absence of water storages, small conduit channel, primitive water supply system, population explosion, migration to towns, drying of sources of water, increase in water demand and finance etc. Since factors like population explosion and migration are difficult to control however other factors can be regulated to some extent to lessen the burden of the water crisis in the hill towns. Therefore the vital requirement for the town to end this emergent water crisis on part of government and the local administration is to establish a widespread

water policies and projects focusing not just on the Big rivers but also to the spring sources which not just satisfactorily fulfill the demand of the residents but also make them aware that it is not only the responsibility of the authorities but also of the local residents to come out and contribute to stop the illegal tappings of water, corruption and deforestation in the town, demonstrate proper garbage disposal in the town (and not in the streams and *jhoras*) and safeguarding and managing of the spring shed area if they have any.

BIBLIOGRAPHY

Addo, I. B., Thoms, M. C., & Parsons, M. (2018). Household Water Use and Conservation Behavior: A Meta-Analysis. *Water Resources Research* , Vol. 54 (10), 8381-8400.

Ayalew, M., Chenoweth, J., Malcolm, R., Mulugetta, Y., Okotto, L. G., & Pedley, S. (2014). Small independent water providers: Their position in the regulatory framework for the supply of water in Kenya and Ethiopia. *Journal of environmental law*, Vol. 26 (1), 105-128.

Alisch, W M Dahlström, W., Plepys, A., Alisch, L., & Lindblom, A. (2012). *Integrated Water Management project in Kurseong:*. Integrated Water Management.

Amponsah, E. N., Aidam, P. W., & Senadza, B. (2009). *Socio-economic Determinants of Sources of Drinking Water: Some Insight from Ghana.* Conference paper, Hamburg: University of Hamburg.

Arsenault, N., Hale, L., Khedkar, P., & Morimoto, Y. (2012). *Integrated Water Management in Kurseong-A PESTLE analysis of the water environment in Kurseong, India.* Lund Sweden: International Institute for Industrial Environmental Economics (IIIEE) at Lund University.

Asante, F. A. (2003). *Economic Analysis of Decentralization in Rural Ghana*. (Germany: Peter Lang).

Avasthe, R., Kumar, A., & Rahman, H. (2013). Potential Water Management Technologies for Sustainable Agriculture in Sikkim and Darjeeling Hills of India. In V. S. K. Palanisami, *Water Management in the Hill Regions: Evidences from Field Studies* (pp. 207-231). New Delhi: Bloomsbury Publishing India Pvt. Ltd.

Bakker, K. (2008). The Ambiguity of Community: Debating Alternatives to Private-Sector Provision of Urban Water Supply. *Water Alternatives* , Vol. 1 (2), 236-252.

Bardasi, E., & Wodon, Q. (2008). Who Pays the Most for Water? Alternative Providers and Service Costs in Niger. *Economics Bulletin* , Vol. 9 (20) 1-10.

Basu, S. K. (2013). *Geology of Sikkim State* . Retrieved March 26, 2019, from http://14.139.206.50:8080/jspui/bitstream/1/4375/1/Geology%20of%20Sikkim%20State.pdf

Bomjan, S. (2008). Urban Growth and Land Use Problems of a Hill Town- A Case Study of Darjiling. In R. S. Mrityunjay M. Jha, *Land Use: Reflection on Spatial Informatics, Agriculture and Development* (pp. 214-225). New Delhi: Concept Publishing Company.

Calder, I., & M.D Newson. (1979). Land use and Upland Water Resources in Britian-a Strategic Look. *Water Resources Bulletin 16* , Vol. 15 (6), 1628-1639.

Castree, N. (2011). Neoliberalism and the Biophysical Environment 3: Putting Theory into Practice. *Geography Compass* , Vol. 5 (1), 35–49.

CGWB. (2014). *Grounwater Scenario of Himalayan Region, India.* Retrieved February 2, 2019, from cgwb.gov.in: http://cgwb.gov.in/Ground-Water/Himalayan%20Report%20All%20Pages.pdf

Chakraborty A. S. (2018). Hamro Jhora, Hamro Pani" (Our Spring, Our Water): Water and the Politics of Appropriation of 'Commons' in Darjeeling Town, India. *Hydro Nepal: Journal of Water, Energy and Environment* , Vol. 22, 16-24.

Chawan, S. V. (2005). *Water Resource of India.* Thane, Mumbai: Vidya Prasarak Mandal, VMP Thane.org.

Chettri, B., & Tamang, L. (2013). Population Growth and Associated Problem: A case study of Darjeeling town. *International Journal of Humanities and Social Science invention* , Vol. 2 (5), 63-67.

Choumert, J., Stage, J., & Uwera, C. (2014). Access to water as a determinant of rental values: A Hedonic analysis in Rwanda. *Etudes et Documents n° 01, CERDI,* , 1-13.

Cornish, P. (1993). The Effects of Logging and Forest Regeneration on Water Yeilds in a Moist Eucalypt Forest in New South Wales Australia. *Journal of Hydrology*, Vol. 150 (2-4), 301-322.

CPGDWB, W.-B. (2010). *CPGD West Bengal, DPR for National Adaptation Fund*. Retrieved November 23, 2018, from www.moef.gov.in: http://www.moef.gov.in/sites/default/files/West%20Bengal.pdf

CSO, C. S. (2018). *ENVISTATS India 2018 (Supplement on Environmental Accounts).* New Delhi.: Central Statistics Office, Ministry of Statistics & Programme Implementation,Government of India,.

Dagnew, D. C. (2012, January). Factors Determining Residential Water Demand in North Western Ethiopia, The Case of Merawi. *A Project Paper* . New York: Cornell University.

Darjeeling Municipality. (2017, April 24). Factors Affecting Access to Drinking Water : An Appraisal of towns in Darjeeling Hills. (P. Pariyar, Interviewer)

Darjeeling Municipality (2015). *Darjeeling Municipality*. Retrieved July 20, 2017, from http://darjeelingmunicipality.in/: http://darjeelingmunicipality.in/

Das, R. (2014). Natural Kurseong is Under Civilized Intervention- an Alarm to its Eco-fitness- A case Study on Kurseong Municipality, West Bengal. *International Journal of Science and Research (IJSR)* , Vol. 3 (7), 496-509.

Das, S. (2010). Water Crisis in Darjeeling Town. *Indian Journal of Landscape System and Ecological Studies* , Vol. 33 (1), 121-128.

Drew, G., & Rai, R. (2016). Water Management in Post Colonial Darjeeling: The Promise and Limits of Decentralised Resource Provision. *Asian Studies* , Vol. 40 (3), 321-339.

Forsyth, T. (2005). Land Use Impacts On Water Resources – Science, Social and Political Factors. *Encyclopedia of Hydrological Sciences* , 1-14.

Ftaïta, T. (2011, December 1). *Community water management. Is it still possible? Anthropological perspectives*. Retrieved July 18, 2019, from http://journals.openedition.org: http://journals.openedition.org/aa/1161 ; DOI : 10.4000/aa.1161

Ghatani, S. (2015, February 27). *Sustainable Urban Water Management in Darjeeling*. Unpublished Mphil Thesis . Gangtok, Sikkim: Sikkim University.

GoWB, (2012). *West Bengal State Action Plan on Climate Change.* West Bengal: Government of West Bengal and Government of India.

Gupta, S., & CGWB. (2014). *Ground Water Scenario of Himalayan Region, India.* Retrieved March 24, 2019, from cgwb.gov.in: http://cgwb.gov.in/Ground-Water/Himalayan%20Report%20All%20Pages.pdf

Hamilton, L. C. (1983). Saving Water: A Casual Model of Household Conservation. *Sociological Perspectives* , Vol. 26 (4), 355-374.

Haq, M., Mustafa, U., & Ahmad, I. (2007). Household's Willingness to Pay for Safe Drinking Water: A Case Study of Abbottabad District. *The Pakistan Development Review*, Vol. 46 (4), 1137-1153.

Hazra, A. (2015). Socio-economic Development of Selected Backward Urban Areas of West Bengal. *The Journal of Social Science Researcher* , Vol. 4 (6), 57-72.

Iskandarani, M. (2002). *Economics of Household Water Security in Jordan.* Frankfurt: Peter Lang GmbH, Internationaler Verlag der Wissenschaften.

Ishaku, H. T., Husain, M.A., Dama, F.M., Zemba, A.A.,& Peters, A.A., (2010). Planning for sustainable water supply through partnership approach in Wukari town, Taraba State of Nigeria. *Journal of water resource and protection*, Vol.*2* (10), 916-922.

Ives, J. D. (1986). The status of Nepal: Development in the Face of Uncertainty. In S. C. Joshi, *Nepal Himalaya, Geo-Ecological Perspectives* (pp. 265-281). Nainital: Himalayan Research Groups.

IWM Kurseong. (2013, June). *Newletter IWM Kurseong Darjeeling.* Retrieved October 4, 2018, from www.kurseong.in: http://kurseong.in/download/Draft_IWMKurseong_Newsletter_4_Eng_130613.pdf

Joshi, D. (2014). Feminist Solidarity? Women's Engagement in Politics and the Implications for Water Management in the Darjeeling Himalaya. *Mountain Research and Development* , Vol. 34 (3), 243-254.

Joshi, D. (2015). Like water for justice. *Geoforum Elsevier Ltd.* 61, 111-121.

Kalimpong PHED. (2014). *New Water Treatment Plant for Kalimpong Municipal Town.* Kolkata: Radiant Engineering Company.

Kattelmann, R. (1987). Uncertainty in Assessing Himalayan Water Resources. *Mountain Research and Development* , Vol. 7 (3), 279-286.

Khawas, V. (2004). *Sustainable development and management of water resource in mountain ecosystem: Some examples from Sikkim Himalaya*. Retrieved November 27, 2015, from http://lib.icimod.org/record/11725/files/26.pdf

Khawas, V. (2003). *Urban Management in Darjeeling Himalaya: A case study of Darjeeling Municipality*. Retrieved November 15, 2015, from www.mtnforum.org/research/library/khawv03e.htm

Kjellen, M. (2000). Complementary water systems in Dar es Salaam, Tanzania: the case of water vending. *International Journal of Water Resources Development* , Vol. 16 (1), 143-154.

Kumar, K., & Rawat, D. (1996). *Water Management in Himalayan Ecosyste: A Study of Natural Springs of Almora.* New Delhi: Indus Publishing Company.

Kurseong Municipality. (2017, May 16). Factors Affecting Access to Drinking Water : An Appraisal of towns in Darjeeling Hills (P. Pariyar, Interviewer)

Kurseong Municipality. (2011, May 11). *Obsevation Report.* Retrieved October 4, 2018, from Kurseong.in: http://kurseong.in/out/Annex6_Observationreport_Kurseong.pdf

Kurseong Municipality-SIDA. (2011, May 11). *Observation Report for Planning Grant for Water Management Study in Kureong Darjeeling District India.* Retrieved October 4, 2018, from www.kurseong.in: http://kurseong.in/out/Annex6_Observationreport_Kurseong.pdf

Lama, M. P., & Rai, R. P. (2016). "Chokho Pani: An Interface Between Religion and Environment in Darjeeling. *HIMALAYA, the Journal of the Association for Nepal and Himalayan Studies* , Vol. 36 (2), 90-98.

Lammerink, M. P., Bolt, E., Jong, D. d., & Schouten, T. (1999). Community Water Management- Strengthening community water management. *PLA Notes* , Issue 35, 21-28, IIED London.

Lepcha, N. K. (2013). Problems And Prospects Of Water Resource Of Kurseong Municipality, Darjeeling District, West Bengal. *Science Park Research Journal* , Vol. 1 (19), 1-11.

Mahamuni, K., & Upasani, D. (2011). *Springs: A Common Source of a Common Resource*. Retrieved 18 12, 2015, from http://sikkimsprings.org/dv/research/299.pdf

McFarland, M. L., & Dozier, M. C. (2004, January). *Drinking Water Problems: Iron and Manganese*. Retrieved March 24, 2019, from soiltesting.tamu.edu: http://soiltesting.tamu.edu/publications/L-5451.pdf

McGarvey, S. T., Buszin, J., Reed, H., Smith, D. C., Rahman, Z., Andrzejewski, C., et al. (2008). Community and Household Determinants of Water Quality in Coastal Ghana. *Journal of Water and Health* , Vol. 6 (3):339-49.

Mell, I. C., & Sturzaker, J. (2014). Sustainable urban development in tightly constrained areas: a case study of Darjeeling, India. *International Journal of Urban Sustainable Development* , Vol. 6 (1), 65-88.

Michael, B. P. (1998). The Role of Women in Water Resources Management: The Tanzania Case. *International Journal of Water Resources Development* , Vol.14 (4), 499-504.

MLA Darjeeling. (2017, April 25). Factors Affecting Access to Drinking Water: An Appraisal of Towns in Darjeeling Hills. (P. Pariyar, Interviewer)

MLA Kalimpong. (2017, March 31). Factrors Affecting Access to Drinking Water: An Appraisal of Towns in Darjeeling Hills. (P. Pariyar, Interviewer)

MLA Kurseong. (2017, October 20). Factors Affecting Access to Drinking Water: An Appraisal of Towns in Darjeeling Hills. (P. Pariyar, Interviewer)

MoEF. (2017, September 11). *ea- Ministry of Environment and Forests*. Retrieved November 23, 2018, from www.moef.gov.in: http://www.moef.gov.in/sites/default/files/Neora%20Valley%20National%20Park%20West%20Bengal%20Final.pdf

Mondal, T. K., & Roychowdhury, P. (2018). Water Scarcity in Himalayan Hill Town: A Study of Darjeeling Municipality, India. In B.Ray, & R. S. (eds), *Urban Drought. Disaster Risk Reduction (Methods, Approaches and Practices)* (pp. 363-383). Singapore: Springer.

Mukherjee, D. (2013). Studies on Resource Management for Sustainable Ecosystem of Eastern Himalaya. *Asian Journal of Agriculture and Food Science* , Vol. 1 (5), 222-235.

Narain, S. (2006). *Community-led Alternatives to Water Management: India Case Study*. HDRO: UNDP.

Municipality Darjeeling. (2015). *Darjeeling Municipality*. Retrieved July 20, 2017, from http://darjeelingmunicipality.in/: http://darjeelingmunicipality.in/

Nauges, C., & Strand, J. (2007). Estimation of non-tap water demand in Central American cities. *Resource and Energy Economics* , Vol. 29 (3), 165-182.

Nayar, V. (2006). Democratisation of Water Management: Establishing a Paradigm Shift in Water Sector The Tamil Nadu Experiment with Governance Reform. *Reforming public utilities tomeet the water and sanitation Millennium Development Goal* (pp. 1-21). United Kingdom: World Development Movement and Water Aid.

NITI Ayog. (2017, December 29). *NITI- Ayog report on springs*. Retrieved November 22, 2018, from NITI- Ayog report: http://dst.gov.in/sites/default/files/NITI-Aayog-report-Springs-29Dec2017-FINAL.pdf

NMHS. (2018, September 18). *National Mission on Himalayan Studies*. Retrieved March 24, 2019, from nmhs.org.in: http://nmhs.org.in/SG_01_2017_18.php

Olajuyigbe, A. E., Rotowa, O. O., & Adewumi, I. J. (2012). Water vending in Nigeria-A case study of FESTAC town, Lagos, Nigeria. *Mediterranean Journal of Social Sciences*, Vol. 3 (1), 229-239.

Onyenechere, E. C., Eleazu, E. I., Azuwike, O. D., Osuji, S., & Igwe, C. F. (2012). The dynamics of domestic water vending in Enugu North LGA of Enugu State, Nigeria. *Journal of Water Resource and Protection*, Vol. 4 (04), 224.

Opryszko, M. C., Huang, H., Soderlund, K., & Schwab, K. J. (2009). Data gaps in evidence-based research on small water enterprises in developing countries. *Journal of water and health*, Vol. 7 (4), 609-622.

Osei, A. Y. (2005). Household Water Security and Water Demand in the Volta Basin of Ghana. *European University Studies* Frankfurt am Main, Berlin, Bern, Bruxelles, New York, Oxford, Wien, 2005 XVI, 151 pp., *8*

Pandey, Kiran. "Down to Earth." 30 August 2018. downtoearth.org. 3 July 2019 <https://www.downtoearth.org.in/news/water/crisis-in-the-himalayas-nearly-50-perennial-springs-in-the-region-have-dried-up-61482>.

Patra, S. (2014, July 17). *Integrated Land and Water Resources in Hilly Areas of India* . Retrieved December 17, 2015, from https://nlup.mizoram.gov.in/uploads/files/discussion-paper.pdf

Persson, T. H. (2002). Household Choice of Drinking–Water Source in the Philippines. *Asian Economic Journal* , Vol 16 (4), 303-316.

PHED Kalimpong. (2018, January 25). Factors Affecting Access to Drinking Water : An Appraisal of Towns in Darjeeling Hills. (P. Pariyar, Interviewer)

Planning Commission GoI. (2008, April). *Hill Areas Development Programme / Western Ghats Development*. Retrieved November 24, 2018, from Planningcommission.nic.in: planningcommission.nic.in/aboutus/committee/wrkgrp11/tg11_hillarea.doc

Poonia, A. (2015). *Sustainable Drinking Water Suppl: A Cae Study of Semi Arid Areas of Rajasthan.* Unpublished PhD Thesis, New Delhi: Jawaharlal Nehru University.

Pradhan, N. (2015, August 2). *Groundwater: It's not a source, it's a resource*. Retrieved December 21, 2015, from http://www.indiawaterportal.org/articles/groundwater-its-not-source-its-resource

R.K.Guha, & Kujur, R. A. (2009). Roof Top Rainwater Conservation in Darjeeling Town, West Bengal, an Option to Mitigate the Crisis of Water Supply - A Case Study at Raj Bhawan,Darjeeling, West Bengal. *Bhu-Jal News quarterly Journal* , Vol. 24 (1), 85-90.

Rai, A. (2018, June 20). *The Ailing Standards of Water Supply and Sanitation in Darjeeling*. Retrieved March 11, 2019, from The Darjeeling Chronicle : https://thedarjeelingchronicle.com/the-ailing-standards-of-water-supply-and-sanitation-in-darjeeling/

Rai, B. (2015). *History of the Darjeeling Himalayan Railway and its socio economic impact on Darjeeling 1880 to 1999.* Unpublished Doctoral Thesis, Siliguri: University of North Bengal.

Rana, S., & Gupta, V. (2012). Watershed Management in the Indian Himalayan Region: Issues and Challenges. American Society of Civil Engineers, Conference Paper, *World Environmental and Water Resources Congress* , 1-12. Retrieved on April 30, 2016 from https://doi.org/10.1061/41036(342)527

Rauf, S., Bakhsh, K., Hassan, S., Nadeem, A. M., & Kamran, M. A. (2015). Determinants of a Household's Choice of Drinking Water Source in Punjab, Pakistan. *Polish Journal of Environmental Studies* , Vol. 24 (6), 2751-2754.

Rautela, P. (2000). *Water Resources in the Himalayas Harvesting, Tradition and Change.* New Delhi: Concept Publishing Company.

Retherford, R. D., & Choe, M. K. (1993). *Statistical models for casual analysis.* John Wiley and Sons.

Rostapshova, O., Roumis, D., & Alwang, J. (2014). *Determinants of water use among urban households in Tanzania: water source access, use, and treatment.* USA: Millennium Challenge Corporation.

Sattar, A., & Ahmad, E. (2007). Willingness to Pay for the Quality of Drinking Water. *The Pakistan Development Review* , Vol. 46 (4), 767-777.

Shah, R., & Badiger, S. (2018, October 8). *Conundrum or paradox: deconstructing the spurious case of water scarcity in the Himalayan Region through an institutional economics narrative.* Retrieved February 9, 2019, from iwaponline.com: https://iwaponline.com/wp/article/doi/10.2166/wp.2018.115/64261/Conundrum-or-paradox-deconstructing-the-spurious

Sharma, B., Riaz, M. V., Pant, D., Adhikary, D., Bhatt, B. P., & Rahman, H. (2010). *Water Poverty in the Northeastern Hill Region (India) : Potential Alleviation Through Multiple-Use Water Systems Cross-learnings from Nepal Hills.* New Delhi: International Water Management Institute.

Sharma, E., Chettri, N., & Oli, K. P. (2010). Mountain biodiversity conservation and management: a paradigm shift in policies and practices in the Hindu Kush-Himalayas. *Ecological Research* , 25: 909-923.

Sharma, V., & Joshi, K. K. (2014). Revoking Historic Water Management System in Himalayan Region through Traditional Practices and Community Involvement. *International Journal of Multidisciplinary Research in Social and Management Sciences* , Vol. 2 (2), 107-110.

Snell, S., & Mundial, B. (1998). Water and sanitation services for the urban poor, small-scale providers: typology & profiles. In *Water and sanitation services for the urban poor, small-scale providers: typology & profiles*. Banco Mundial. Retrieved on February 9, 2019 from (http://www.wsp.org/publications/global_typology.pdf)

Soares, L. C., Griesinger, M. O., Dachs, J. N., Bittner, M. A., & Tavares, S. (2002). Inequities in Access to and Use of Drinking Water Services in Latin America

and the Caribbean. *Pan American Journal of Public Health* , 11(5/6), 386-396.

Starkweather, J. A., & Moske. (2011, August). *Multinomial Logistic Regression*. Retrieved August 29, 2018, from https://it.unt.edu/sites/default/files/mlr_jds_aug2011.pdf

Straub, S. (2009). *Governance in Water Supply*. Washington DC: Global Development Network GND .

Syamroy, M. (2011). *Accounting for air and water Resources a case study of West Bengal,* Unpublished Doctoral Thesis, Kolkata: Jadavpur University.

The Himalayan Beacon. (2018, August 30). *Work on Amrit water supply project initiated by Darjeeling Municipality*. Retrieved November 26, 2018, from Youtube : https://www.youtube.com/watch?v=DOHVHLxixjQ

The Indian Express. (2018, August 15). *To tackle water crisis, Rs 750 crore proposal sent to govt: Gorkhaland Territorial Administration*. Retrieved February 19, 2019, from indianexpress.com: https://indianexpress.com/article/cities/kolkata/to-tackle-water-crisis-rs-750-crore-proposal-sent-to-govt-gorkhaland-territorial-administration-5307262/

Vaidya, R. A. (2015). Governance and management of local water storage in the Hindu Kush Himalayas. *International Journal of Water Resources Development* , Vol. 31 (2), 253–268.

Vlachos, E., & Braga, B. (2001). The Challenge of Urban Water Management. In J. A.-G. Cedo Maksimovic, *Frontiers in Urban Water Management: Deadlock Or Hope* (pp. 1-36). London UK: IWA Publishing.

Wang, L. (2017, April 28). *asknature.org*. Retrieved September 9, 2018, from https://asknature.org/strategy/deciduous-trees-allow-higher-seasonal-water-yields/#.W5d1AiQzbIU

Whaley, L., & Cleaver, F. (2017). Can ‘functionality’ save the community management model of rural water supply? *Water Resources and Rural Development* , Vol 9, pg. 56-66.

WHO. (2003). *Iron in Drinking wate- World Health Organization.* Retrieved March 24, 2019, from www.who.int: https://www.who.int/water_sanitation_health/dwq/chemicals/iron.pdf

Wittington, D., Lauria T. D., & Mu, Xingming. (1991). A Study of Water Vending and Willingness to pay for Water in Onitsha, Nigeria. *World Development*, Vol. 19 (2-3), Pg. 179-198

Yeung, J., Gupta, S., & Guy, M. (2019, June 28). *India has just five years to solve its water crisis, experts fear. Otherwise hundreds of millions of lives will be in danger*. Retrieved July 1, 2019, from cnn.com: https://edition.cnn.com/2019/06/27/india/india-water-crisis-intl-hnk/index.html

IMAGE 1: Glimpses of Public water supply in Darjeeling town

Source: Primary Survey, April 2017

Source: Primary Survey, April 2017

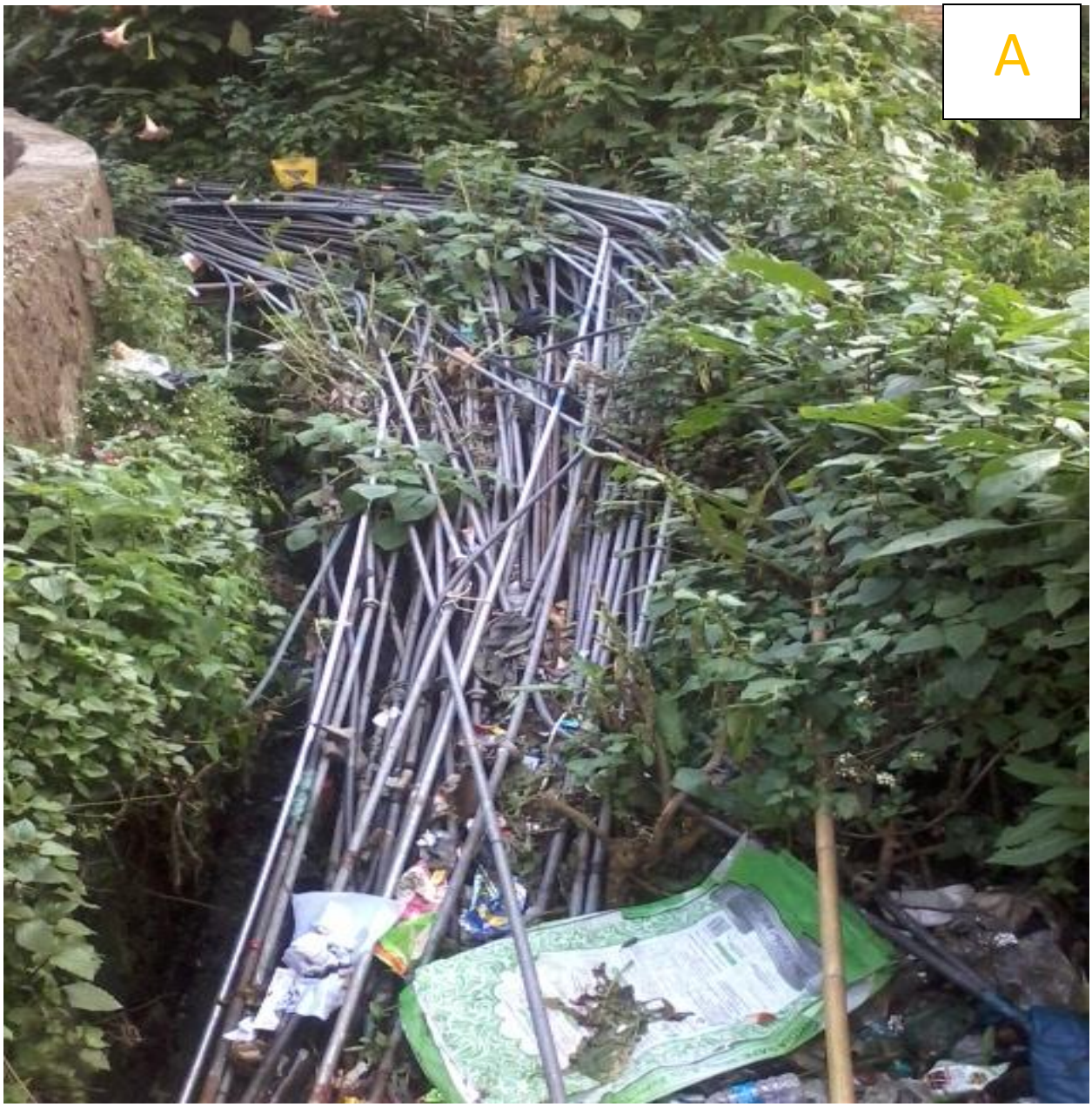
Source: Primary Survey, April 2017

IMAGE 2: Glimpses of Public water supply in Kalimpong town

Source: Primary Survey, June 2017

Source: Primary Survey, June 2017

IMAGE 3: Glimpses of Public water supply in Kurseong town



Source: Primary Survey, May 2017

Source: Primary Survey, May 2017

Source: Primary Survey, May 2017

IMAGE 4: Some Illegal connections from the source inside the forest area

Source: Primary Survey, May 2017

Source: Primary Survey, May 2017

IMAGE 5: Management of water in the towns

Source: Primary Survey, April 2017

Source: Primary Survey, April 2017

Source: Primary Survey, April 2017

Source: Primary Survey, April 2017

Source: Primary Survey, April 2017

IMAGE 6: Cultural aspect of spring water management in the Towns

Source: Primary Survey, April 2017

Source: Primary Survey, May 2017

Source: Primary Survey, January 2018

APPENDIX I

Different Sources of Drinking Water in Darjeeling Hills according to census of India 2011

Area Name	Location of source of drinking water	Total Number of Households	Tap water from treated source	Tap water from un-treated source	Covered well	Un-covered well	Hand pump	Tube well/ Borehole	Spring	River/ Canal	Tank/ Pond/ Lake	Other sources
Darjiling	Total	147,878	42.33	8.40	6.25	14.67	7.25	4.95	13.16	0.16	0.64	2.19
Darjiling	Within the premises	77,315	46.27	5.83	10.62	21.91	9.67	5.70	-	-	-	0.00
Darjiling	Near the premises	40,085	45.40	12.22	1.19	7.90	4.88	3.83	21.31	0.21	1.26	1.80
Darjiling	Away	30,478	28.29	9.90	1.81	5.24	4.23	4.53	35.80	0.49	1.42	8.38
Kalimpong -I	Total	1,523	17.47	1.71	1.51	-	-	0.07	78.59	-	0.39	0.26
Kalimpong -I	Within the premises	206	98.54	0.97	0.49	-	-	-	-	-	-	0.00
Kalimpong -I	Near the premises	945	1.69	1.27	-	-	-	0.11	96.30	-	0.63	0.00
Kalimpong -I	Away	372	12.63	3.23	5.91	-	-	-	77.15	-	-	1.08
Kurseong	Total	3,271	18.22	56.96	0.24	0.03	0.06	-	21.06	1.16	0.64	1.62

Kurseong	Within the premises	651	47.62	51.46	0.77	0.15	-	-	-	-	-	0.00
Kurseong	Near the premises	1,459	11.99	62.23	-	-	-	-	22.55	1.78	1.23	0.21
Kurseong	Away	1,161	9.56	53.40	0.26	-	0.17	-	31.01	1.03	0.26	4.31

Source: Computed from the Census of India, 2011

APPENDIX II

List of Main Distribution Reservoirs and Subsidary Distribution Tanks in Darjeeling Town

Sl No.	Reservoirs	Capacity in Gallons
1	St. Paul's Tank	235812
2	Rockville Tank Iron	56651
3	Rockville Tank Masonry	58012
	Subsidiary tanks	
1	Ghoom lower tank	20000
2	Ghoom upper tank	20000
3	Retreat tank	5000
4	Bloomfield Tank	500
5	Kinchen view tank	400
6	Bhagakul tank	10000
7	Bokshi jhora tank	10000
8	Rose bank lower tank	10000
9	Bhaktay Busty tank	500
10	Clover cot tank	10000
11	North view tank	5000
12	Y building tank	5000
13	Butcher busty tank	5000
14	Meadow bank	10000
15	Old gym khana tank	10000
16	New singamari tank	10000
17	Old singamari tank	10000
18	Goflay tank	20000
19	Chota ging tank	2000
20	Bara ging tank	400
21	Toongsoong tank	10000
22	Toongsoong tank	5000
23	Bhutia busty tank	5000
24	Chowk bazaar fire fighting tank	30000
25	Mt. Verbon tank	200000
26	Mahakal Tank	100000

Source: Darjeeling Municipality, 2015

APPENDIX III

Total Water Demand and Supply of Darjeeling Town

Total population	120000
Total demand	1860000 gallons/day
Water available	527500 gallons/day
Water deficit per day	1332500 gallons/day
Net water available (to public)	637500 gallons/day

Source: Darjeeling Municipality, 2015

APPENDIX IV

Kalimpong Town Water Supply Networks of Tank

Sl No.	Reservoir	Capacity
1	Delo Top Lake (CIVIL)	20 lakh gallon
2	Delo Lower Lake (CIVIL)	40 lakh gallon
3	Tripai Tank	a) 50,000 gallon b) 5000 gallon
4	S D Hospital Tank	a) 20,000 gallon b) 5,000 gallon
5	WHO Tank	25,000 gallon
6	Mission Tank	a) 10,000 gallon b) 25,000 gallon (FIRE TANK)
7	Damber Chowk Tank	10,000 gallon
8	Bagh Dhara Tank	10,000 gallon
9	Chest Clinic Tank	10,000 gallon
10	Seed Farm Tank	10,000 gallon
11	S.D Jail Tank	a) 10,000 gallon b) 25,000 gallon (FIRE TANK)
12	Park Tank	a) 50,000 gallon b) 10,000 gallon
13	Atisa Road Tank	10,000 gallon
14	Bong Barbot Tank	10,000 gallon
15	Ringkingpong Tank	a) 1 lakh gallon b) 50,000 gallon
16	Kalimandir Tank	7,000
17	St. Philomena Tank	5,000 gallon
18	11th Mile Tank	20,000 gallon

Source: PHED office, Kalimpong 2017 Total tank cap= 5.07 lg

APPENDIX V

Water Demand and Supply of Kalimpong Town

Existing House Connection	7306
Existing Annual Tariff Charges	Rs. 300
New Connection Charges	Rs. 5000
House connection Charges	Rs. 250
Present Water Demand	8 lakh Gallons (british period)/ 4.0 MLD (present)
Domestic water demand (projected for the years 2032 & 2047)	70 l.p.c.d (Liters per capita per day)

Source: PHED Office, Kalimpong 2017

APPENDIX VI

Sources of water for feeding the Central Reservoir in Kurseong

Sl No.	Sources of perennial khola (river) and jhoras (spring)	Location	Feeding reservoir
1	Darey khola	Near bagora	Central water reservoir at durpin (Dowhill forest area)
2	Baluwakhani khola (8^{th} mile)	Near sonada	Eagle's craig central reservoir
3	Aringalay khola	Near dilaram	St. helen's central reservoir
4	Sepoydhura khola	Near sepoydhura	St. helen's central reservoir
5	Whistle khola	Near St. Mary's hill	Circular reservoir near church (St. Helen area)
6	Babu khola	Near Gundrukay busty	C.W.R at durpin (Dowhill forest area)
7	Pahwa khola	Near deorali busty	C.W.R at victoria
8	Chittray khola	Near chittray busty	C.W.R at Victoria (dowhill forest)
9	Amaa khola	Near khundrukey busty	C.W.R at durpin
10	Thotay khola	Near tung	Eagle's craig central reservoir

Source: Kurseong Municipality, 2011-2012

APPENDIX VII

Water Scarcity during Summer Months

Total Storage facility during the summer months	3,05,000 gallons/day
Net available	2,89,750 gallons/day
Present population of Kurseong town	40,172
Add floating population per day	2000+
Total	42,172
Average water supply per day	2,89,750 gallons per day
Population served	42,000
For one unit of population	6.90 gallons per day per head
Present demand per day	8,40,000 (42,000 population @20 gallons/per head/per day)
Actual supply available per day during the dry season	2,89,750 gallons
Shortfall during dry period	5,50,250 gallons

Source: Kurseong Municipality 2011-2012

APPENDIX VIII

Approved allocation of Special Central Assistance and expenditure under HADP/WGDP from fifth to seventh plan and annual plan (1990-91)

Hill areas in the State of	Fifth plan (1974-79)		Sixth plan (1980-85)		Seventh plan (1985-90)		Annual plan (1990-91)	
	Allocation/ revised allocation	Expenditure	Allocation/ revised allocation	Expenditure	Allocation/ revised allocation	Expenditure	Allocation/ revised allocation	Expenditure
West Bengal	15.00	15.00	29.85	29.85	44.55	44.55	16.32	16.32

Source: Planning Commission Report on HADP/WGDP, GoI, 2008

APPENDIX IX

Approved allocation of Special Central Assistance and expenditure under HADP/WGDP from eighth to tenth plan and Annual plan (2002-07)

Hill areas in the State of	Fifth plan (1991-92)		Sixth plan (1992-97)		Seventh plan (197-02)		Annual plan (2002-07)	
	Allocation/ revised allocation	Expenditure	Allocation/ revised allocation	Expenditure	Allocation/ revised allocation	Expenditure	Allocation/ revised allocation	Expenditure
West Bengal	19.32	19.32	96.60	96.60	111.15	109.58	121.15	121.14

Source: Planning Commission Report on HADP/WGDP, GoI, 2008

APPENDIX X

Physical and financial progress under AMRUT 2015-2016 (Darjeeling)

Name of ULB	Approved SAAP		DPR (Y/N)	SLTC (Y/N)	Work order (Y/N)	Implementation progress		Amount disbursed till date (in lakh)
	Project Name	Amount				Physical (%)	Financial (%)	
Darjeeling	Water supply project for Darjeeling municipality	20484.71	Y	Y	Y	14		3892.09

Source: State Annual Action Plan (SAAP), 2017-2018 under AMRUT West Bengal

APPENDIX XII

The status of fund release and resource mobilization 2015-16

City Name	Project name	Fund flow						Total fund flow to project	Total spent on project
		GoI		State		ULB/others			
		Approved	Disbursed	Approved	Disbursed	Approved	Disbursed	Approved	Disbursed
Darjeeling	Water supply project for Darjeeling municipality under AMRUT	10242.355	2048.471	9218.12	1843.624	1024. 236	183.98	4076.075	

Source: State Annual Action Plan (SAAP), 2017-18 under AMRUT West Bengal

INTERVIEW SCHEDULE FOR MUNICIPALITY/PHED WATER SUPPLY INCHARGE

Name	
Designation	
Address	
total number of employees	

1	What is the daily requirement of the water within the municipality area?
2	Does this volume satisfy the demand of the people in the town? Yes No If no then how do you manage to provide the water for them_____
3	How many water bodies are there in the towns? How many of them are functional and non functional?
4	How many water storages are there in the town?
5	Does Spring water come under your jurisdiction? Yes/ No explain_____
5	As they are drying up day by day what plans do you have to revive those them?

6	How do you manage to provide the water during the emergencies (lean period/tourist season/natural disasters)?
7	What kinds of obstacle do you face from the public and government and opposition side politicians/councilors regarding the drinking water?
8	What is the average demand of water in the town? And how is the department fulfilling that demand?
9	How does your department manage to supply the water during the lean periods?
10	Is there any waste water treatment plant in the town? YES/NO. If No then what is the reason?
11	Is your system 100% metered? a. YES NO b. If no then why it is not

12	How do you charge for the water?
13	Do you charge differently for the households and commercial sectors? Explain_____
14	What is the reason behind the problem of water management in the hills?
15	How can this problem be solved? And what is the contribution of your department regarding this?
16	Do you provide education and training for the staffs? When and where will this training be held?
17	How can the general public be part of this water management in the Hills?
18	Have you ever organize any awareness programs related to the water conservation and management practices in the town? Please explain.

19	Do you have any water management acts/plans? What are those plans?
20	Do you often monitor the leakage, illegal connection and misuse of water?
21	What do you do if you find the illegal tapping of the water?
22	How many water development projects have been implemented so far in the region?
23	When was it implemented? And has it been successful?
24	If not then what is the reason for not being successful?
25	Did you try to approach the local politicians (govt. /opposition) regarding the drinking water issues?
26	How and when did you approach them and what was their reaction on the above issue?

INTERVIEW SCHEDULE FOR PRIVATE WATER SUPPLIERS (VENDORS)

Name of the Respondent	
Age	
Gender	
Marital Status	
Caste	
Education	
Main Occupation	
Secondary Occupation	
Monthly income	
Address	

1	For how long you've been engaged in this business?
2	From where do you get the water for your business?
3	Is that source reliable throughout the year? YES/NO
4	If no then how do you manage to get the water during that time?
5	What is the quantity of the supply for A) Dry period _____ B) Wet period _____
6	What are the means of water distribution to the households? A) Jerkins/Buckets B) Tanker trucks C) Carts
7	State the average volume and number of household to which water is supplied per day

8	State the average volume and number of commercial/Institutions to which water is supplied per day?
9	How much do you charge for every liter?
10	Did you often increase the price of water? Yes No.
11	If YES then do you notify the buyers about it? what is the way of notification
12	What is the method of collection of money from the households?
13	Is there any problem from the households while collecting the money? Yes No If yes then what are those problems? _____
14	What is the capacity your container?
15	How do you ensure that your container is clean?
16	How many times do you supply in a day? And what is the maximum supply?
17	Who buys the maximum water from you?
18	What is the means of communication through which the customers can contact you? A) Through Phone B) Meet face to face c) Any other means

19	What problems do you face while collecting the water?
20	How do you manage the water in times of scarcity and how much do you charge?
21	How do you manage to get the water during the Tourist season/Strikes/ natural disasters?
22	Have you ever tried to collaborate with the Municipality/PHED regarding the water supply in the town? Yes No If yes then how did they collaborate with you?
23	Did anybody ever intercepted in your work? Yes No If Yes then who are they Administrative Non Administrative
24	What they said and whom did you approach for the help?
25	Have you registered yourself for supplying the water to the households? Yes No If yes then what is the procedure of the registration? If No then what is the reason for not registering?

26	What is the nature of your arrangement for water supply?
27	Are there any competition/ coordination amongst the vendors for water supply?
28	How is your opinion about the water management in the town?
29	Did you try to contact any politicians/councilors of your area regarding the issues of water? Yes No If Yes how did you contact them and what was their reaction?

HOUSEHOLD QUESTIONNAIRE

General Information	
Name of the Respondent:	
Address:	
Ward No.:	
Family type:	

DEMOGRAPHIC CHARACTERISTICS

Sl. no.	Name of the member starting from the head of the household	Relation to head	Age (Years)	Sex (Male/Female)	Marital status*	Educational level
(1)	(2)	(3)	(4)	(5)	(6)	(7)
1						
2						
3						
4						
5						
6						
7						
8						

*Marital status-1=Married 2-Unmarried 3=widowed 4=Divorced/separated

OCCUPATION AND INCOME OF THE HOUSEHOLD

Sl. no.	Worked anytime during last year*	Category of economic activity**	Occupation	Nature of employment#	Income per month (Rs.)	Secondary occupation	Income per month (Rs.)	Total income (Rs.)
(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)
1								
2								
3								
4								
5								
6								
7								
8								

*Main worker- if worked for 6 months or more if worked for 6 months or more) - 1, Marginal worker (if worked for 3 months or more but less than 6 months) - 2, Less than 3 months - 3, Non worker (if not worked at all) – 4

**Cultivator-1, Agricultural labourer-2, Worker in HH industry, other worker-4

#Contractual, Full time, Part time, Self-employed

HOUSEHOLD AND HOUSING CHARACTERISTICS

1	**Religion of the household**	
	A) Hinduism	B) Islam
	C) Christianity	D) Others (specify)
2	**Social group of the household**	
	A) Schedule caste (SC)	B) Schedule tribe (ST)
	C) Other backward class (OBC)	D) Others (specify)
3	**Type of latrine**	
	A) Service	B) Pit
	C) Septic tank/flush system	D) Others (specify)
	E) No latrine	
4	**Bathroom available? (yes/no)**	
5	**How many latrines and bathrooms?**	
6	**Water connectivity in bathroom and latrine? (yes/no)**	
7	**Type of drainage connectivity for waste water**	
	A) Open kutcha	B) Open pucca
	C) Covered pucca	D) Underground
	E) No drainage	
8	**Main source of energy for cooking during the last 30 days (record all mention)**	
9	**Main source of energy for lighting during the last 30 days (record all mention)**	
10	**Water connectivity in the kitchen? (yes/no)**	

11	**Main material of the floor (record observation)**	
	A) Mud	B) Wood/bamboo
	C) Burnt brick	D) Stone
	E) Cement	F) Mosaic/floor tiles
	G) Others (specify)	

12	**Main material of the roof (record observation)**	
	A) Grass/thatch/bamboo/wood/mud etc.	B) Plastic/polythene
	C) Hand made tiles	D) Machine made tiles
	E) Burnt brick	F) Stone
	G) Slate	H) G.I/metal/asbestos sheets
	I) Concrete	J) Others (specify)
13	**Main material of the exterior walls (record observation)**	
	A) Grass/thatch/bamboo etc.	B) Plastic/polythene
	C) Mud/unburnt brick	D) Wood
	E) Stone not packed with mortar	F) Stone packed with mortar
	G) G.I/metal/asbestos sheets	H) Burnt brick
	I) Concrete	J) Others (specify)
14	**Ownership status of this house**	
	A) Owned	B) Rented
	C) Others	
15	**If rented, what is the monthly rent (Rs.)?**	
16	**Owned any other house? (yes/no)**	
17	**What is the use of the house?**	
	A) Residential only	B) Residential cum commercial
	C) Residential cum others	
18	**Does this household have a ration card? (yes/no)**	
19	**If yes, type of ration card**	
	A) Antyodaya	B) BPL
	C) Others (specify)	

20	**Does your household have (yes/no)**	
	Electricity?	A radio/transistor?
	A television?	A telephone/mobile phone?
	A computer/ laptop?	A motor cycle/scooter?
	A car/jeep/van?	A cycle/bicycle?
	A bank account/post office account	

INFORMATION RELATED TO DRINKING WATER

1	**What is the major source of water for your household?**	
	A)Tap water	B)Spring
	D) River	E) Tank/Pond/lake
	F) Other sources	
2	**Where is the location of the drinking water?**	
3	**What is the distance of the source from the residence?**	
3	**How much drinking water you use per day?**	
	A)_____ liter	B) Don't know
4	**What is the frequency of water supply from your main source?**	
	A) 24 hour supply	B) More than once a day
	C) Once a day	D) Once in two days
	E) Once in three days	F) Once a week
5	**Is this frequency sufficient for your need? (yes/no)**	
6	**If No then how do you fulfill your additional requirement?**	
7	**If you use natural springs then how far is that spring?**	

8	**Who usually goes to fetch the water from the spring?** A) Women B) Men C) Children D) Others (specify)
9	**How do you manage to get the water from the spring during the emergency situation?**
10	**If you buy water from the private vendors how many liters do you buy?**
11	**What is the rate per liter/Tank/Jar/Bucket?**
12	**How do you contact the vendor?**
13	**What is the quality of the water purchased from the vendors?** A) Good B) Bad C) Don't Know
14	**16) Please mention the months where you buy the maximum water from the vendor?**
15	**What is the frequency of purchase from the vendor?** A) Daily B) Once a week C) Twice a week D) Once a Month E) Any other_____
16	**When is the Purchase applicable for the season to buy from the vendor?** A)Dry season B) Wet season C) Throughout the year

17	**Is there any shortage of water supply within your household? (yes/no)** **If yes then how do you manage?**
18	**What could be the reason of water scarcity in your household/ Area?**
19	**How are you dealing with the shortage of water in your household?**
21	**Do you pay for water? (yes/no)**
22	**If yes, then how much does you pay?**
23	**Is it paid monthly/quarterly/yearly?**
24	**What is the method of payment?** A)Banking B) In office C) Any other methods
25	**Did the cost ever increased since last year? YES/NO**
26	**Have you been notified of the increase of the costs? YES/NO**
27	**If yes then what is the medium of notification?**
28	**In your house which activities consumes highest water per day?** A) Drinking B) Cooking C) Washing Utensils D) Washing clothes E) Bathing F) Cleaning G) Sanitation

29	**Per capita water consumption in the household (liters/capita/day)** A) < 70 E)145-170 B) 70-95 F) 170-195 C) 95-120 G) > 195 D) 120-145

INFORMATION RELATED TO WATER TREATEMENT, SAVING AND CONSERVATION

1	**Do you treat your water at home? YES/NO**
2	**If yes then how do you treat it?** A) Boil B) Add Bleach/Chlorine B) Strain it through the cloth C)Use a water filter D) Let it stand and settle E) Others_____
3	**How often do you treat your drinking water?** A) Always B) Sometimes D) Never E) Don't know
4	**What is the water saving measures used in your household?**
5	**Are you interested in being informed about saving water at home?** A) Yes B) Maybe C) Not at all
6	**Are there any water-saving measures practiced in the household? (yes/no)**

7	**Where do you store your water?** A) Copper vessel B) Aluminium C) Stainless steel D) Plastic E) Others (Specify)
8	**How often do you clean your drinking water container?** A) Once every day B) 2-3 times a week C) Once a week D) More than once a week
9	**Why do you believe that water conservation in your area is an important issue?**
10	**Does anyone from the local administration have ever invited you to discuss about the problems of water and how it can be managed? (yes/no)** **If yes then how did they invited you?**
11	**Have you ever noticed any public information program on water conservation? (yes/no)**
12	**Would you be willing to participate in the program? (yes/no)**
13	**Would you be interested in attending workshops, or volunteering in water related activities in your area? (yes/no)**
14	**Why do you think it would be a good idea to conserve water?**
15	**Do you know about rain water harvesting and how it helps to solve the water problem?**

16	**Is there any NGO's who is working on water issues in your area? YES/no** **If yes please mention the name of the NGO_____**
17	**Do you know any Religious/Social groups who are working on water in your area? YES/NO** **If yes then please mention what are they doing?**
18	**Have you ever participated in water management within your community? (yes/no)**
19	**If yes how many members are there _____**
20	**What work do they do related to the drinking water in your area?**
21	**Do you have any fight related to water? (yes/no)**
22	**If yes then please mention the reason for the fights_____**
23	**How do you solve those fights?**

INFORMATION RELATED TO COMPLAINTS DONE AND ACTION TAKEN BY THE AUTHORITY

1	**Who provides you with the drinking water in your household/area?**
2	**Has the water supply pipes and taps broken down in the past one year? (yes/no)**
3	**If yes, how frequently it has been broken?** A) Once a week B) Once a fortnight C) Once a quarter D) Once in six months E) Once a year
4	**Is the Public tap fixed promptly when it breaks down? (yes/no)**
5	**Have you made a complaint related to your drinking water service in the past one year? (yes/no)**
6	**What is the complaint and to whom did you complain?**
7	**What was the result of the complaint?** A) Prompt action taken B) Delayed action taken C) No action taken
8	**Are you satisfied with your drinking water service?** A)Extremely satisfied B) Moderately satisfied C) Not satisfied at all
9	**What are the reasons for your satisfaction?**

10	**What are the reasons for your dissatisfaction?**
11	**Have you paid extra money for any service related to drinking water in the last one-year? (yes/no)**
12	**For what purpose have you most recently paid that money?** A)To get the new connection/ access water supply B) To finish the repair work C)Any other_____
13	**How much did you pay? (Rs.)**
14	**Was that money demanded (or did you pay on your own)?** A) Demanded B) Paid on my own
15	**Did the work get done after paying that money? (yes/no)**
16	**Would you be willing to pay more for the better accessibility of the water? (yes/no)** Explain_____
17	**According to you which part of water supply really needs up gradation? (Record all mention)** A)Quantity G) Service Quality B) Quality E) Maintenance C) Pressure F) Others_____ D) Rate E) Reliability F) Billing System

18. How would you rate the current public water service in your area?					
	Excellent	Very Good	Good	Poor	Very bad
Purity					
Color					
Taste					
Pressure					

INFORMATION RELATED TO DRINKING WATER AND HEALTH

1	**What is the Quality of your domestic tap water?**
2	**Did you/children suffer from drinking-water related diseases last year?** A) None B) < 5 times C) 5- 10 times D) > 10 times
3	**How many times were you/children diagnosed of drinking-water related diarrhea by doctor in 2016? _____times**
4	**Do you think above-mentioned diarrhea was associated with drinking water habits? (yes/no)**
5	**Did you face any diseases related to drinking water besides diarrhea? (yes/no)**
6	**If yes then what are those diseases?**
7	**In which season do you have severe drinking water related diseases?** A) Winter B) Rainy C) Summer D) Spring/Autumn
8	**Have you ever had any medical problems in your area connected with bad quality of drinking water?** A) Never B) Very seldom C) Quite often D) Don't know

9	**Did you complaint to your respective authorities about the quality of the water? (yes/no)**
10	**If yes then who do you complaint and what response did they give?**

INTERVIEW SCHEDULE FOR FOCUS GROUP DISCUSSION (FGD)

Name of the Respondents	
Age	
Gender	
Marital Status	
Caste	
Education	
Monthly income	
Address	
Name of the Community	
Number of the members	

1	How was your community formed?
2	What is the source of drinking water in your community? How do you manage it?
3	Who are the Principle members of your community?
4	How does your community cope up during drinking water problem? Explain _____
5	In what ways do you think that the situation of your town can be improved if you participate in water conservation and management along with the municipal/PHED authorities?
6	Do you think the water conservation and management is important? Why?
7	How does your community managed to get the water during shortages/ strikes/ natural disasters?
8	Have you tried to contact the politicians/councillors of your area regarding the issue of water? What was their reaction?

9	Does your representatives ever met with the government and non government authorities regarding the complaint on the water related issues? What was the reaction of those authorities?
10	How many women are there in your community?
11	Do women attend community meetings? YES/NO If No then what are the reasons for not attending?
12	Do you think the role of women is important for the water conservation and management?
13	In your opinion how women can be involved in water conservation and management? Explain? _____
14	Is there any conflict amongst the community over the drinking water issues? How do you resolve those conflicts?
15	What are the challenges facing by the community to participate in water resource management in your area?
16	Have you joined any kinds of seminars/workshops organized in your area to aware local people about the importance of water and its conservation? YES/NO If yes then who organizes these seminars/workshops? And where is it organized in your area?

17	Did you tried to approach the municipality/PHED regarding the water management in your area? YES/NO If YES then what was their reaction?
18	Are you satisfied with the overall services that the municipality/PHED has provided regarding the water? YES/NO If no, what changes you would like to have/suggest to improve the services?
19	What would you like to suggest other communities over water management?

INTERVIEW SCHEDULE FOR MEMBER OF THE LEGISLATIVE ASSEMBLY- MLA (EACH TOWN)

Name	
Designation	
Age	
Address	

1	Why do you think there is water problem in the town? What is the reason?
2	What can be done in order to minimize the water problem?
3	What kinds of pressure do you face from the public and other politicians/councilors regarding drinking water?
4	As a member of the legislative assembly what are your efforts to overcome this problem?
5	Who is responsible for water management in the town?
6	How can a common people be a part of the water management/conservation in their area?
7	During your tenure did you try organize any kind of awareness program for the local people about the importance of the water and its conservation?

8	What do you think about the leakage, illegal connection of water? What should be done in this situation?
9	How many water projects have been implemented so far? Has it been successful if no then what do you think is the reason for not being successful?
10	Did you try to approach the local people, municipal/ PHED officials and the state authorities regarding the drinking water issue? When did you approach and what was their reaction?
11	Do you think that there is some special connection in the town? How can it be curbed?
12	Some people cannot have access to the drinking water while some are getting enough how can we balance this situation?
13	As the member of the legislative assembly what have you done and what can you do in order to solve the drinking water problem in your town?
14	In the next assembly meeting what are you going to propose regarding the drinking water problem of your town?
15	What messages do you want to give to the people of your town regarding the drinking water?