

## Hill Women-led Spring Water Management in Darjeeling Himalayan Region, West Bengal

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**Abstract:** Water crises is a major problem of Darjeeling, West Bengal, India where rainfall is plentiful. Darjeeling gets only one-third of its daily water requirement through municipal pipelines. The water supply network is mostly town centred so the peripheral areas are deprived of water. Private suppliers also supply water at Rs. 300/- per month per household. Darjeeling Municipality established in 1850 has a centralised water management infrastructure laid down between 1910–30. The water supply system originates in Senchel Wildlife Sanctuary, located 15 kilometres upstream of Darjeeling with two lakes and a storage of 33 million gallons of water that is recharged by 26 springs. This centralised system fails to acknowledge the vibrant 90 odd natural springs in the town that people are dependent upon. These urban springs have diverse community-based management systems that have evolved over time and are now facing challenges of rapid urbanisation, market forces, upstream concretisation and contamination and reducing discharges. Due to deforestation which is leading to high runoff resulting to less recharge of groundwater. Women, are worst hit, as they have to travel miles to fetch water in this rugged terrain for her family while their male counterpart are busy to make both ends meet. Every household maintains a kitchen garden whose water is also being procured by females through irrigation. Rooftop rainwater harvesting is the imperative way to mitigate the water crisis. Moreover, reuse, recycle and reducing wastage will help to mitigate this water crisis.

**Keywords:** Jhora (spring), Discharge, Rainwater harvesting, Reuse, Recycle, Deforestation

### 1. Introduction

Water is an essential natural resource for human existence. A safe and reliable supply of water is one of the most basic of human needs and is an important lifeline in any urban area. There is a multi-interest utilization of water resources everywhere as water is needed for virtually every human endeavour.

Covering an area of 4.85 square miles, the town of Darjeeling is supplied with water from 26 springs (Jhoras) situated in the Senchel wildlife Sanctuary [1]. Collected in large conduits which bring water on gravity to the storage reservoirs at Senchel namely 'North Senchel and South Senchel Lake' (Darjeeling Municipality Website, <https://darjeeling.gov.in/public-utility/darjeeling-municipality/>) [2]. There are 85 natural springs available within Darjeeling Municipal Area. The Darjeeling Municipality website mentions a list of 85 Jhoras in Darjeeling Municipal area. The number of Jhoras remains contested. For instance, [3] mention that there are 7 main Jhoras, 27 minor Jhoras and about 65 km of roadside drain within the municipal area, which starts from Jaldhapara spur and joins different streams down below. These springs provide about 20,000 gallons of water per day to the residents of the town [4]. Several other drains have emerged and many subsumed, diverted and blocked dry recently due to the increased encroachment for building houses, shops, pavements, dumping garbage etc. These are of concretized encroachments on the natural pathways of water. The natural flow of these drains and outlets is severely constrained by human activity. Naturally, during monsoons the pressure is felt in and around these pathways of water resulting in landslips, drain bursts etc. Also, during dry season these natural pathways of water are conveniently used as dumping zones by the people and also the Municipality. Drinking Water being a State subject, it is States, who plan, design, approve and implement drinking water supply schemes. Government of India supplements the efforts of the States by providing technical and financial assistance.

## 2. Statement of the Problem

Darjeeling Himalaya, West Bengal, India is rich with water coming from plentiful rains in the monsoon and snow fed rivers passing the land. Yet, in this water rich region there is water crisis which has been seen in the Darjeeling, Kalimpong Municipality, Kurseong Municipality and Mirik reports.

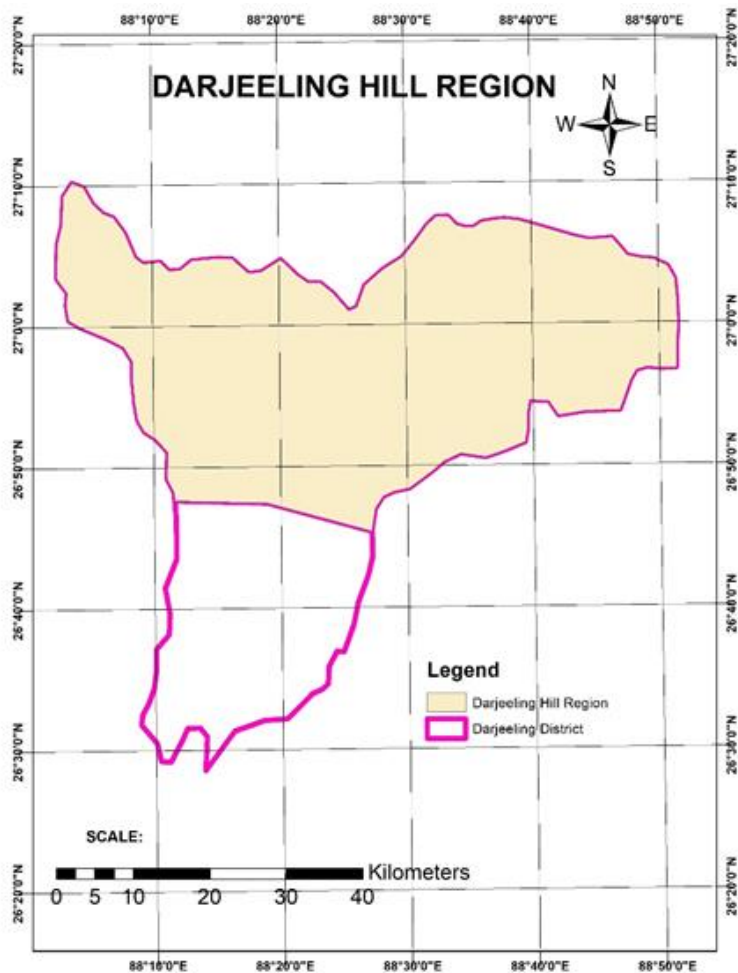
### 2.1 Materials and Methods

The population data has been downloaded from district census handbook of Darjiling district. The count of springs in Darjeeling District and Kalimpong District has been procured from Jharnadhara website. The district map of West Bengal has been used for delineation of study area in Arc Map 10.1 version. The graphs have been prepared on the basis of calculation, done manually, in Excel.

## 3. Delineation of the Study Area

Darjeeling is located at an average elevation of 2128 m in the Darjeeling Himalayan hill region on the Darjeeling-Jalapahar range that originates in the south from Ghum. The range is Yshaped with the base resting at Katapahar and Jalapahar and two arms diverging north of Observatory Hill. Darjeeling is a popular and a hill station in the state of West Bengal. Darjeeling is actually a widespread district although the popular Darjeeling hill town is the

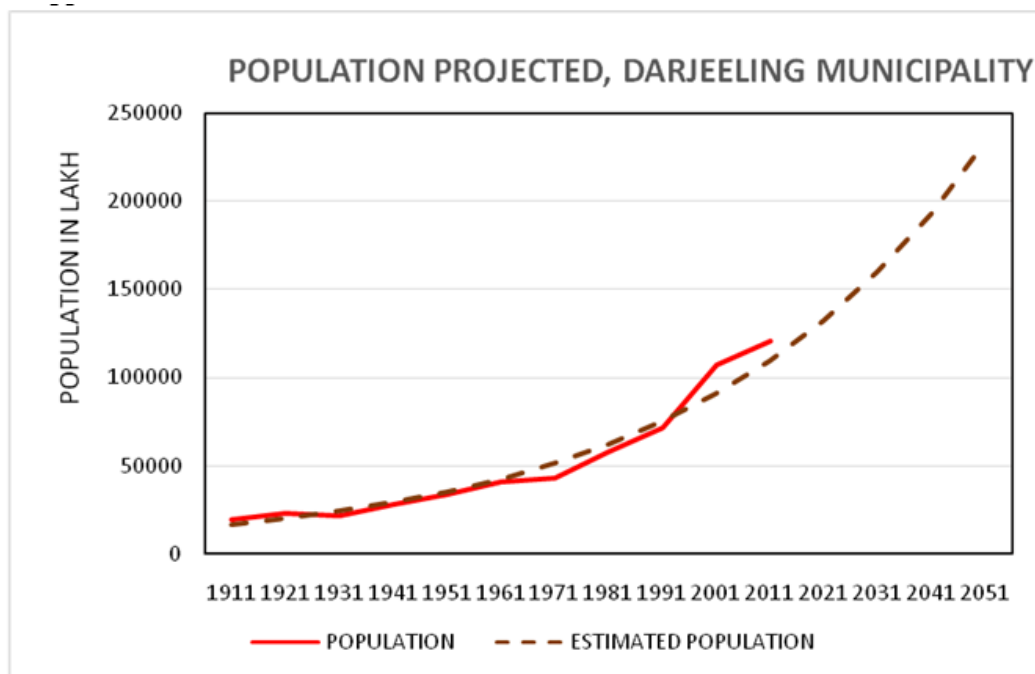
nucleus of the place. The name 'Darjeeling' came from the Tibetan words 'dorje' meaning thunderbolt (originally the scepter of Indra) and 'ling' is a place or land, hence 'the land of the thunderbolt'. With its temperate climate, magnificent nature and happy smiling faces all around, Darjeeling came to be called as Queen of the Hills. While the hill town is quite small (about 10.4 km<sup>2</sup>). Known for its scenic beauty, snow-clad Himalayas, and tea gardens, Darjeeling is frequented by tourists from all over the country as well as from around the world. Especially during the summers, the place is a preferred destination due to its pleasant weather [5].



**Figure. 1.** Map of the Study Area (Darjeeling Hill Region)

Darjeeling Municipality is one of the oldest municipalities in India being established in 1850. The municipality in 2011 had a population of 120000 living in 13.81 sq km. Darjeeling is located at an average elevation of 6,982 ft (2,128 m). The annual total rainfall in Darjeeling town fluctuates between 1870-3690 mm.

Kalimpong is an important town in the Darjeeling Himalaya with a population size of 49,403 (Census 2011) and spread over 23 wards in 3.5 sq km. The town centre is located on a ridge connecting two hills, Delo and Durpin at an elevation of 1247m and 1704m. The River Teesta flows in the valley below separating Kalimpong from the state of Sikkim. The town is a major hub for the agricultural communities of the sub-division and used to be the gateway to Tibet. The town is different from Darjeeling in that in all directions the town merges seamlessly with agricultural communities. The water source for Kalimpong municipality is the Neora forest, which is 86 km away from Kalimpong. Water brought from there is stored in a reservoir at Deolo and then supplied to the town [6].



**Figure. 2.** Projected Population in Darjeeling Municipality Area

[Source: Census Report, 2011] [2]

Population growth and demographic change have played a determining role in the process of urbanization in Darjeeling town. The density of population per square kilometre of Darjeeling town was 2,675 in 1951, which went up to 6,912 per km<sup>2</sup> in 1991 and from there to 10,141 per km<sup>2</sup> in 2001 and substantially increase to 11,240 per km<sup>2</sup> in 2011. As per the 2011 census, the Darjeeling town urban agglomeration with an area of 10.57 km<sup>2</sup>, has a population of 1,18,805 persons. Also, the town has an additional average diurnal floating population of 20,500 - 30,000, mainly comprising of the tourists and visitors. The town houses about 31% of its population in the slums. This is the result of the unprecedented urban growth due to the unsustainable migration in the area (mainly the low-class wage earner) for better opportunity.

The colonial town of Darjeeling, the oldest Municipality in the hills and formed in 1850, was designed for a mere population of 10,000. So, the population spurt has made the town more prone to the environmental problems in recent decades as the region is geologically relatively new with hosts of environmental problems and hence unstable in nature.

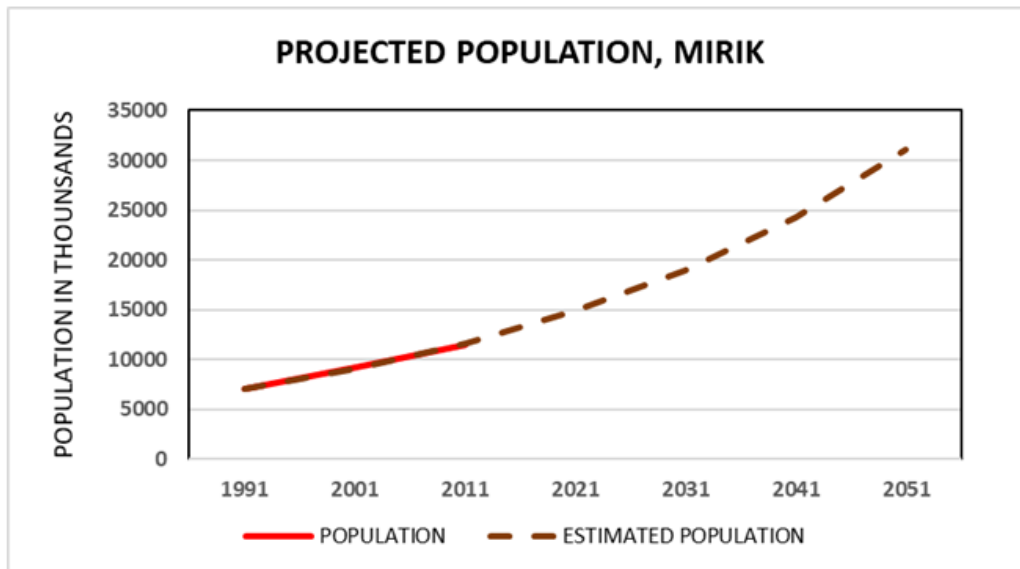


Figure 3. Projected Population, Mirik

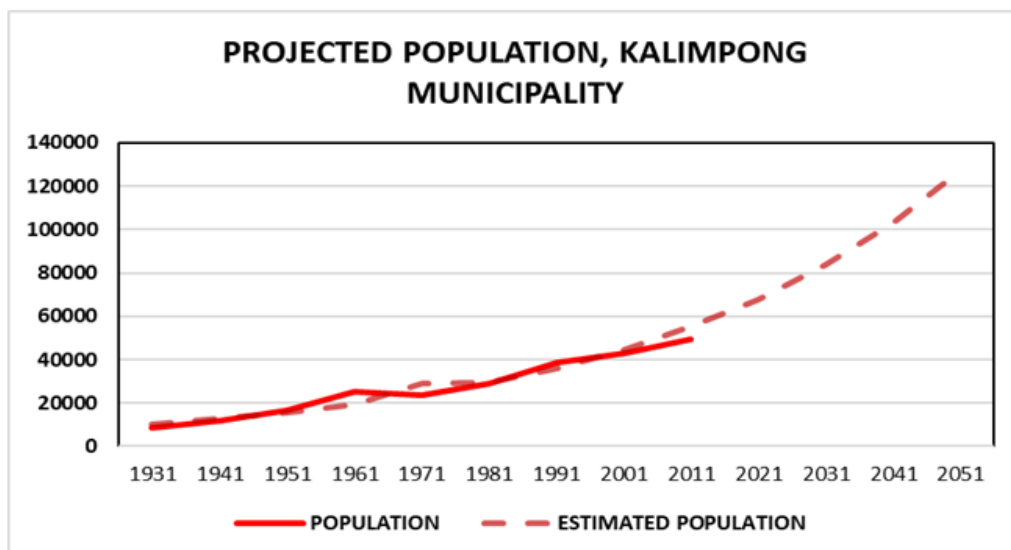
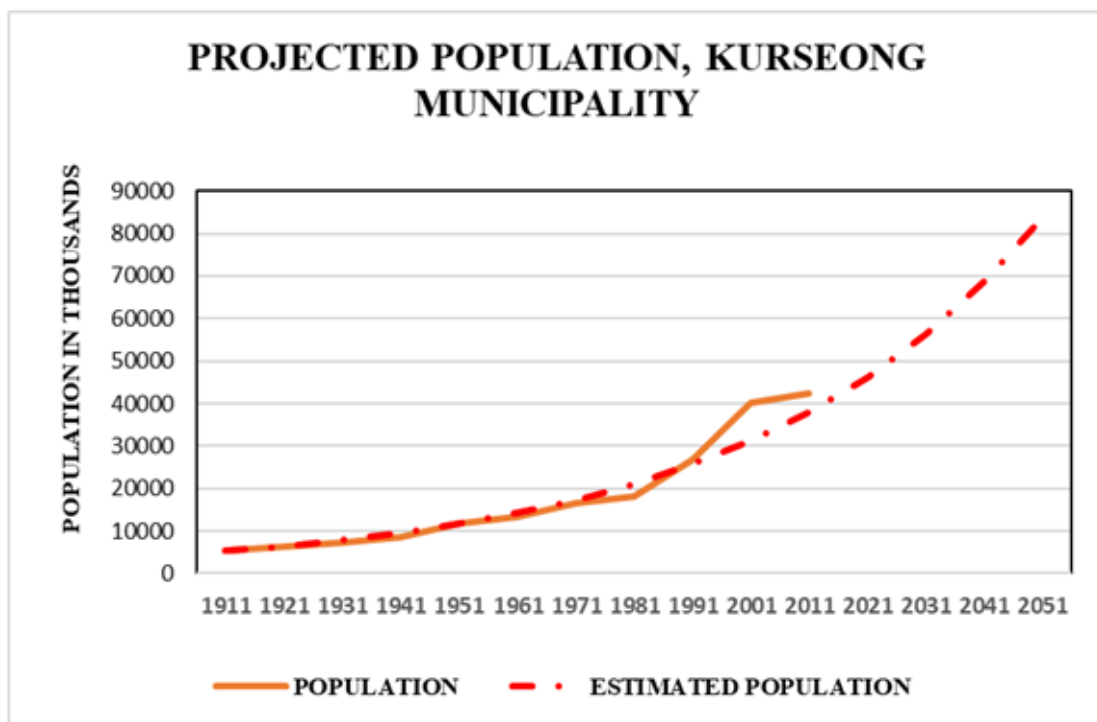


Figure 4. Projected Population, Mirik

[Source: Census Report, 2011] [2]



**Figure 5.** Showing Projected Population of Kurseong Municipality

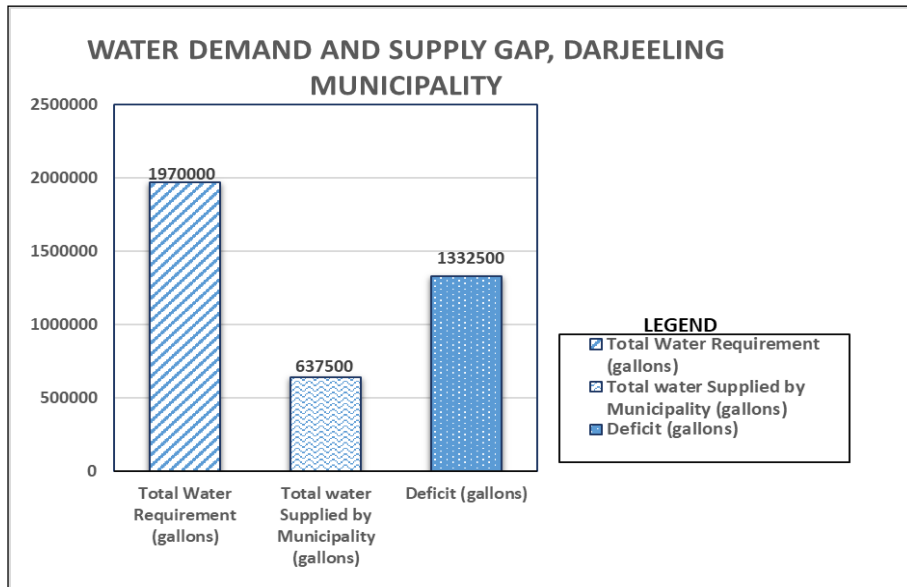
[Source: Census Report, 2011] [7].

Environmental degradation has adversely affected Darjeeling's appeal for tourists. It is observed that in 1901 merely 16,924 persons only used to live in Darjeeling town. But at present the urban population in Darjeeling town has reached to 1,18,805 persons during 2011 census period. which happens to the loss of water in transmission from Sanchel lakes to the 11 township is around 30-35 per cent of the water supplied. The crisis has meant a spin off a lucrative private water trade of over 120 tankers, hand pushed carts, water carriers and private pipe lines from different water sources. Mirik, a notified area authority municipality, also falls in this Darjeeling Hill region. It also exhibits a increase in population as depicted in the graph. It has to build its infrastructure to accommodate the rising population thereby providing the residents all necessary amenities especially water.

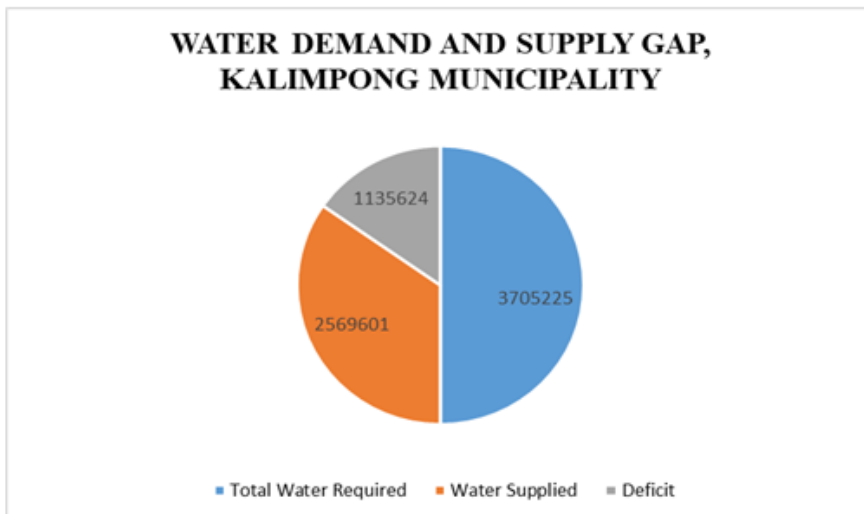
Kalimpong town is a major tourist hub where several homestays, hotels and lodges have come up in the last few years. These commercial units require almost 10,000 to 12,000 litres of water daily. To make explicit the stress, the per day urban water deficits are 13,32,500 gallons in Darjeeling; 3,00,000 gallons in Kalimpong.

**Table 1.** Total Water Demand and Supply Calculation of Darjeeling Municipality

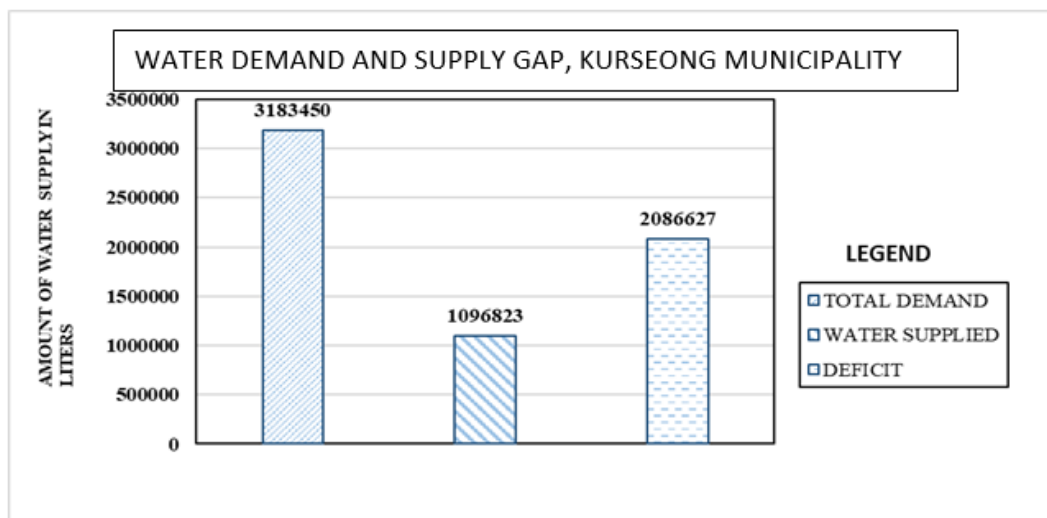
Total Water Requirement (gallons)	Total water Supplied by Municipality (gallons)	Deficit (gallons)
1970000	637500	1332500



**Figure. 6.** Water Demand and Supply Gap, Darjeeling Municipality  
[Source: News report and complied by author]



**Figure. 7.** Showing water demand and supply gap, Kalimpong Municipality[8]  
[Source: News report and complied by author]



**Figure 8.** Water Demand and Supply Gap, Kurseong Municipality[8]

[Source: Kurseong Municipality]

**Table 2.** Showing intake of water from springs, Darjeeling, Source

Intake of Water	Capacity (gallons/day)
Reservoir of Sinchel Lakes	3,36,000
Pump from KhongKhola	75,000
Springs from Rambhi catchment area	1,50,000
Boxijhora	12,000
Laldihiki, Bhyaguldhara, Bhotedhara, Giridhara Springs	20,000
Total	6,17,000

[Source: Chettri, 2016] [9]

The daily water requirement of the town is about 19,70,000 gallons. The municipality supplies around 6,37,500 gallons of water and the town experiences a water deficit of about 1,33,25,000 gallons per day. Darjeeling Town has over 85 springs.

Kalimpong Municipality also suffers from the same water crisis. The water is available only two to three days a week. The three main sources at NeoraKhola, Relli and Thukchuk have dried up. Earlier, Deolo reservoir, fed by these streams, always had about 8 lakh gallons of water. But for the past 15-20 days it has come down to 3.5 lakh gallons to 5 lakh gallons [5].

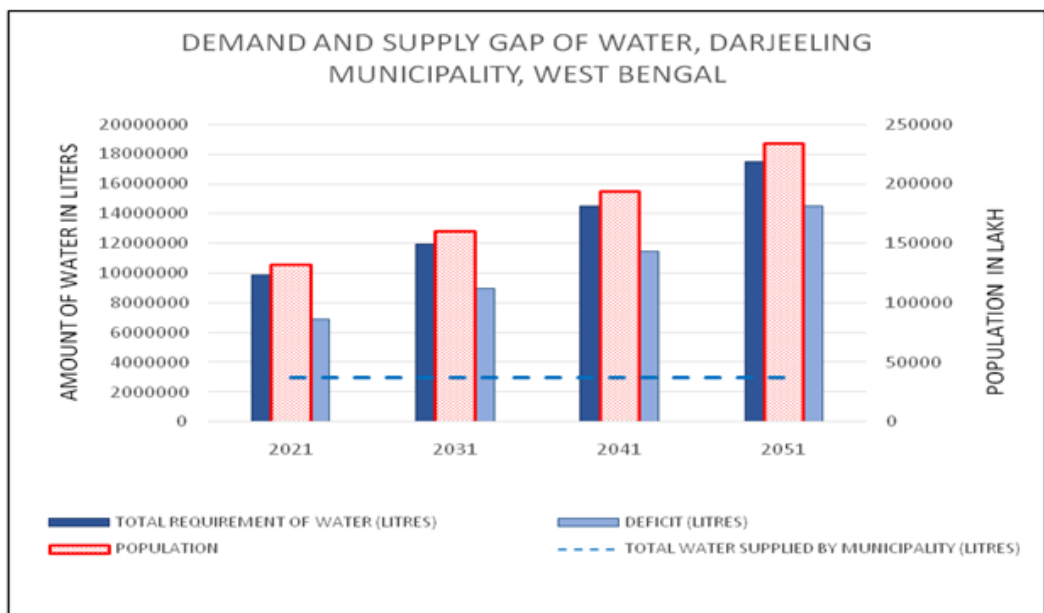
The above table shows the increase in water demand and supply gap with increasing population which calls for a proper planning of water supply by identify the alternative sources like rain water harvesting as this region receives maximum amount of rainfall.



**Table 3.** Showing Number of Gram Panchayats and Springs in Darjeeling and Kalimpong Districts Source: [6]

Sl. No.	Name of District	Name of Block	No. of Gram Panchayat	No. of Springs
1	Darjeeling	Darjeeling Phulbazar	23	134
		JorebunglowSukhiapokhari	16	79
		RangliRangliot	11	51
		Kurseong	14	100
		Mirik	6	17
2	Kalimpong	Kalimpong-I	18	126
		Kalimpong-II	13	71
		Gorubathan	11	38

[Source: Jharnadhara,2018] [11]



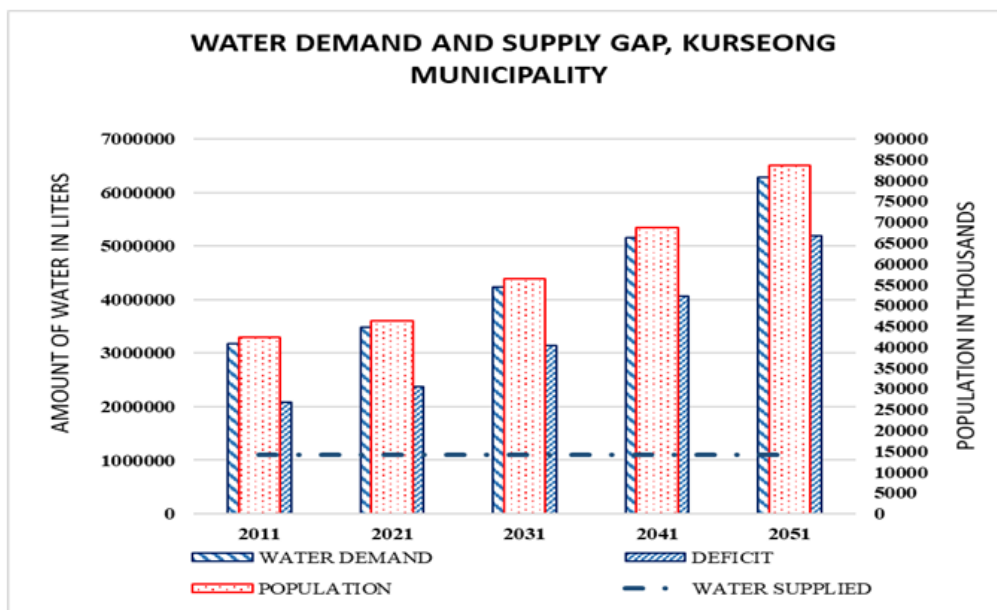
**Figure 9.** Water Demand and Supply Gap, Darjeeling Municipality[2]

[Source: Darjeeling Municipality and compiled by author]

**Table 4.** Showing estimated water demand and supply gap, Darjeeling Municipality [9]

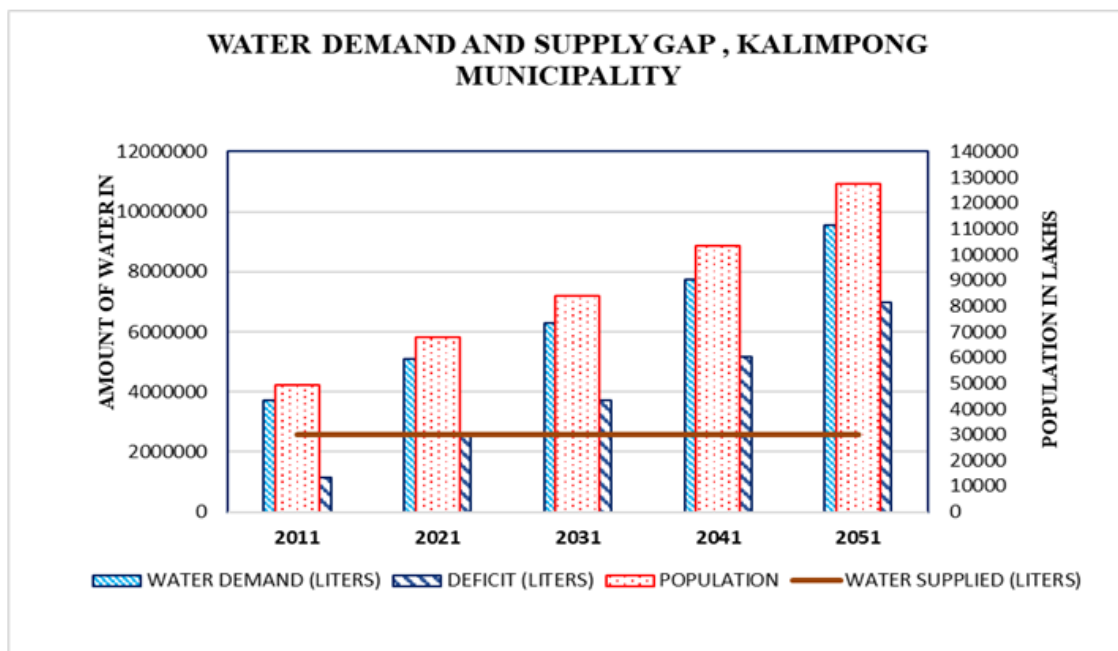
Year	Population	Total Requirement of Water (litres)	Total Water Supplied by Municipality (litres)	Deficit (litres)
2021	132045	9903375	2998132	6905243
2031	159685	11976375	2998132	8978243
2041	193111	14483325	2998132	11485193
2051	233535	17515125	2998132	14516993

[Source: Darjeeling Municipality and compiled by author] [2]

**Figure10.** Showing estimated water demand and supply gap, Kurseong MunicipalitySource: [Source: Kurseong Municipality and compiled by author] [7]**Table 5.**Showing estimated water demand and supply gap, Kurseong Municipality Souce: [8]

year	population	water demand (liters)	water supplied (liters)	deficit (liters)
2011	42446	3183450	1096823	2086627
2021	46366	3477450	1096823	2380627
2031	56462	4234650	1096823	3137827
2041	68756	5156700	1096823	4059877
2051	83727	6279525	1096823	5182702

[Source: Kurseong Municipality and compiled by author]



**Figure 11.** Showing estimated water demand and supply gap, Kalimpong Municipality

[Source: Kalimpong Municipality and compiled by author] [8]

From the above table it is clear that the water demand will rise with increase in population over the years keeping the present supply as constant. The water demand is huge and its high time when alternative sources of water needs to be identified. Rain water harvesting can be one of the solutions to this problem along with establishment of treatment plants for treating waste water and then supplying the same as done in Singapore [10].

This is clear from above table that the demand for water will escalate with the increasing population, so this is time for proper planning how to solve the problem of water crisis.

**Table 6.** Showing estimated water demand and supply gap, Kurseong Municipality

Year	Population	Water Demand (liters)	Water Supplied (liters)	Deficit (liters)
2011	49403	3705225	2569601	1135624
2021	67915	5093625	2569601	2524024
2031	83760	6282000	2569601	3712399
2041	103301	7747575	2569601	5177974

2051	127401	9555075	2569601	6985474
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## 5. Water Management Approaches

### 5.1 Conceptualising and demonstrating the decentralisation of water management

The decentralisation water supply system rests on the existence of several natural springs scattered over the length and breadth of the town. These natural springs has varied water availability, accessibility and ownership thereby promoting varied instances of decentralisation which in the recent times has proved to be the most feasible model of water management system in many parts of the town. The decentralization of water resource management has become one of the most susceptible and intervening act to take on the situation of water crisis in Darjeeling municipal area. Decentralization brings in competent provisions among the stakeholders and promotes the equitable allotment of the spatial distribution of natural springs is highly uneven and exhibits varied accessibility tendencies in different wards.

### 5.2 Women Participation

There is a long history of women's involvement in local organizations. Participation in community managing work as part of the "triple role" of women (along with their reproductive and productive roles), and notes that this has formed the basis for many welfare approaches to women (e.g., mothers' clubs, provision of relief, or community services such as domestic water supply or health care) that treat women's organizations as an extension of their domestic roles. Other literature and efforts to organize women have focused on information and political empowerment. Female networks may be important, especially where male and female social networks are highly segregated. Women play a pivotal role in garnering water for her family.

### 5.3 Decentralised Water Management Through Community Initiatives

Community led initiatives have always been attempted to decentralise the water management system in Darjeeling town. The people from different ethno-religious background have always come together to efficiently solve the problems of their locality and the issues of water crisis is one of them. Darjeeling town basically consists of a class-less, cosmopolitan society where people from different castes, creeds and colours share equal social status, together recognised as the Gorkha community. Gorkha are basically the hill people and are often recognised as Nepalese in Darjeeling. The Gorkha community is an intricate blend of various tribes and ethnic groups, coming from different religious and cultural backgrounds. Samaj are self-funding and basically run for the social welfare and upliftment of the community itself. It is a social organization where people sharing similar needs, area and village identity come up together to help each other in hours of need. The Samaj has made efforts to ensure

equitable water resources are a natural extension of the purpose of samaj. Many samaj are taking care of springs and are utilising the available water for non-centralised distribution system.

The Water Carrier Porters ('Coolies') and water carriers who are locally referred to as 'bhariya', 'namley' 'bharibokney' in most cases hail from Nepal and Indo-Nepal border areas. These water carriers supply in jerry cans to individual houses and both men and women are engaged in this business.

There is a definite need for a water policy for better management of springs that communities depend upon. This policy needs to bring in equity and social justice at all levels.

## **6. Conclusion and Suggestions**

Few research papers have been review and the following suggestions have been jotted down which are as follows:

- In hilly terrain of Darjeeling area, water supply is mainly based on spring water. Considering the water crisis during summer months, rainwater and spring water conservation at proper locations in different types of reservoirs are to be encouraged and is to be utilized with proper treatment.
- There is need of improvement for old and complicated water distribution system for this, realignment of the main supply line is needed under the supervision of an expert engineer.
- A washerwoman, from Kalimpong at Bagdhara, has to walk 3.5 km everyday to wash the clothes which she is doing for the last three years.
- Illegal connections /leakages can be solved by laying alternative pipelines at such locations and it should preferably be laid with sufficient soil cover from top to avoid illegal tapping.
- The local authority and the local NGOs should work together to detect the number of households unknowingly drinking contaminated water due to lying of their pipe line under the drain and they should be provided with potable water.
- Renovation work of the pipeline needs to be undertaken to stop wastage due to leakage [12].
- Waste water may be treated and supplied which demands for well-equipped treatment plant, as done in Singapore [10].
- Water from kitchen may be used for gardening, washing cars and flush.

Thus, this is high time when we should come together to solve the water crisis of the Mountainous region like Darjeeling Hill Region which receives plenty of rainfall. Most imperative task is to reduce wastage of water and reuse the water in most effective way.

## References

- [1] <http://dm.gensoftindia.co.in/assets/Jhoras.aspx>
- [2] Darjeeling Municipality (2011). Darjeeling Municipality. Darjeeling, West Bengal
- [3] Joshi, D. (2014). Feminist solidarity? Women's engagement in politics and the implications for water management in the Darjeeling Himalaya. *Mountain Research and Development*, 34(3), 243-254. <https://doi.org/10.1659/MRD-JOURNAL-D-13-00097.1>
- [4] Rasaily, D.S. (2014). Darjeeling PahadkaNagarpalikaKshetra ko Vikas raKhane Paani Ko ItihaasSanchipta ma, San. 1835–2012.
- [5] Sharma, G., Namchu, C., Nyima, K., Luitel, M., Singh, S., & Goodrich, C. G. (2020). Water management systems of two towns in the Eastern Himalaya: case studies of Singtam in Sikkim and Kalimpong in West Bengal states of India. *Water Policy*, 22(S1), 107-129. <https://doi.org/10.2166/wp.2019.229>
- [6] Ravidas Rajeev. (March 22). Water every three days - Kalimpong supply hit, sources infected with bacteria, The Telegraph Online <https://www.telegraphindia.com/west-bengal/water-every-three-days-kalimpong-supply-hit-sources-infected-with-bacteria/cid/446849>
- [7] Kurseong Municipality. (2011). Indo-Swedish Project & Water Suply. [12] Kurseong Municipality
- [8] <https://kalimpong.gov.in/about-district/>
- [9] Chhetri, A., & Tamang, L. Decentralization of water resource management: issues and perspectives involving private and community initiatives in darjeeling town, west bengal.
- [10] Ramesh, M. (2021). *Watershed: How We Destroyed India's Water and How We Can Save It*. Hachette UK
- [11] Sharma Ashwani, (2020). From 'water-starved' to 'water-surplus': Shimla's success story inspiring other Himachal towns. *Citizens Matters Magazine*. <https://citizenmatters.in/conservation-and-increased-availability-of-water-in-shimla-and-himachal-towns-19442>

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