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DOMESTIC WATER SOURCES IN AIZAWL CITY

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ABSTRACT

The water needs of the hilly people for generations have been met by natural sources of water. Traditionally, Tuikhur (i.e., water seepages accumulated in artificially fabricated reservoirs and springs water collected in artificial tanks) on the hill slopes and collection of rainwater is used as the main source of drinking water in Aizawl. With increasing population, traditional source of water became progressively inadequate for fulfilling the water needs of the people. Despite the area is gifted with abundant rains, the major portion of it goes waste in the form of surface runoff due to high relief and steep slopes. At present, the capital of Mizoram faces water crisis and despite piped water supply scheme, the quantum of water supplied is far below the civic standards. The present study aims at to get information of households' different means of access to water supply to meet their daily requirements.

Keywords: *Tuikhur, House Connection, Rainwater, Source of Water.*

Introduction

Water is clearly the single biggest crisis facing in the study area and the stress is very much revealing. In fact, from being a necessity, water has now become a luxury in the city. With pipes running empty, the city is turning into villages providing water by small services. Rapid pace of urbanisation has led to drying up of traditional water sources, like *tuikhur*, stream, rainwater harvesting. Therefore, to meet their daily requirements people use different water sources. Natural water sources are available on both the eastern and the western slopes of the study area. However, due to increasing population, natural sources of water became progressively inadequate to fulfill the daily water requirements of the people. In addition, most of the natural water sources are becoming seasonal or the yield reduced considerably due to the neglect of the recharge area. Thus, most families are subjected to heavy rationing of water for domestic purpose, especially during the dry winter season. This is a stress period where people have to queue up long hours to fetch water from limited water sources.

Literature Review

Access to safe drinking water is indicated by the number of people using proper sanitary sources. According to WHO and UNICEF (2000) standards minimally acceptable water access consists of having a source of abundant, safe drinking water within 200 m. As of 2000, it has estimated that one-sixth of humanity (1.1 billion people) lacked access to any form of improved water supply within 1 km of their home. Access to water services forms a key component in the UNDP Human Poverty Index for developing countries (UNDP, 1999).

As many as 500 million urban residents have inappropriate access to water services or experience water scarcity (USAID and PADCO, 2001). The World Bank (2001) reports stated that 25 per cent of the urban population of Latin America and 60 per cent of the urban population of Africa are not connected to official utility networks and rely on alternative sources for their water supply. Low-income families that construct dwellings at the urban fringe far removed from main trunk lines, providing adequate supplies of safe water will remain one of the biggest urban challenges in coming decades (Howard and Bartram, 2005).

In 2004, about 3.5 billion people worldwide (54 per cent of the global population) had access to piped water supply through house connections. Another 1.3 billion (20 per cent) had access to an improved water source through other means than house connections, including standpipes, water kiosks, protected springs and protected wells. Finally, more than 1 billion people (16 per cent) did not have access to an improved water source, meaning that they have to revert to unprotected wells or springs, canals, lakes or rivers to fetch water (World Bank, 2004).

Globally, 1.1 billion people lack access to improved water supply, and 2.6 billion are without improved sanitation. Most of these live in rural areas, but the number of urban dwellers without adequate water and sanitation services is increasing rapidly. The majority of those without adequate sanitation services live in Asia, but sub-Saharan Africa has the highest proportion of people without water. Water-related diseases, linked to inadequate access to safe water and basic sanitation, are endemic in many regions. There are 4 billion cases of diarrhea each year, causing 2.2 million deaths (5,000 every day), mostly of children under the age of five (UNDP, 2006).

In developing countries, many households do not have access to piped water to the home and as a result, there is widespread use of a wide variety of water sources. These include public taps, water sold by households with a connection and purchase from vendors (Whittington *et al.*, 1991; Cairncross and Kinnear, 1992; Howard, 2001; Tatietse and Rodriguez, 2001). They also include a variety of small point water supplies such as boreholes with hand pumps, protected springs and dug wells (Gelinas *et al.*, 1996; Rahman *et al.*, 1997; Howard *et al.*, 1999).

Significant health gains accrue by ensuring access to an improved water

sources within one kilometre of the user's home (Esrey *et al.*, 1985; Howard and Bartram, 2003). Reducing the proportion on the global population that does not enjoy such access remains a global goal for the water sector (UNGA, 2000). Further significant health gains are accrued once water supply is delivered 'on-plot' through at least one tap (Howard and Bartram, 2003). Experience suggests that improvements in water supply and water-handling hygiene are typically incremental and may be most significant for those that have least access to basic water supply services (Kalbermatten and Middleton, 1999).

Study Area

Aizawl, the capital of Mizoram state, is situated in on the hillcrests, steep slopes and small valleys. It is located on a north-south elongated ridge, which acts as the main hill from which many small ridges and valleys are extending towards the east and west directions (**Figure 1**). The topography is highly undulating and rugged. The unique physical attributes of this rugged land are marked by extreme fragility and frequent landslides, limited land space, steep slopes and lack of accessibility. The city reveals a rapid and uncontrolled growth pattern with multi-storey settlements that has mushroomed unplanned on highly risk prone slopes. The altitude varies from 120 m to 1400 m above mean sea level. It falls between 23º 40' N to 23º 50' N latitudes and 92º 40' E to 92º 49' E longitudes (**Figure 2**). It covers an area of about 128.98 sq km, and as per Aizawl Municipal Corporation Report 2020, the population is 3,59,829 persons. There are a number of streams in and around Aizawl City, but none of them is dependable for providing adequate water. The only dependable source is river *Tlawng* located more than 1,000 m below the city.

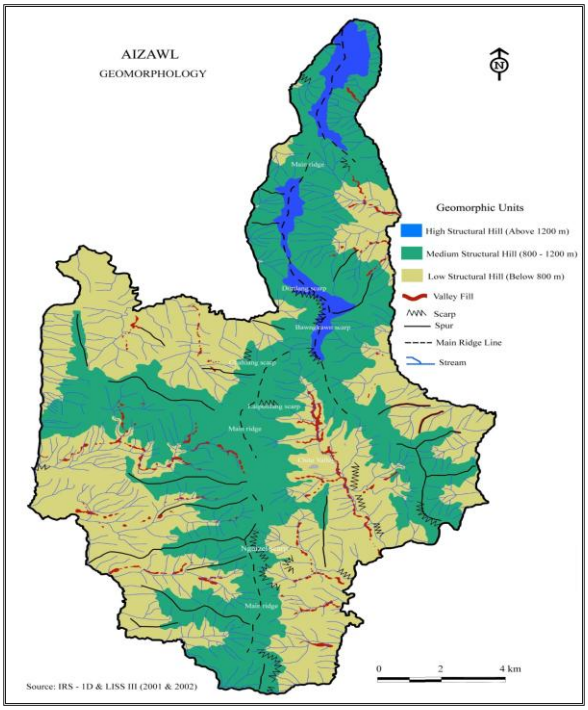

Figure 1: Geomorphology of Aizawl City

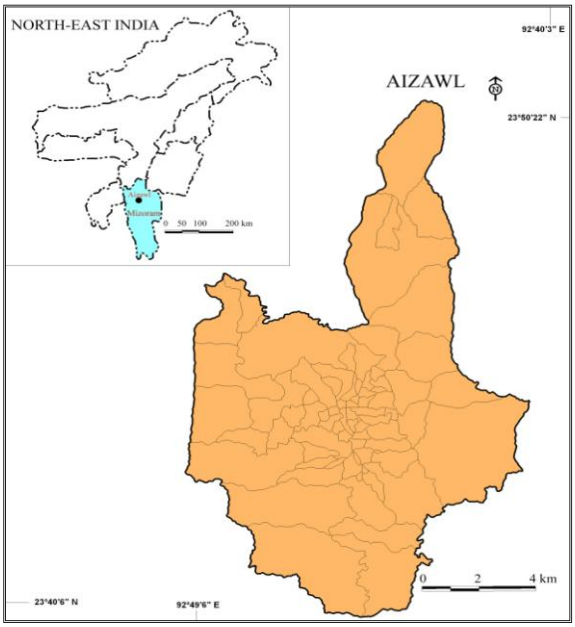

Figure 2: Location of Aizawl City

Objectives of the Study

The objectives of the present study are as follows:

a) To study the various sources of domestic water supply at the households' level

b) To find out the households' principal source of domestic water supply

Data Base and Methodology

The present study is based on the information obtained from primary and secondary sources.

(i) Households' survey was carried out in 15 local councils out of 83 local councils of the study area during November – December 2018. This amounted to coverage of 18.07 per cent of the total local councils. The number of sample households selected from each of the sample local councils are 50 households, thus data was collected from 750 households. The sample households have a total population of 4,454 persons, children account for 32.88 per cent of the total. The mean value of households' size is 5.91, with a standard deviation of 0.90. About 69 per cent of the sample households own their homes and 31 per cent live in rented houses.

(ii) To conduct households' survey, few households have been identified because studying all the households in the sample local councils is usually impracticable in view of time, money involved, and other considerations. A stratified random sampling procedure was used to select local councils for the survey, i.e. number of population, number of households having house connections and geographical location were taken into considerations to give an overall view of each corner of the study area. Households to be surveyed were selected based on random sampling method and it is believed that they are reasonably representative households in the study area.

(iii) Households' water sources have been classified into principal/main source of water and supplementary sources of water. Principal/main source of water refers to the water source that the households' has been obtaining the largest amount of water and the other sources is considered as supplementary sources of water supply. Therefore, data were collected through a structured schedule and an effort was made to get the relevant information from the ones that were assumed responsible for the collection and use of water. Being responsible is here understood as the one administering the water and not necessarily the ones fetching it. For this reason female household heads or other female family member and not children were preferred as respondent.

Results and Discussion

Water Sources at the Households' Level

Roughly, 50.66 per cent of the households have access to house connections; 21.46 per cent have access to public taps; 75.06 per cent collect rainwater;

53.60 per cent use *tuikhur*; 20.13 per cent use hand pumps; 42.40 per cent purchase water from tankers, and 0.66 per cent use dug wells (**Table 1**). The fact that the number of water sources is nearly triple to the number of households shows that people depend on multiple sources for their water supply. This indicates that only a particular source is unable to cater the households' water needs throughout the year.

Therefore, 72.12 per cent of the households have access to piped water supply either through house connections or public taps. Out of this, about 21.46 per cent have access to public taps and the rest 50.66 per cent have access to respective house connections. In 2004, about 54 per cent of the global population had access to piped water supply through house connections (World Bank, 2004). Subsequently, the 54th round of National Sample Survey Organization data shows that 70.10 per cent of the households in urban India depend on tap water (NSSO, 1999). Thus, the number of households using tap water in the study area is slightly higher than the 54th round figures of NSSO while the percentage of households having access to house connections is lower than the global percentage.

Due to unreliability of piped supply, *tuikhur* and rainwater harvesting play a significant role in meeting water supply needs of the people. In fact, *tuikhur* and rainwater collection are the important sources of water in the local councils where the piped water supply is unreliable and those who cannot afford house connection. The users of public taps are high in those local councils where the users of house connections are low. The users of hand pumps are also high in the local council areas where in-house piped connection is less. Since wells are privately owned, and located within the private premises the users are very less. Commercial water tankers do play an important role in meeting the water requirements of the people during the dry winter season. It indicates that due to the failure of public agency (PHED) to provide water to the people the water vendors have their hey-day in the study area, particularly during dry winter/lean period. Interestingly, no households purchase water from water tanker during the rainy season, while 42.4 per cent purchase during the dry season.

Table 1: Sample Households Reporting Different Means of Access to Water Supply

Water Sources	No. of Households	Percentage
House Connection	380	50.66
Public Tap	161	21.46
Rainwater	563	75.06
Tuikhur	402	53.6
Hand pump	151	20.13
Water Tanker	318	42.4
Dug Well	5	0.66

Principal/Main Source of Domestic Water Supply

Principal/main source of water refers to the water source that the households have been obtaining the largest amount of water. Even though there is widespread use of wide variety of water sources, people use only three water sources as their principal source of water, such as house connection, *tuikhur*

and rainwater harvesting. About 50.66 per cent of the households use house connection as their principal source of water supply (**Table 2 & Figure 3**). Although the service that they receive is often substandard, yet all the households having house connections use it as their principal source of water supply. In fact, the number of house connection users in sample local councils is more or less proportionate to the PHED figure. It is important to note that no household uses public tap as the principal/main source of water, indicating its unreliability. The reliability of piped water supply to a household is defined in terms of the adequacy of the provided service levels for the purpose at hand (Madanat and Humplinck, 1993).

Tuikhur are by far the most prevalent alternative to house connection as it they are used by 45.87 per cent of the households as their principal source of water. Majority of the households in the local councils where house connection utilities are absent use *tuikhur* as their principal source of water supply. Despite that the respective local council is within reach of the piped water network, a large number of households use *tuikhur* as their principal source of water supply. It indicates that households' monthly income, which is a proxy for ability to pay, is a significant predictor for piped water in residence, because in these local councils, majorities are lower income families. Usually, house service connection requires the payment of large sums at a time (for connection fees), and this clearly limits the potential for poor families to have pipe connection. It also involves a commitment to monthly bill payment that is contrary to income patterns. Hence, for them pipe connection costs tend to be unaffordable.

Table 2: Principal Source of Water (% of households)

Source of Water	Percentage
House Connection	50.66
Tuikhur	45.87
Rainwater	3.47

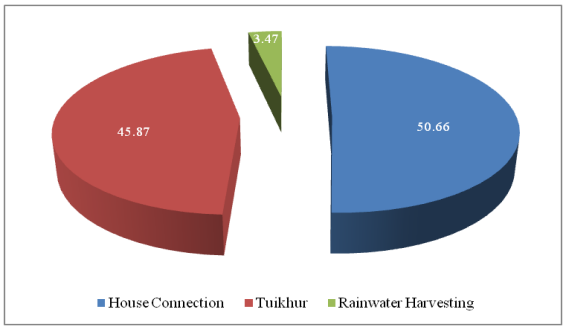

Figure 3: Principal Source of Water (% of households)

Moreover, though the number of households collecting rainwater is high (75.06 per cent), only 3.47 per cent of the households use it as their principal source of water supply. The users of rainwater harvesting as principal source of water supply have been noticed from four local councils, all of them lie on the periphery of the study area. Thus, roof water-harvesting offers very little scope for ensuring it as main source of water supply in the study area due to physical and economic constraints.

From the point of hydrological opportunities, roof top water harvesting appears to be one of the most convenient strategies for mitigating the growing domestic water crisis in the study area. At the same time, in hilly terrain that suffers

from lack of natural storage of water, roof water harvesting systems can be economically viable proposition for supplementing conventional water supply systems.

Along with hydrological opportunities, what is also equally important is the physical feasibility of installing roof water harvesting for making it as the principal/main source of households' water supply. The issue of scalability is directly linked to this. Roof top rainwater harvesting requires large under-ground or ground storage tanks. Nevertheless, the study area housing stocks are not going to provide the kind of land area required for constructing such large tank, which is necessary for storing the water for the lean season. It appears that the system will be unviable in the core area with high concentration of population and houses meanwhile it might be viable in the outer areas with scattered population and houses.

Conclusion

The residents of Aizawl city used both traditional and modern water sources to meet their domestic water requirements. Out of six types of water sources, half are traditional sources, i.e., *tuikhur*, rainwater harvesting and dug wells, while the remaining half are modern sources, viz., piped water supply, hand pumps and water tankers. It has been observed that most households are not using water from only one source but from multiple sources. Households' domestic water source is governed by the availability of water sources in their respective area and households' economic conditions. About 50.66 per cent of the households use house connections, 45.87 per cent use *tuikhur* and 3.47 per cent use rainwater harvesting as their principal source of water supply.

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