

Chapter-IV

Delivery of Water Supply and Sanitation in Guwahati City

4.1. Introduction

In this chapter data been analyzed, interpreted and the result of the study on the delivery of water supply and sanitation at the ward level (three wards selected from the core, intermediate and periphery locations of Guwahati city) has been discussed in detail. The analysis mainly concentrates on water supply and sanitation in the services areas of Middle Income and Low Income households in these areas of Guwahati city. The indicators taken into consideration for effective delivery of services include (i) accessibility (ii) reliability (iii) affordability and (iv) sustainability of services. One of the objectives of the study is to examine the role of governance in terms of efficiency and equity. This chapter presents empirical data with regard to efficiency in water supply and sanitation (WSS) facilities at the ward level of Guwahati city.

The sub-indicators used in the study to check accessibility, reliability and affordability of services are as follows:

Accessibility: The sub-indicators considered for accessibility of water are- access to municipal potable water, multiple sources of water supply, purpose of water consumed, storage measures, quality of the water and adequacy of water.

Reliability: The sub- indicators taken into consideration for reliability of water services are- frequency of piped water supply, regularity of water supply, duration of supply, satisfaction with present timings of water, advance notification of stoppage of water supply, water quality impact on household health (public health issues), public complaints on water service delivery.

The sub-indicators used in the study to check reliability of sanitation facilities are- household toilet facility, toilet facility connected with sewer, well served drainage facility for home, collection of garbage regularly, frequency of garbage collection, attending to

the complaints about garbage and waste, waste-water stagnation, complaints of bribe, health impact of poor sanitation facility.

Affordability: The sub-indicators used in the study to check affordability of services are-dependency on private sources for water, water storage measures, method of water purification, regular payments of bills.

4.2. Present Status of Water Supply in the Guwahati City

The drinking water needs of the majority of the population in the city are at present fulfilled by the municipality through piped supply or water tankers. However, the quantum of supplied water is quite limited and irregular and there is a mismatch between demand and supply. The local residents face tough situations, especially during the dry winter season in the city. Under such circumstances, many private initiatives have also come up to cater to the ever-increasing demand to a great extent but most of them operate illegally. Over-exploitation of ground water by such agencies has caused public resentments in some localities of the city.

Nonetheless, the Guwahati Municipal Corporation (GMC) has been playing a very important role by supplying drinking water to the people of the city. The main source of water for their three water-treatment plants is the river Brahmaputra. However, GMC also has ground water as its source for some areas. For this purpose, it dug 20 deep tube wells. Water is supplied directly to the consumers in and around the location of the respective wells. According to 2014 statistics, water supply from the plants under the GMC served approximately 40,000 households. It has a total supply capacity of 530 million liters per day. Out of 31 municipal wards, 16 are fully covered by these plants and some wards are partly covered. Thus, it has been able to meet the demands of drinking water only up to a very limited extent. As the installation capacities of the plants are meager, it can only cover approximately 40 per cent of the total population of the city (GMC, 2014); the population of Guwahati city according to 2011 Census of India is 963,429.

To meet the need of water, three new water supply schemes have already been undertaken by the state government for the entire Guwahati city. For this purpose, the

whole city has been divided into three parts, that is, eastern, south central and western Guwahati. The management and operation of each area will be under three different agencies, that is, JnNURM (Jawaharlal Nehru National Urban Renewal Mission, JICA (Japan International Cooperative Agency) and ADB (Asian Development Bank). So far, 75 per cent works of these projects have been completed. At present, laying of pipelines is going on in full swing in the entire city. It is expected that the project will be operational by end of 2015 and mid of 2016. In the mean time Guwahati Jal Board (2011) has been instituted as the new institutional mechanism for handling water supply functions and will supersede all existing agencies that are responsible for water supply in the future. It is anticipated that such development may provide major relief for Guwahatians as they are expected to be provided 24x7 pre-paid metered water supply.

4.3. Situation of Groundwater in the Guwahati City

The importance of groundwater for the existence of human society is unparalleled. It is a major source of drinking water in both urban and rural areas, besides being a significant source of water for the agricultural and industrial sectors. The city of Guwahati, in spite of being located on the bank of the mighty Brahmaputra, depends heavily on ground water, for its water requirements. About 69.90% of the households in the city use ground water, while 27% depend on piped water supply and about 1.30% on surface water obtained mainly from streams (Goswami et al., 2005). Since the last few years, due to excessive growth of population and the subsequent overexploitation of groundwater, the water table in many parts of the city has been showing a declining trend. Another root cause of domestic water crisis in this part of the world is the system of water rights under the common law in India which gives ownership of groundwater to the landowner, despite the fact that groundwater is a shared resource from common pool of aquifers.

There has been a perceptible reduction in the ground water level during the last 10 to 15 years affecting households of the city. The problem is far more acute for those households, which have either dug wells or deep tube- wells as the source of potable water. In the core city area (ward no. 10), the average depth of dug well is found to be 25 ft. whereas; the average depth of deep tube well is found to be 150 ft. In the intermediate

area (ward no. 20), the average depth of dug well is 35ft and of deep tube well is found to be 200 ft. In the periphery region (ward no. 25), the average depth of dug well and deep tube- well is 20 ft. and 200 ft. respectively.

From a comparative analysis of the three wards in relation to the ground water level conditions, it is found that the number of people affected by the problem of water level reduction is more in intermediate area (ward no. 20). This can be attributed to the over-exploitation of ground water through hapahazard growth of apartments, alongside other associated vertical growth. These apartments fail to provide the required amount of uninterrupted running water to their customers. To overcome the scarcity, the owners of the apartments prefer to go for boring wells for the extraction of ground- water. In most of the apartments, it has been observed that these deep tube- wells are the only source of water. However, such over- extraction of ground- water from a limited parcel of land use has led to the reduction of ground water level of ring as well as tube- wells around the neighbouring areas.

4.4. Public Water Supply System in the Study Area

The public water supply system of the selected wards (10, 20 and 25) depends both on water from the river Brahmaputra as well as on ground water. Drinking water supplies in the study area are under the management of two different organizations - Guwahati Municipal Corporation (GMC) and Assam Urban Water Supply and Sewerage Board (AUWSSB) (Table No.-4.1). Ward No. 10 falls on the core of the city which includes Panbazar area, Paltanbazar area, Fancy Bazar area, Jorpukhuri area, part of Latasil area, Ambari area, Lakhtokia area and Police Reserve area. Ward No. 20 is an intermediate location of the city and it covers areas like Anil Nagar, Tarun Nagar, Ambikagiri Nagar (Part), Nabin Nagar (Part), Sri Nagar, Sundarpur, Manik Nagar, Japarigog, Krishna Nagar, Bikrampur and Kalyanpur. On the other hand Ward No. 25 is a peripheral ward which includes Hengrabari area, Sarumataria area and Satgaon area (Part). The primary data on issues associated with drinking water availability and sanitation facilities has been generated from this areas under the three selected wards targeted for the study.

Table No.-4.1: Agencies or Organisations for Drinking Water in Guwahati City

Ward No.	Authority
10 (Core)	GMC
20 (Intermediate)	GMC
25 (Periphery)	AUWSSB

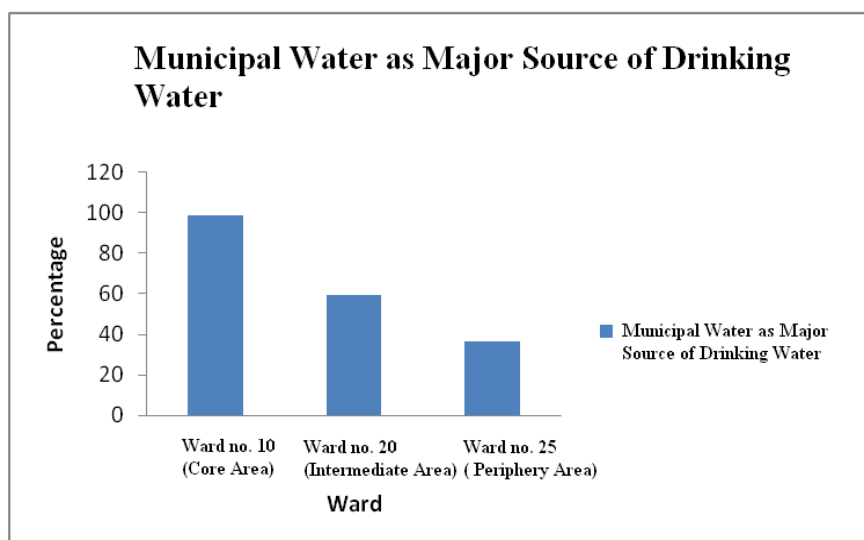
Source: GMC office, Panbazar

Accessibility of water

With increased population and associated pressure on resources led to over-exploitation of water resources and water scarcity, which have become a nightmare to a huge section of population all over the globe, more specially in the developing countries(Borah: 2013) In similar context, the all-India scenario of drinking water supply continues to be deficient(Mckenzie and Ray: 2005; Vishwanath: 2013). The water supply in most Indian cities is only available for a few hours per day, pressure is irregular, and the water is of questionable quality. No major Indian city has a 24 hour supply of water, with 4 to 5 hours of supply per day being the norm (McKenzie and Ray: 2009) and the city of Guwahati is no exception (Borah: 2013).

Access to safe drinking water is measured by the proportion of population with access to an adequate amount of safe drinking water located within a convenient distance from the user's dwelling. 'Access' is interpreted as actual use by the population. Accessibility is assessed in terms of access to improved water source which implies to the percentage of the population with reasonable access to an adequate amount of water from an improved source, such as a household connection, public standpost, borehole, protected well or spring, and rain water collection. Unimproved sources include vendors, private tankers , *kuccha* wells and unprotected wells and springs. Accessibility of drinking water (sources) in core, intermediate and periphery locations of the city are shown in the following figures 4.1 and 4.2.

Figure-4.1: Municipal Water as Major Source of Drinking Water



Source: Field Survey

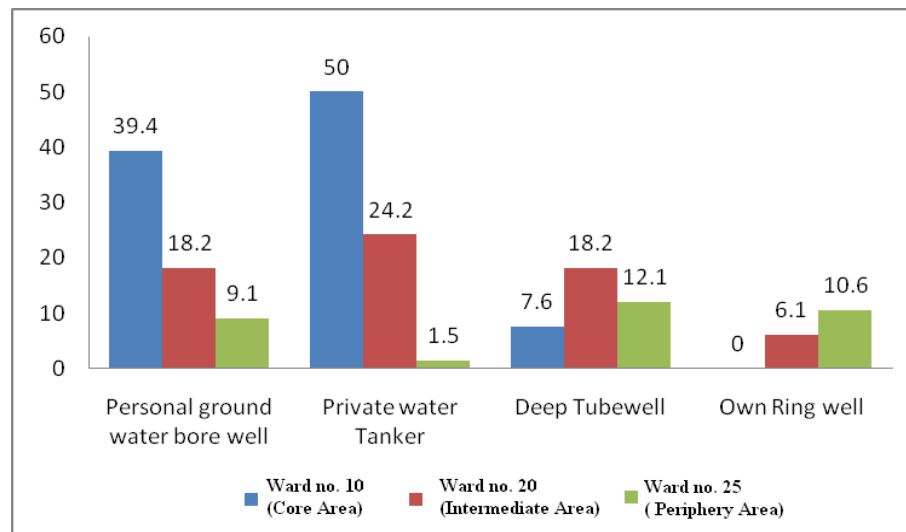
The system of public water supply in the study area is administered through two major organizations – the Guwahati Municipal Corporation (GMC) and Assam Urban Water Supply and Sewerage Board (AUWSSB). Our field survey reveals that there is a vast difference among the three wards in terms of public water supply connection which is shown below:

Core city area: The data regarding the sources of water (Table 4.2) reflects that the municipality water is the primary source in ward no. 10, which covers 98.5 per cent of the households. As the city’s main public water distribution system is located in this ward, therefore, availability and reliance on public water system is found to be more here.

Intermediate area: The survey reveals that as you move from the city’s core to the intermediate locations of Guwahati, reliance on public water system is found to decrease. Municipality water supply system covers 59.4 per cent of the households in ward no. 20. Supply is found to be more or less regular, except in the dry season, when water supply becomes intermittent. Insufficiency of public water supply affects the users of the ward who are left with no option other than depending on the private water suppliers. Private water suppliers support around half of the households in the area.

Periphery area: In ward no. 25, the percentage of households having piped water supply is only 36.4 per cent. In this ward, water is supplied by the Hengrabari water plant, which is under the jurisdiction of Assam Urban Water Supply and Sewerage Board. It is seen that another major source of drinking water for this ward is ring wells. These wells have come to play a very crucial role on meeting the demands of drinking water in the absence of a proper reliable public water supply system. Another reason for the dependence on ring wells is due to the high cost involved in taking a new water supply connection. Besides these, the areas under this ward are hilly and many households living in the upper slopes do not have any connections of piped water supply. Even in the households having piped water supply connection, the quantity of supplied water is very less.

Figure- 4.2: Multiple Source of Water Supply in Guwahati City



Source:Field Survey

The data regarding other sources of water in the study area reflects that personal ground water bore- wells, deep tube- wells and private water tanker systems have come to play a very crucial role on meeting the demands of drinking water in the absence of a proper reliable public water supply system. Even in the households having piped water supply connection, the quantity of supplied water is very less and both GMC and AUWSSB have failed to fulfill their demands. The study showed that the need of water is fulfilled by different sources according to the affordability and availability of the water supply.

Core city area: The data regarding the sources of water reflects that the municipality water is the primary source in ward no. 10, which covers 98.5 per cent of the households. However, 39.4 per cent of the households rely on personal ground water bore well, 50 per cent on private water tankers (commercial water supplying agencies) and 7.6 per cent depends on deep tube wells. This is because frequency of supply is limited to just once per day and supply duration ranges from two to three hours. Besides, they require more water during festival seasons and for domestic rituals.

Intermediate area: The reliance on public water system is found to be decreasing in intermediate and periphery areas of Guwahati City. In the ward no. 20 piped water supply supports 59.4 per cent of the households. Apart from it, personal ground water bore well meet the need of (18.2 per cent) households in this intermediate area, followed by private water tanker 24 per cent, deep tube well (18.2 per cent) and own ring well (6.1 per cent).

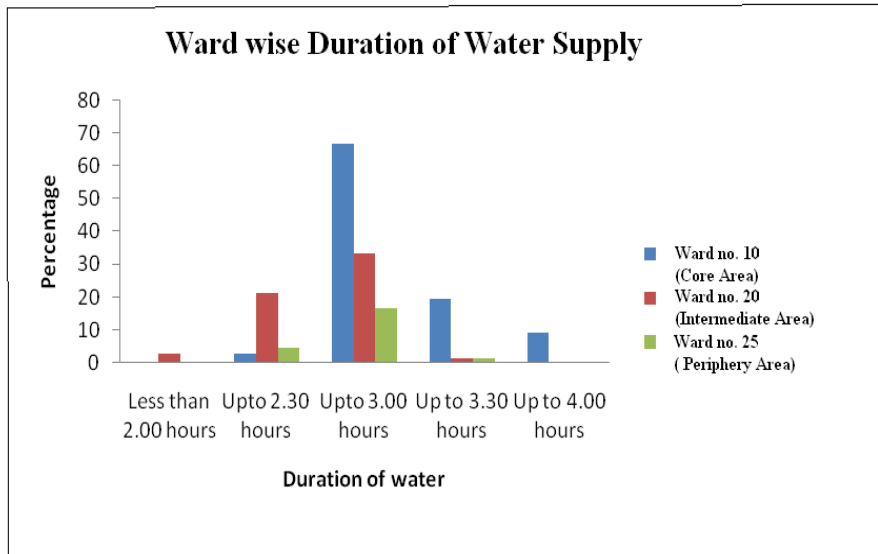
Periphery area: In ward no. 25, share of piped water reduced to 36.4 per cent of households. 9.1 per cent rely on personal ground water bore well, 1.5 per cent on commercial water supplying agencies (private water tankers), 12.1 per cent on deep tube wells and 10.6 per cent depends on own ring wells. Among the wards, share of deep tube well and own ring well (especially in ward 10 and 20) as a source of water is found to be limited. But it is seen that major sources of drinking water in ward no. 25 are deep tube wells and own ring wells, which serves about 12.1 per cent and 10.6 per cent households respectively. These tube and ring wells come to play a very crucial role in meeting the demands of drinking water in the absence of a proper reliable public water supply system. Another reason for dependence on ring wells is due to the high cost involved in taking a new water supply connection. Besides, the area is hilly and many households living in the upper slopes do not have any connections of piped water supply because the AUWSSB has not laid pipes in these locations and does not cater to the populace of these areas.

Even in the households having piped water supply connection, the quantity of supplied water is very less and some households disconnect piped water due to high water bills. Around 10.6 per cent households of this ward are having individual ring well as supply water fails to fulfill their demands.

Frequency and Regularity of Water Supply

Access to safe water depends not simply on the supply of treated water; it also means continuity or regularity of water supply. Continuous water supply plays a vital role in ensuring water quality. Intermittent water supply aids degradation of the quality of water because it results in low supply pressure and as a consequence, there is the risk of in-pipe recontamination. The risk of exposure to contaminated water is almost non-existent in continuous water supply, thereby reducing the risk of waterborne diseases. Continuity or regularity of water supply as per the national benchmark is 24 hours (hrs), popularly known as 24x7 water supply system, which is supposed to supply water to consumers 24 hrs a day everyday of the year through a transmission and distribution system- that is continuously full and under positive pressure. In a developing country like India, water supply is mostly intermittent. Currently none of the cities in India have 24 hour water supply as prescribed by the service level benchmark. The frequency and regularity of public water supply system in core, intermediate and periphery areas of the city are shown in the following figure 4.3.

Figure-4.3: Duration of Water Supply



Source: Field Survey

Data on duration of water supply reveals that there is a difference among the three wards.

Core City area: In ward no. 10, 66.6 per cent get water for 3 hours per day, while 19.7 per cent for 3.30 hours and 9.1 per cent for 4 hours per day.

Intermediate area: In ward no. 20, 33.3 per cent respondents get water for 3 hours, 1.5 per cent for 4 hours per day.

Periphery Area: Data on duration of water supply in ward no. 25 reveals that 16.7 per cent get water up to 3 hours and 1.5 per cent for 3.30 hours per day. In terms of frequency of supply, it is limited to just once per day and supply duration ranges from three to four hours.

Interestingly, our study reveals that during the monsoon season, water supply is stable. However, during the winter season (October to March) the frequency of supply becomes highly intermittent. This is because the river Brahmaputra is the main source of water for the city, and during winter season the water level of the river gets reduced. However, among the three wards, supply scenario is comparatively impressive in ward no. 10, as the Panbazar water-treatment plant of GMC is located in this ward.

Generally, water and sanitation projects experience their most serious problems with operation and maintenance and with cost recovery aspects due to which the consumers have to face the problem (Biswas, 1979). In this context, the water supply system operating under the two different agencies of Guwahati city too have faced this problem and runs in a chaotic situation without proper management. Therefore, it is imperative for these local governments to plan for smooth operation and maintenance, in order to ensure sustainability of all the water supply plants of the city, at least until the new water supply project, which is currently undergoing construction, comes into operation.

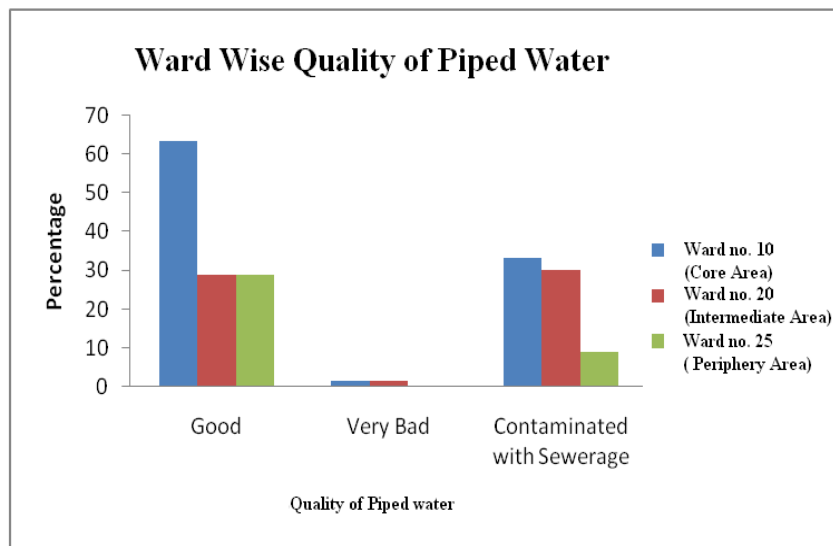
Quality of Water

The WHO *Guidelines for Drinking-water Quality* (Who 1993, 1997, 1998) assess the health risk posed by contaminants in drinking water. The WHO's primary health requirement is a sufficient water supply, which the Government of India takes to mean 40 litres per person per day. The second requirement is that the water be microbiologically safe. In most developing countries, India included, the primary contaminant of surface and ground waters is human and animal waste. The Who guidelines suggest that *E. coli* (the indicator organism for bacterial contamination) should not be detectable in a 100-ml sample of water, but with fewer than 100 coliforms, the water is considered to be of 'moderately' good quality. The Government of India accepts these guidelines but has been unable to ensure that they are met. Water-borne diseases from faecal contamination are one of the biggest public health risks in the country. (McKenzie and Ray: 2009). Moreover, the monitoring of water quality in Indian cities is haphazard, while municipal board, public health engineering organizations, public health directorate of health and family welfare department claim to conduct regular tests of supply water, but the key findings are generally not made public. Standards for drinking water that are actually enforced could have enormous positive impact on public health. But for this to occur, the procedures for water testing and data sharing have to be made regular, standardized and public (Mckenzie and Ray: 2009).

Water quality refers to the chemical, physical, biological, and radiological characteristics of water. It is a measure of the condition of water relative to the requirements of one or more biotic species and or to any human need or purpose. It is most frequently used by reference to a set of standards against which compliance can be assessed. The most common standards used to assess water quality relate to health of ecosystems, safety of

human contact and drinking water. The presence of contaminants and the characteristics of water are used to indicate the quality of water. These water quality indicators can be categorized as: biological: bacteria, algae, Physical: Temperature, turbidity and clarity, colour, dissolved solids. The overall quality of piped water in the study area is shown in the following figure 4.4.

Figure-4.4: Overall Quality of Piped Water (taste, smell and colour)



Source: Field Survey

Core city area: In response to the question relating to the overall quality of piped water as shown in the table (table no. 4.5), 63.6 per cent household of ward no. 10 are of the view that quality of pipe water is good and according to 33.3 per cent pipe water is contaminated with sewerage at the time of flood.

Intermediate location: In ward no. 20, 28.8 per cent households opine that water quality is good and according to 30.3 per cent water is contaminated with sewage.

Periphery Region: Similarly in ward no. 25, 28.8 per cent households are of the view that pipe water is good and for 9.1 per cent it is contaminated with sewage.

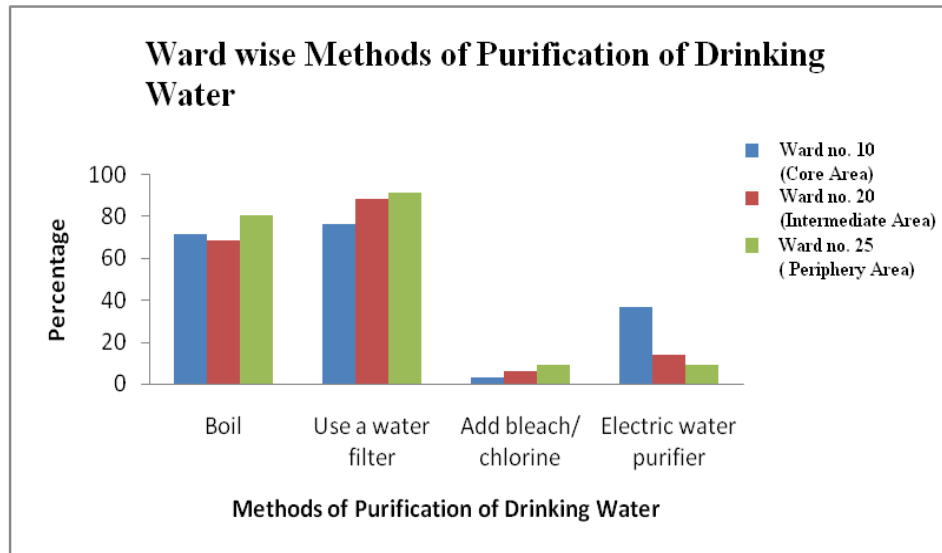
The study reveals the contamination of sewage has been accentuated due to faulty machinery and ill- maintenance of the equipment. It has been observed that in most of the

by-lanes in the wards water leakage from the supply pipes is a common phenomenon. Moreover, at the time of floods, especially during the summer seasons, polluted water enters through the leakages of the old pipes and fittings and consumers are often supplied with such polluted water. Though the people of the locality have complained about the situation but replacements of the pipelines have rarely been made.

Water Quality impact on household health

Water treatment methods include filtration, chemical disinfection, boiling, add bleaching power, chlorine etc. For filtration there are different types of household filters which remove a high proportion of solids and silts. Most household filter technologies operate by gravity flow or by water pressure provided from piped supply. Some filters used for ultra-filtration, nano-filtration by households require electricity. Chemical disinfection includes chlorine-based technology. Mostly disinfection of drinking water in developing countries is done primarily with free chlorine, either in liquid or dry form. Boiling is a simple way whereby water is heated until it comes to a “rolling boil”, which means large bubbles continuously form on the surface of the water which is maintained for one minute. Although home-based water treatment improves the quality of water immediately, the quality frequently worsened in the cups used for drinking, thereby causing a recontamination just before drinking. In this context it is important to practice hygiene while handling water at each point of potential contamination. The methods adopted by the respondents for purification of drinking water in the study area are shown in the following figure 4.5.

Figure-4.5: Method of Purification of Drinking Water adopted by household



Source: Field Survey

Purification methods vary in municipality wards (core city), intermediate and periphery regions.

Core city area: The study reveals that in ward no. 10, 71.2 per cent households boils water in order to drink clean and safe water. 75.8 per cent uses water filter for purification, only 3 per cent add bleaching power in their ring well and 36.4 per cent use electric water purifiers.

Intermediate area: In ward no. 20, 68.2 per cent households boil water, 87.9 per cent use water filters, 6.1 per cent add bleaching power in ring well and 13.6 per cent uses electric water purifiers for safe drinking water.

Periphery area: In periphery area, 80.3 per cent household boils water, 90.9 per cent uses water filter, 9.1 per cent add bleaching power and 9.1 per cent uses electric water purifiers in ward 25.

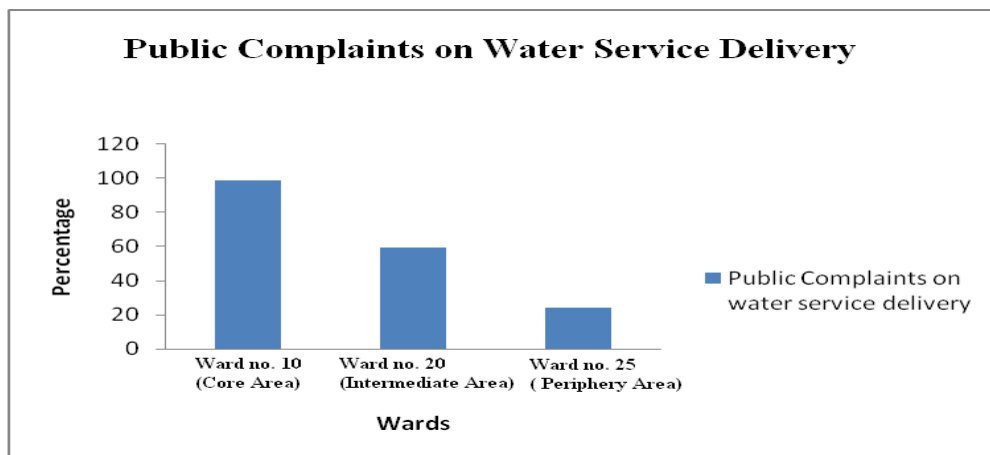
The field investigation reveals that most of the respondents among the three wards adopted boiling and water filtration to drink clean and safe water. They are conscious

about their health and hygiene. According to them, at the times of floods, especially during the summer seasons, polluted water enters through the leakages of the old pipes and they are often supplied with such polluted water. So, they applied such methods for purification of municipality water. In ward no. 25, 10.6 per cent respondents have their own water arrangement like ring well and they add bleaching powder and chlorine in their wells in order to drink clean and safe water.

Complaints of Water Service Delivery

Consumer grievance redressal is an important function of an efficient, responsive and transparent municipal body. The basic purpose behind a grievance redressal mechanism is to provide a platform to the citizens to lodge their complaints related to various services they receive from the municipal body, voice their opinions and provide feedback on various services rendered by ULBs. It bridges the communication gap between the municipal bodies and the citizens and provides citizens a platform through which they can get their grievances redressed in a timely and transparent manner. It also serves as a means to measure the efficiency and effectiveness of municipal bodies as it provides important feedback to the ULBs on the working of the administration. But in the city of Guwahati above mentioned features are missing to a great extent. The complaints related to water service delivery are shown in the following figure-4.6.

Figure-4.6: Complaints by Households regarding Water Service Delivery



Source : Field Survey

The data regarding the public complaints on water service delivery in the study area reflects that the respondents give written complaints and protest demonstrations to the concerned authority about the irregularity and quality of drinking water.

Core city area: It is revealed from table no. 4.7 that 98.5 per cent launched complaints in ward no. 10. This locality faces acute water crisis due to erratic supply. In Jorpukhuri area, irregular water supply has hit the people hard. The local complained that in many parts of the area, some unscrupulous elements carry out water theft by installing powerful motors. They often notice reduced flow of water supply whereas; people who do not have an authorized connection are getting adequate water. They are of the view that GMC authorities must inspect such areas, especially in wee hours to control water theft in this area.

The households of this core area also buy water from private water suppliers. The private suppliers buy water from the GMC Panbazar Water Plant and sell the same to the user for Rs. 350 per tanker. Each tanker contains 3,000 litres. The GMC sells water at Rs. 30 per 1,000 litres to the private party. Residents of the locality complaints that water tanker do not contain the stipulated quantity. They have made complaints several times to the GMC water works department. During the personal interview with the deputy Mayor of the Municipal Corporation, the issue has been raised. The public representative told that GMC water supply wing is only selling water to the private party and is not responsible with the delivery of water. According to him, private tankers come to Panbazar water treatment plant and delivers water on payments. So GMC is responsible to the private parties for delivering water not to the end users. But he remarked that he will look into the complaint made by the residents of the wards.

Intermediate area: In ward no. 59.1 per cent households have made complaints on water service delivery. The residents of the area also complained that they do not get water for two-three days at a stretch, which badly affects their everyday activities. They said, “We are taxpaying citizens, yet, we do not get any of the civic facilities properly, including water supply”. Despite several representations and protest demonstrations, the

residents of the intermediate area are awaiting a positive response from the Municipal Corporation.

Periphery area: Similarly, 24.2 per cent respondents of ward no. 25 made complaints on water service delivery. For the people of the hilly terrains of Hengrabari and Lichubagan areas acute shortage of water during winter season has become a part of their lives. Largely dependent on the natural sources (ring well and tube wells) of water, the people of these localities face immense difficulties during winters. The long pending demand of the residents to take up small schemes for providing immediate relief to the locals is yet to get a positive response from the authorities. It is a common complaint that the authorities asked them to wait for the new mega water supply scheme to complete. Moreover, the people of the locality also made complaints related to underground water boring. In many apartments, builders have undertaken boring work, which has resulted in a water crisis in neighbouring areas. Boring has apparently resulted in drains in the locality getting clogged. People are satisfied that GMC has stopped boring after they started complaining.

4.5. Access to Sanitation facilities in the Core, Intermediate and Periphery Areas of Guwahati City

Sanitation has a close and direct link with the environment, water supply, health and hygiene. The Guwahati Municipal Corporation (GMC) is the sole authority for sanitation as well as collection and disposal of the garbage in the municipal area of the city. The present analysis with regard to sanitation facilities in the core, intermediate and periphery areas of the city has been generated from the three selected wards targeted for the present study. The sub-indicators used in the present analysis is to check reliability of sanitation facilities are- household toilet facility, toilet facility connected with sewer, well served drainage facility for home, collection of garbage regularly, frequency of garbage collection, attending to the complaints about garbage and waste, waste-water stagnation.

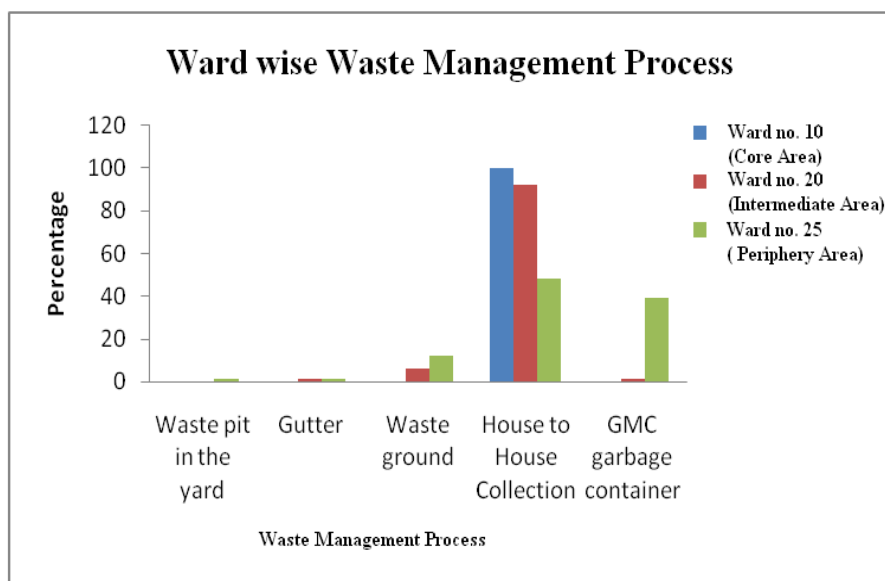
Household Toilet Facility

All the respondents of the core, intermediate and periphery areas of the city have their own toilet facility in their premises but most of the individual houses have septic tanks without any collective disposal system for effluents. The sewage from septic tanks goes directly into the open drain. The soak pits connected to septic tanks are becoming non-functional due to high sub-soil water table within a short span of time. And as such it has become a source of public health hazards. The city of Guwahati does not have any integrated sewerage system at present.

Domestic Waste Management

Waste management is all those activities and action required to manage waste from its inception to its final disposal. This includes amongst other things, collection, transport, treatment and disposal of waste together with monitoring and regulation. It also encompasses the legal and regulatory framework that relates to waste management encompassing guidance on recycling etc. The term usually relates to all kinds of waste, whether generated during the extraction of raw materials, the processing of raw materials into intermediate and final products, the consumption of final products, or other human activities, including municipal (residential, institutional, commercial), agricultural, and special (health care, household hazardous wastes, sewage sludge). Waste management is intended to reduce adverse effects over human health and environment. The domestic waste management process adopted by the respondents in the core, intermediate and periphery region of the city is shown in figure 4.7.

Figure: 4.7. : Domestic Waste Management Process



Source: Field Survey

The Guwahati Municipal Corporation (GMC) is the sole authority for sanitation as well collection and disposal of the garbage in the city. Data on domestic waste management process reveals that there is a difference among the three wards.

Core city area: In response to the question relating to the domestic waste management in core city area, 100 per cent respondents are satisfied that there is the provision of door-to-door collection of household solid waste in their ward. According to them management of domestic waste has become a complex problem (deplorable) for last few years. But now it very easy as Guwahati Municipal Corporation has adopted new Solid Waste collection and transportation system in association with different NGOs from July, 2014. Now, Jiban Sathi Society (NGO, selected for ward no. 10) is collecting segregated waste from door to door on daily basis. The NGO is collecting wet waste on daily basis and dry solid waste minimum once in a week. Each household of the ward is now paying Rs. 30 per month as user charge as fixed by the Corporation to the NGO. The collected user charge will be deposited to GMC account within 24 hours from the date of collection. The user charge is collected against the money receipt issued by GMC only. Daily collection statement of user charges has to be submitted to the Commissioner, GMC, Divisional

Engineers and the Ward Committee by email or any other means by the NGO in a prescribed format. Collection of user charges is the sole responsibility of the NGO and percentage of collection will be considered towards performance.

Intermediate area: As far as garbage management in ward no. 20 is concerned, 6.1 percent households use waste ground for domestic disposal, 92.4 percent responded that there is provision of house to house collection of waste and 1.5 percent uses GMC garbage bin for domestic waste. There is no provision for door-to-door collection of solid waste in areas like Japarigog, Krishna Nagar, Bikrampur under this ward. So, people of these localities use nearby small waste ground for domestic waste disposal. It was observed during the investigation that the people were not sincere enough to dispose waste at the designated storing points or bins. The “out of sight, out of danger” perception of the people was making them to throw the waste on the grounds, a little away from their houses was causing problem to others and environment. But in areas like Anil Nagar, Tarun Nagar, Sri Nagar, Ambikagiri Nagar, Sundarpur, Rajgarh Manik Nagar the picture is quite different. In these areas the NGO named Gitanjali collects solid waste from door-to-door to the designated secondary collection point or Transfer Stations on daily basis. The NGO collects waste from doorsteps by ringing bell and following a fixed time schedule (6 am to 8am and 5 pm to 9 pm in the evening) every day. So, 92.4 per cent respondents of these areas are satisfied with this system under taken by the Municipal Corporation.

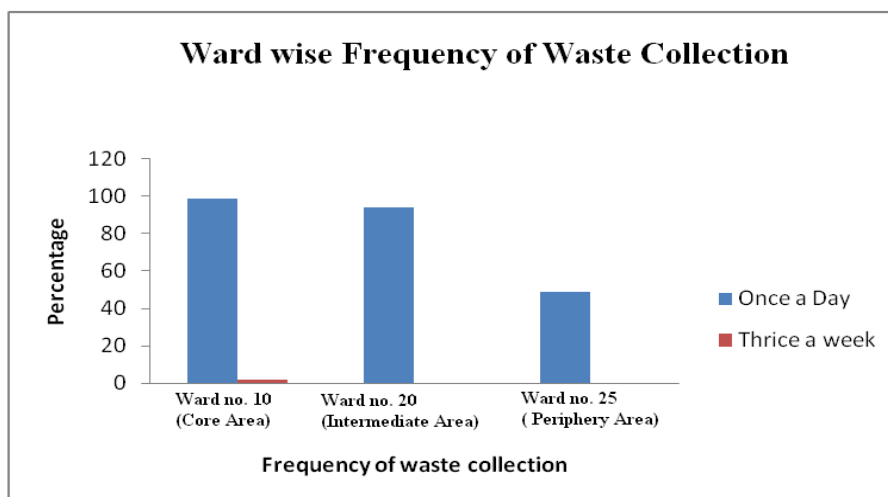
Periphery Region: The data regarding the garbage management in the periphery area reflects that 1.5 percent households use waste pit in the yard for waste disposal, 1.5 percent use gutter, 12.1 per cent use waste ground. While in 48.5 per cent households have house to house collection of domestic waste and 39.4 per cent uses GMC garbage bin for domestic waste in ward 25. In areas like upper Hengarabari, Sachal and Dwaranda the people throw garbage in their backyards and burn it. These areas are relatively sparsely populated and which have enough space to dispose of the garbage in the surroundings. The system of door-to-door collection of solid waste is still not followed in these areas. While a majority of (48.5 per cent) respondents from Sarumataria, Down

Town, and Satgaon area told that an NGO called Uttaran Social Welfare Society collects domestic waste from their houses on daily basis. Each household of the ward is now paying Rs. 30 per month as user charge as fixed by the Corporation to the NGO. But the respondents (39.4 per cent) from Rangkimi Path, Dalbari Road, Dwaraka Sachal Suk Road are of the view that they throw garbage in the bins installed by the GMC in their localities (illustrated in picture V). The respondents of these areas have reported that the number of GMC bins used in this area is lesser in comparison to other wards of the city. Moreover, they have also reported that door-to-door collection of Municipal Solid Waste (MSW) scheme is not fully implemented in their ward. Some households from their ward are covered by this scheme but their area is still deprived from this civic facility. They hope that they will get a positive response from the GMC authorities in this regard very shortly.

Picture V: A view of GMC Garbage Bin in periphery area of the city



Figure-4.8.: Frequency of Waste Collection



Source: Field Survey

Data on frequency of waste collection reveals that there is a similarity among the three wards. In ward no. 10, 98.5 per cent respondents opined that the NGO collects solid waste on a daily basis and take it to the designated secondary collection point or Transfer Stations. The NGO divides Municipal Solid Waste (MSW) as Biodegradable (wet waste) and Non-biodegradable (dry waste). The workers of the NGO collect wet MSW on daily basis and dry MSW minimum once in a week from the households of the ward. The respondents have reported that people from the NGO come to their door step every day from 6 am to 8 am in the morning or 5 pm to 9 pm in the evening for the collection of domestic waste (illustrated in picture VI). Similarly 93.9 per cent respondents in intermediate area and 48.5 per cent respondents in ward no. 25 are agreed that in their areas also the NGOs collect solid waste by following a fixed time schedule (6 am to 8 am or 5pm to 9 pm) every day.

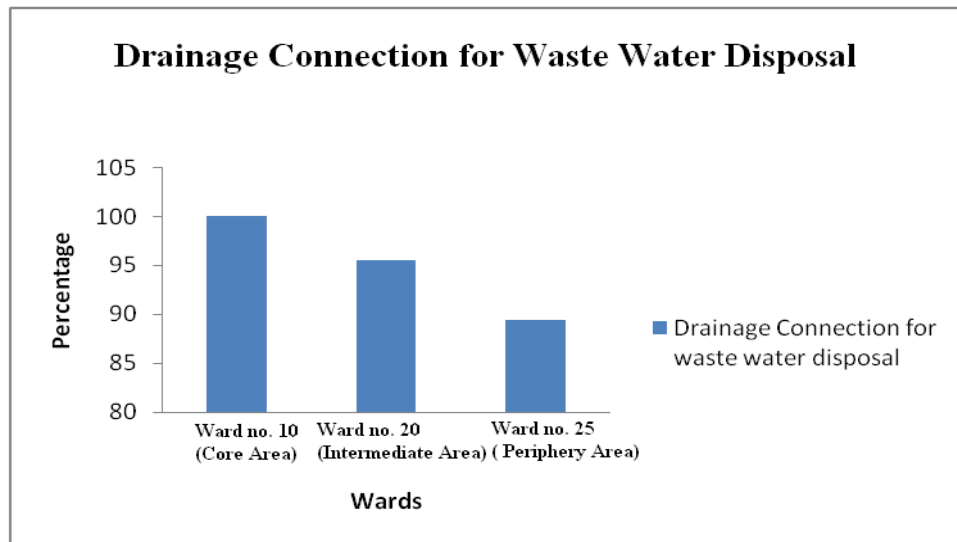
Picture VI: NGO Worker is collecting Domestic Waste from Household in the Ward



Waste Water

Wastewater is a term that is used to describe waste material that includes industrial liquid waste and sewage waste that is collected in towns and urban areas and treated at urban wastewater treatment plants as well as sewage that comes from single houses in the countryside that is treated on-site in either septic tanks or individual wastewater treatment systems. Wastewaters from single houses in the countryside that are not connected to sewers are generally treated on-site by septic tank systems or individual domestic wastewater treatment systems. The process of wastewater disposal in the study area is shown in the following figure 4.9.

Figure-4.9.: Drainage Connection for Waste Water Disposal



Source: Field Survey

The study showed there are drainage connections for domestic waste water disposal in all the three wards of the city. Drainage connection refers to the connection of domestic drain with the GMC's public drain in the locality.

Core city area: The study reveals that 100 per cent respondents of ward no. 10 are of the view that they have drainage connection for their domestic waste water disposal. But for few years, the residents of Panbazar have expressed their resentment over the lack of initiative on the part of authorities to clean the drainage system of the area. Residents of ward also complained that various government departments are clearing new construction projects in the areas in a haphazard manner, without carrying out a detailed survey regarding the flow of drain water in the area and it causes artificial flood during summer season. So, from the field survey it is clear that though there is hundred per cent drainage connection in the core city area, it not constructed in a scientific manner which creates problems in the locality.

Intermediate area: In intermediate location (ward no. 20) of the city, 95.5 per cent responded that they have drainage provision for waste water disposal (illustrated in pictureVII). The respondents of this ward have been demanding the authorities to make

the water exist channels free from encroachment ensuring smooth water passage, which is mainly responsible for the water-logging problem in almost all the localities of the ward. The problem of urban floods is deteriorating in intermediate location of the city with every passing year, whereas some localities like Anil Nagar, Nabin Nagar, Tarun Nagar face water logging almost throughout the year. It is the utter failure of the civic authorities to drain out water, even in the dry season, alleged by the respondents of the area.

Periphery area: It is revealed table no 4.10 that 89.4 per cent respondents of ward no 25 disclosed that they have drainage connection for domestic waste disposal. The respondents of the periphery region expressed that existing drainage facilities in their areas are not adequate to carry all domestic waste water from each of the localities. Hence, some more new drains could be constructed along the natural slope of the area. Moreover, existing drains can be renovated for easy flow of both waste water and rain water with provision of annual clearance. They also told that as most of the roads, inside their area are very narrow, underground drains are desirable. These roads should not be utilized for drain-cum-footpath indiscriminately.

Picture VII: Drainage Provision for Domestic Wastewater Disposal in the Study Area



4.6. Observations and Conclusion: On the basis of the above analysis of data, following conclusions may be drawn with regard to the objective of the study.

Water and Sanitation play a crucial role in the improvement of the socio-cultural and economic endowment of man. As such, access to clean and protected drinking water and good sanitation facilities has been treated as a fundamental right for the people of India. Although, there were not any well-planned public supply systems in the cities like Guwahati in the past, prevalence of small water tanks and wells excavated by the Ahom rulers emphasized the public welfare measures taken. Besides these wells and tanks, the river Brahmaputra also served as important sources of water for the people of the city in the past and continues to. After Independence, initiative for public water supply took a shape through the formation of Guwahati Local Board and subsequent development of Guwahati Municipal Corporation. At present, the major source of drinking water in the city is municipality water and other sources are like- individual ring well, deep tube-well, personal ground-water bore well. However, for a certain section of people the only sources of their drinking water is the commercial water supplying agencies (private water tanker).

Municipality water supply scheme covers 65 per cent of the households- in the study areas of the city. Supply is found to be more or less regular, except in the dry season, when water supply becomes intermittent. The condition seems to be worse in the peripheral areas (ward no. 25) of the city where the households having piped water connection (36.4 per cent), the quantity of supplied water is very less. Insufficiency of public water supply affects the households of the area that are left with no option other than depending on other sources like deep tube-well and ring well. These wells have come to play a very crucial role on meeting the demands of drinking water in the absence of a proper reliable public water supply system in the periphery regions. However, in the core area (ward no. 10) of city supply of water is found to be impressive because it lies adjacent to water supply plants. It can be said that the status of drinking water availability in the Guwahati city is below the average Indian urban situation. Per capita water consumption is found to be 90.6 litres against Indian urban standard of 135 litres. The

city is growing very rapidly in many aspects in the name of external face-lift and modernization of infrastructure, but it can be said that in terms of the growth of basic necessities the picture remains abysmal and needs immediate attention. However, amidst the prevalence of the dreadful water supply facilities, with the on-going construction of the new water supply system, Guwahatians continue to anticipate that 24x7 affordable, clean and reliable water supply service with adequate pressure would be achieved in the near future, which would significantly improve their current standard of living.

The study also reveals that Guwahati city does not have any integrated sewerage system at present except for certain residential areas such as the Railway Colonies, Guwahati Refinery colonies and the residential areas under defense establishments. All the mentioned areas have their own separate sewerage facilities. For the rest of the residents of the city, most of the individual houses have septic tanks without any collective disposal system for effluents. The sewage from the septic tanks goes directly into the open drain, which leads to loss of flowing capacity of the drains. This ultimately makes the surroundings unclean, unhygienic and conducive for growth of disease-carrying organisms. The soak pits connected to septic tanks are becoming non-functional due to high sub soil water table within a short span of time.

The unplanned urban development of Guwahati city has created stagnant pools of waste water, which has become breeding place for mosquitoes and other disease carrying organisms and has become a source of public health hazards. Therefore, immediate steps have to be taken to provide a comprehensive sewerage system of collection, treatment and disposal of all spent wastewater of the city in a scientific manner. Key issues pertaining to sanitation are similar to that of drainage. Hence it is imperative to have an integrated sewerage and drainage scheme, which also takes into account sewerage, sewage treatment and storm water drainage. The Guwahati Municipal Corporation (GMC) is the sole authority for the sanitation as well as collection and disposal of the garbage in the city. But the study reveals that this urban local body is too weak to ensure effective delivery of services in the Guwahati city. Therefore there is a need for undertaking an assessment of the existing institutional structure for urban governance in

Guwahati to assess gaps, overlaps and duplication of functions between various organizations.