YITBAREK ANDUALEM MEKONNEN

ASSESSMENTS OF URBAN DOMESTIC WATER SUPPLY CHALLENGES IN INJIBARA TOWN, ETHIOPIA

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A THESIS SUBMITTED TO THE GRADUATE SCHOOL OF APPLIED SCIENCES OF NEAR EAST UNIVERSITY

By
YITBAREK ANDUALEM MEKONNEN

In Partial Fulfillment of the Requirements for the Degree of Master of Sciences in Civil Engineering

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This thesis is my original work and has not been presented for a degree in any other university and I declare that all information in this thesis has been obtained and presented in accordance with academic rules and ethical conduct and also all sources of material used for this thesis have dully acknowledged.

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To my parents…

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ABSTRACT

The objective of this study is to assess the major challenges and existing situation of domestic water supply systems of Injibara town, Ethiopia. The study used a household questionnaire, personal observation, and key informant interview to collect necessary data's. 680 households were selected from the town using simple random sampling technique. The data collected from the respondents were analyzed using the statistical package for social science model (SPSS-25) and coding data to identify the major causes and challenges of domestic water supply in the study area. The findings of this study revealed that, existing water supply has multiple problems. These are lack of funding, the rapid growth rate of population, loss of water by leakage, unauthorized connections and lack of power to pumping facilities. The maximum production of the spring and boreholes discharge was only 36% of demand capacity. Moreover, the distribution pipeline breakage due to water pressure in various portion of the town causes frequent disruption of water supply. The domestic water supply coverage of study town was only 40%. Only 46.4% of the respondents were using piped water while the remaining 53.6% get water from unsafe alternative sources. Additionally, the willingness to pay any amounts of money to improve the existing water supply for the future time was only 25.6%. There is no coordination, participation, and awareness of the population about the aim of water supply for their life by using water direct or indirect. To sum up with the existing domestic water supply is inadequate for all town communities. Therefore, it is recommended to redesign all components of water supply schemes starting from population forecasting up to distribution systems.

***Keywords*:** Access of water; demand; distribution; production; water interruption; Water supply; water tax; Injibara town

ÖZET

Bu çalışma, Etiyopya'nın Injibara kasabasında su dağıtım altyapısının mevcut durumu ve bulunan zorlukları tesbit etmek için hazırlanmıştır. Çalışmada ev kullanıcılarına sunulan anketler, kişisel gözlemler ve yetkili kişilerle yapılan görüşmeler kullanılmıştır.Kullanılan veriler kasabada rastgele seçilen 680 evden alınmıştır. Toplanan veriler,Sosyal Bilimler Statistik Program ile (SSPS-25) analiz edilmiş ve şebekedeki ana sorunlar ve zorluklar bu şekilde tespit edilmiştir. Bulunan sonuçlar su dağıtım şebekesinde birçok sorun olduğunu ortaya çıkarmıştır. Bunlar yetersiz kaynak, nüfustaki hızlı artış, kayıp ve kaçaklar ve pompalama istasyonları için yeterli enerji olmaması olarak sıralanabilir. Mevcut kaynakların maksimum üretimi ihtiyacı sadece %36'sını karşılayabiliyor. Dahası, şebekelerde oluşan arızalardan dolayı oluşan basınç düşmeleri kasabada sıklıkla su kesintilerine sebep oluyor. Su şebekesi kasabanın %40'lık kısmını kapsıyor. İlaveten, katılımcıların %46.4'ü şebekeden gelen suyu kullanırken, geriye kalan %53.6'sı su ihtiyacını alternatif kaynaklardan karşılıyor. Su şebekelerinin geliştirilmesi için ödeme yapmaya istekli katılımcılar sadece %25.6. Toplumun, doğrudan veya dolaylı olarak su konusunda herhangi bir koordinasyonu, farkındalığı ve gayreti bulunmuyor. Özetleyecek olursak mevcut su şebekesi kasabanın ihtiyaçları için yetersiz durumdadır. Bu sebeple, nüfusun öngörülerek sistemin alt yapısının tekrar tasarlanıp hazırlanması önerilmektedir.

Anahtar kelimeler: Su erişimi; talep; dağıtım; üretim; su kesintisi; Su tedarik etmek; su vergisi; Injibara şehri

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LIST OF ABBREVATION

ADF:	African Development Fund
BH1:	Borehole one
BH2:	Borehole two
CBOs:	Community Based Organizations
CSA:	Central Statistical Agency
CVM:	Contingent Valuation Methods
HHs:	Households
ITWSSO:	Injibara Town Water Supply and Sewerage Office
JMP:	Joint Monitoring Program
M^3/S:	Meter Cubic per Second
MDG:	Millennium Development Goal
MWR:	Ministry of Water Resources
NAS:	National Academy of Science
NGOs:	Non-Governmental Organizations
NUPI:	National Urban Planning Institute
OECD:	Organization for Economic Cooperation and Development
UFW:	Unaccounted for Water
UN:	United Nations
UNDP:	United Nation Development Program
UNESCO:	United Nation Education, Scientific and Cultural Organization
UNICEF:	United Nation Children's Fund
WBRR:	World Bank Regional Report
WHO:	World Health Organization
WRMEDO:	Water Resources and Mine Energy Development Office
WSP:	Water and Sanitation Program

CHAPTER 1
INTRODUCTION

1.1. Background

Water is the most fundamental need for all living things like human, animals, and plants, without it existing, will be impossible on land for all living things. Next to air, water is the most necessities for survival on the earth (Kumar and Desta, 2018).

The flexible arrangement of sufficient and safe drinking water is the most important of every single person (Arturo et al., 2017). And furthermore, adequate measure of potable water supply is one of the essential urban administrations, which significantly influences the financial development of city or towns and the social aspects of individuals. Therefore, many urban areas in the world are challenging difficult problem of water supply deficiencies. This problem is common in a large portion of underdeveloped countries, as well as Ethiopia, which is particularly most markedly unpleasant and multidimensional ways. ‘‘All resources that nourish life owe their existence to water’’ from the smallest algae to the huge mammals along with everything they live on, feed on and make possible their breeding are the creations of water (Kabiso, 2015). Thus, all peoples of their stage of development, economic and social conditions depend on access to drinking water supply quantity and quality must be equal to their basic needs for their day to day activities.

Water is increasingly recognized as the main cause in economic development, social and reduction of poverty (Haziq and Panezai, 2017). It is considered as economic goods nowadays. The studies made by different agencies have considered the importance of water supply in meeting the Millennium Development Goal (MDG), which has focused water supply that direct and indirect contribution to the entire goal as well as a majority of the targets. In contrast to that, the role of water is not only focused on its central role to achieve the goal on environmental sustainability and on the way to meet the target on water supply, sanitation and hygienic, rather centered to other developmental activities (Alua et al., 2019).

Water is the most essential for all public services throughout the world. It is most important for life next to oxygen (Rathnayaka et al., 2016). Anything that affects the provision of water supply, therefore, tends to disturb the survival of humanity and their life. Water is the basic

need for human being welfare. Adequate domestic water supply is an entry point to sustainable development by the economy and social aspects. However, in most developing countries have limited access to water quantity with poor water supply, hygienic and sanitation is extending the poverty, like Ethiopia.

Even though, Ethiopia is a country with high surfaces and groundwater potential that has twelve major river basins, including the Blue Nile and eleven significant lakes, which makes the country the "Water Tower" of East Africa (Kassa, 2017). However, access to safe local water supplies, hygienic and sanitation benefits in several parts of the country is among the least in Sub-Sahara Africa. As the urban area in many developing countries, there are serious issues in addressing the difficulty to demonstrated satisfactory reasonably for every single urban resident in Ethiopia, household water supply deficiency and less quality are real issues which required the deepest consideration and obligation. There is a different challenge that affects water consumption which is not available to all dwellers in urban areas. Because of inadequate structures combined with quick population development and urbanization and also the gap between water consumption and water supply of town communities for their activity (Temitope and Oyedotun, 2017). This condition is the same in the study area.

Water is an essential resource for lives and developments of one town or city (Emenike et al., 2017). Ethiopia is capitalized with huge water resources having groundwater and surface potential yet access to residential water supply is constrained because of physical and socio-issues of the population. This influence appropriate arrangement of water management, environmental change and influences the amount of water consumption extremely household for drinking water supply and different domestic activities, high measures of urbanization and improvement, per capita consumption, population distribution in the town and financial elements are considered as large difficulties in Ethiopia, especially in the study area. This condition was progressively caused by mismanagement additional migration population and sizes of the urban region. In study town, there is not adequate quantity and quality of domestic water supply for the town community at the past and the current time. The study area is Injibara town, Awi zone in Amhara Regional states of Ethiopia, which is the capital town of Awi zone. This studying is identified significant sources of water supply and adequate quantity of water demands levels of households, levels of water supply and distinguish the real problems of the residential water supply of this region. Also, to explain determinant factors that influence the

demands of water supply from households of study town depends on the existing water supply system.

The problem consideration in water supply and sewerage systems in Ethiopia and particularly in study town is described by management deficiency of physical framework and deficient of administration ability to hand arrangement and administrative issues and to design, work and keep up the administrations of water supply plans. Deficient water sources, demands, distribution network and low consumption of residential water supply are the major problem in the study are due to high numbers of population and financial levels of the town communities.

The primary drinking water supply for the study town was spring source is referred to locally name as sutang spring developed in 1985. This source is the primary source of the town for a long time with good quality and still used to for a few town communities. After some decayed drilling two additional boreholes during 2015, this source is the main source of the town before four years and up to now, but not enough or fit the present town community demand of water supply and there is not quality.

Furthermore, Injibara town is one of rapidly growing town in the country with rapid urban growth rate, high population increase which resulted from high immigration and growth rate but low investment on portable water supply provided to the town due to lack of urban infrastructure and services. The dwellers of this town faced water supply shortages and part of these dwellers have got fetch water from unprotected alternative sources and bought from the better households 25 liters by 1.00, 1.25, 1.50, 1.75 and 2.00 Ethiopian birr from a different distance. The study town is the capital town of the Awi zone, which is an increase in population, economic development and three-dimensional development. Regard to CSA, its population number in 2014, 2015, 2016, 2017 and 2018 was 35849, 37718, 39654, 41735 and 43777 respectively. This quick development of the town has achieved a huge increment in the interest for urban framework supply, especially adequate quantity and quality water supply of the town.

1.2. Statement of the Problem

Injibara town has issues of insufficient household water quantity and quality. The community of the town could not gate a sufficient quantity of water supply for different domestic activities. Due to this reason the community fetches water from different alternative water sources from a far distance every day.

The community growth rate of study town is very fast through a year due to different factors. These factors are an explanation of a numbers of personal sectors, governmental and non-governmental organization and also great numbers of peoples migrate from a rural area and from some urban areas to find different kinds of job and the air condition is better for the living.

The current situation of piped water of the study area is insufficient for the community, which cover only 40 percent of the total community of the town. The great parts of peoples meet their daily water consumption fetching from traditional hand dug, spring, rivers, and rainwater during rainy seasons. But these sources are unsafe and unprotected, which are causes various water borne and water-related diseases on the community of the town. Especially traditional hand dug well is placed near to toilet pits; it is not greater than 8-12m because the land of residential is very small in urban areas. Regard to the Injibara town health center report in 2018 the waterborne, water-related and washing diseases are one of the top ten diseases in the study area.

The challenges of domestic water provide within Injibara municipality is no single issues of adequate quantity and quality however there is a challenge on distribution networks. The heads of Injibara town WSS office state the distribution network has a great challenge on the domestic water supply of the town community every day through the year.

The total numbers of customers of town piped water supply users are very low compared to the total numbers of households in town which are 13601. Total customers using piped water supply is 5924 but these only 5223 are households from total households, which are only 38.4% and 698 costumer's different organization in town. The present piped water supply has many factors for all household to uses like a high cost for new pipeline connection, operation, and maintenance and also interrupts every day. The distribution rate of piped water supply during in week maximum 3 to 4 days for 5-6 hours. Due to these reasons, more community forced to fetching water from unprotected and unsafe sources to meet their consumption and some people buy water from illegal persons and shops by high prices.

Shortages of sufficient quantity of water supply in town cause various effects on community-related to their economy and health matter. Because they forced fetching water from unsafe water sources without considering the water quality to fulfill their demands, therefore more numbers of households affected by water-related diseases and to pay high amounts of money for illness persons without a plan.

In the study area, the children and women are highly affected to fetching water every day from a far distance rather than other communities in town. These affect their productivities and education and working time inside and outside the home and also their energy.

The numbers of socio-economy activities are very low in town, like industry and others due to the scarcity of water supply for the different purpose of industry works and supply of industry.

In study area there is no coordination and participation of the community, CBO, governments offices and NGOs to identify and solve the current situation of water challenges to communicate with ITWS office and pay money to improve the better water supply than existing water supply systems for a future time.

1.3. Objectives of the Study

A major goal of this study is identifying the amounts of water quantity and problems of water shortage in town. The general aims of this studying are to assess the major challenges and causes of inadequate quantity and quality of domestic water supply in studying town. Its specific objectives are:

1. To assess the main types of domestic water supply sources and its coverage in studying town
2. To observe water demand, production, and consumption of a town
3. To examine water coverage and distribution system of water supply
4. To identify the major causes and challenges of non-sustainable water supply in study area
5. To assess tariff setting structure of water and its equality for all communities of the town
6. To assess the coordination and participation of community, COB, governmental organization and NGO to identify and solve the problems of domestic water supply
7. To identify the willingness to pay any amounts of money to improving better water schemes

1.4. Research Questions

To accomplish the above-explained studying objectives must solve the following main research questions.

1. What are the most important sources of domestic water supply in the study area?
2. What is the current situation of water in the study area?
3. What is the present condition of water demand, production, consumption, and coverage?
4. How was the structure of water taxes at the existing situation in town?
5. What the main causes and problems of water shortages?

6. Are there the people who will pay any amounts of money to improve the better water supply schemes than existing water supply systems?
7. What is coordination and participation of the community, CBO, NGO, governmental and private organization to identify and solve existing water supply problems?
8. What is possible and best solution to reduce water shortage?

1.5. The Scope of the Study

The scope of this study is restricted to residential water supply and does exclude industrial and other demands of water, because of time and financial limitations, this investigation is constrained on Injibara town water supply. Particularly the research was focused to identify the problems of adequate water supply in five kebeles (closures) namely 01, 02, 03, 04 and 05 in town. The sample magnitude is restricted to 5 percent of the whole residential in the five closers of the town that means the whole numbers of the household in 2018 is 13601, from this 5% is 680 sampled households were taken from five kebeles.

The scope of the investigation regarding the topic was restricted to evaluate the issues of sufficient domestic water supply only in terms of the equitability of the distribution in all parts of the town, its sufficiency, quality, and availability to all community.

1.6. Significances of the Study

Residential water supply is the real issue or problems in the whole world superior in underdeveloped countries, similar to sub-Saharan Africa, particularly in Ethiopia. This investigation is considering degree, coverage, and essentials of the town water supply system in study town to assessing the major causes and challenges. The general aim of this studying was identifying the main problems of domestic water in town community which have no adequate and safe drinking and hygienic water, especially some low levels of their salary people. Therefore, the consequence of the investigation is important for the following reasons: The Amhara Region state, particularly policy maker institution, Injibara municipality offices, and water supply and sewerage offices can be findings of this thesis to identify the major cause and challenges of the existing water supply system of the town. And also, outputs of this thesis are used to as inputs for future study and redesign of the domestic water supply of the study town and recommended the corrective measurements of on current and future situation of domestic water consumption of town and also it can be contributing to optimal uses of water for

beneficiaries. This study is used to for other researchers as a reference to study other urban areas of inadequate domestic water supply major causes and challenges for a future time.

1.7. Limitation of the Study

The study was limited inadequate access water condition of Injibara town because of the absence of enough related composed material or writings from the local sources in the field, the investigators forced upon the comparing outside urban water supply sources.

The other issue looked by the examination procedure is the absence of enough measures of fund and duration. It is difficult to direct these types of research without an adequate quantity of cash, time and source. Even though, sustainability of water schemes includes a number of aspects such as technical, financial, environmental, social and institutional. Another major issue to getting sufficient and essential primary and secondary data. These challenges are as follow:

1. Some legislative workplaces were not volunteered to give the required quantity and quality data.
2. Because of poor records of the information in the administration workplaces, it was poor the fundamental and applicable data
3. The structure change of the general population divisions had additionally an effect on information gathering.
4. Exchanging of the governmental employees from one place to another place and also position to positions.

1.8. Organization of the Thesis

Normally the study has six chapters. The primary chapter consists of the introduction of the paper, statements of the problems, objectives of the investigation, research questions, scope of the investigation, significant of the study, and limitations of the study. The second chapter of the investigation describes a related literature review on urban domestic water supply. The third chapter explained the investigation of the area (history and background, location, topography, and climatic conditions), materials and methodology which including research design, data sources, and type, data collection techniques and methods of data analysis. The fourth and fifth chapter describes the results and discussion of the thesis. And the final chapter is the conclusion and recommendations of the paper.

1.9. Definition of Key Terms

The following words are used inside this paper and each word has its definition as follow:

Water Supply: water which is used to for domestic purpose, industrial, institutional, commercial, public and animals watering in one town or city.

Domestic consumption: the water is used for various household activities, such as for food preparation, drinking, bathing, ketch, hygienic purposes.

Piped water: is a type of water sources which is designed and protected water supply and used various purposes for community water consumption.

Water demand: water required by the town for household person consumption, creature consumption, business consumption, organization consumption, industrial consumption, guests demand and recompense for unaccounted for water.

Household: All people living under one rooftop or possessing a different lodging unit, having either guide access to the outside

Kebele: the smallest organization of population unit living in town or city in Ethiopia government administration order.

Urban: Built-up and populated region that incorporates a district and by and large, has a populace of at least 2000 population area.

Safe water: Portable water free from unsafe microorganisms and substances, regardless of whether it might have color, odor, or taste issue because of broken down minerals.

Household connection: is water service of pipeline linked inside house pipes to at least one taps, for example, in the dining room and washroom or tap set inside the compound.

Public tap: is community water bono from which individuals be able to gather water. Some low-pay family units those cannot allow the costs of a family connection are depending on public water focuses.

Water vendor: is a water merchant who collects water from alternative sources or private tanker and sold by high prices for other community during the water shortage.

CHAPTER 2
LITERATURE REVIEW

2.1. Urban Water Supply

Water is the fundamental required for human survival and economic development, the arrangement of satisfactory supply of sufficient water in an urban region in both developed and developing countries are basic for their life (Kassa, 2017). In connection to this, creating countries the arrangement of satisfactory demotic clean water supply even though drinking, cleaning, washing, and so on, enhances human services by reducing the rate of waterborne and water-related diseases, for example, Amoeba, Diarrhea, Cholera, and Typhoid (Karimi, 2016). This likewise limits both mortality and dreariness rates and the number of working days lost and decreases work proficiency. Diminishing the rate of diseases will cut interest for enhanced treatment and facilitates equalization of installment issue challenging particularly least creating nations. Water is one of the essential basic powers for manageable advancement of any town or city and also the nation, where it's a financial, social and ecological improvement are to vast degree reliant on enhanced satisfactory local water supply administrations. Access to water supply, hygienic and sanitation are an essential need and a human right (Adegbehin et al., 2016).

Water is a prime natural resource and an essential human need. Without having the entrance to satisfactory water supply each human's action is pointless and the privilege to utilize other elective sources will be abused (Chalchisa et al., 2017). An entrance to the water supply is a fundamental need and establishes a standout amongst the most imperative human rights. Individuals' lives and vocations rely upon the water.

In this manner, the protected or clean, satisfactory and available supplies of water together with legitimate cleanliness and sanitation are really basic and essential needs parts of major medicinal services for the population. Concurring this, the Ethiopia water and sanitation program has distinguished the idea of linkage among WSS and destitution decrease (Abdisa and Reddy, 2014). As indicated by the area program, a maintainable enhancement in water supply, cleanliness, and sanitation condition is fundamental to: -

- Limit incomes failure because of unreasonable time and vitality spent in gathering water
- Increase salary gaining potential through an increase in efficiency of their work

- Reduce the price of social insurance benefits particularly for waterborne and related disease, for example, Amoeba, Guardia, Diarrhea and Typhoid and so on
- Increase their salaries from dairy cattle that rely upon water
- Increment the personal satisfaction of the poor through, to make a constructive effect on maternal and child medicinal services, improvements in school enlistment and participation, better school hygiene and sanitation, limit home obligations and time spent on water gathering particularly for children and ladies.

Ministry of Water Resources additionally considered the supplementary as the fundamental advantages that particularly ladies get from water plan. These are: -Time and energy sparing as the consequence of which they take an interest in other development exercises, for example, generation, training arrangement making, satisfactory and clean residential water supply for drinking, clean, cooking and sanitation and consequently, better wellbeing and proper type of open focuses that meet the kind of water holder they utilize (Yongsi, 2010).

In this manner, the interest protected, sufficient and available urban and rural water supply activities, especially in underdeveloped countries, have been expanding after some time as a consequence of the rising way of life and the population increase coming because of normal development and additionally regional urban movement, under such conditions making arrangements for water conveyance framework in both here and now and long haul is basic to guarantee that the population gets satisfactory local water supply. In greats, developed countries, the local water supply to families, commercial and industry are all of drinking water standard even though just a little extent is really consumed for food cooking and some other domestic activities (Misgena, 2015).

2.2. Access of Safe Water

Access refers to one's capacity of money related expense and the ability of separation, ease and energy to achieve those facilities that improve one’s living situation (Emenike et al., 2017). The problem of openness likewise includes the facilities being situated inside safe physical reach, being reasonable and being available in law.

Access to facilities, for example, residential water supply, social insurance, clothing, cooking, and instruction can be manufacturing a few homes having practically no entrance to them (Temitope and Oyedotun, 2017).

Regard to the evaluations of WHO, families which are established in the low salary regions is more than multiple times more inclined to need access to enhanced water supply than family units in the high-income region in a similar country (Hussien et al., 2016). Seen that family units that obtain not exactly a dollar daily might be just about multiple times more motivated to need access to enhanced satisfactory local water supply, hygiene, and sanitation than those winning in excess of two dollars for every day (Iraj and Rao, 2016).

Access to the safe water supply is estimated by the extent of the population with access to a satisfactory measure of clean drinking water situated inside a real separation from the customer's dwelling. WHO/UNICEF joint checking modified characterized at country level "Access" is interpreted as genuine use by population. Access of water supply in an urban zone not in excess of 200 meters separate from HHS to an open stand post may think about functional access of water. In-country regions get to demonstrates that a man does not need to spend uneven getting water relies upon the family needs. The practical access must be somewhere around 20 liters for every individual every day from the separation of a source inside one kilometer of the customer's family units (Koop and Leeuwen, 2017). Safe drinking water supply is imperative to human and other life which lives on the land, despite the fact that it cannot contain calories or natural supplements. Access to protected and satisfactory drinking water supply enhanced in the sequence of the most recent decades attractive much every part of the world, yet at the same time around one billion individual's absence of access to protected and sufficient water supply and 2.5 billion needs gets to legitimate hygiene and sanitation. There is a reasonable relationship between the entrance to sufficient and protected and total national output per persons. In any case, a few observers have evaluated that by 2025 the greater part of the total population will challenge water-based weakness, contracting our water future report, issued in November 2009, recommends that by 2030 in some developing countries of the world, water request will better water supply by half. Water assumes a critical job on the world economy and society, as it works as a dissolvable for a wide assortment of synthetic substances and encourages modern cooling and transportation. Around 70% of the crisp water utilized by people goes to agriculture manufacture (Aynalem, 2015). Sufficient and safe drinking water supply is the real important for all mankind as much a due as perfect air, anyway, access to the satisfactory and clean water supply can be considered as one of the fundamental needs and rights of an individual (Admasie and Debebe, 2016).

Safe drinking water supply coordinated with enhanced hygiene and sanitation addition to the general wealth of population, it has critical behavior on death rate, life span, and efficiency. Nevertheless, most of the total population in both rural and urban settlements does not approach satisfactory and protected drinking water supply (Rumalongo et al., 2017).

According to WHO only 16% of the population in Sub-Saharan Africa approached access to sufficient and clean drinking water supply through HHs association which is yard private or yard shared association. Not just their poor access to punctually open drinking water supply, nevertheless when water is accessible in these residential communities there are dangers of pollute because of many variables like ill-advised wastewater and solid waste transfer and absence of enough water supply foundation, for example, pipeline for water distribution framework (Eytan and Dorothee, 2018).

Access to safe water is the offer of the population with functional access to sufficient measures of clean water supply, safe water including treated surface water and treated groundwater however uncontaminated water, for example, spring and boreholes (Asgedom, 2014). A sufficient measure of water is expected to fulfill metabolic, hygienic, sanitation and local necessities normally around 20 liters of safe water supply per individual every day. This smallest amount anyway changes relying upon whether it's a rural area or an urban region and whether warm or atmosphere condition around the territories. Due to this reason the Africa water development report in 2016 that clarified as essential human water should be 20 to 50 liters for every individual of protected and uncontaminated water day by day. Access to water is essential for human wellbeing and occupation, which is the reason the MDG target is detailed of improved good quality of water supply, hygiene and sanitation basics are broadly perceived as a basic part of human rights, economic and social development (Ahmed et al., 2016).

The poor persons living in rural and peri-urban settlements are most in the requirement for improved and protected drinking water supply, proper types of hygienic and sanitation and furthermore access to water for other household exercises of houses (Chalchisa et al, 2017). The WHO in 2016 reports that damaged drinking water supply causes about 1.8 million persons to pass on for diarrheal illnesses every year around the world. Ethiopia is a country in which the water supplies, hygienic and sanitation framework is low still nowadays. For the most parts, access of sufficient and safe water supply is the most imperative for all urban and country

individuals due to undergo their life on the land and create an economy, social viewpoints and increase their productivities.

2.3. Domestic Water Supply

Domestic water supply is characterized as water utilized for all resident purpose including demands of drinking, cooking or food preparation, washing, showering, cleaning and sanitation (Arturo et al., 2017). For every one of this residential use, a specific amount of water must be accessible. In any case, there is a problem to distinguish an obvious least measure of water for every residential action. For the manageability of life, a base amount of water is required of water by a human body. The prerequisites as to the roundness of water supply over every one of these utilizations and not exclusively in connection to the utilization of water. Even though this expansive definition gives a general structure to resident water use in the setting of value necessities, it is less helpful while considering amount require a water supply.

The daily necessities of drinkable water supply per individual for their fundamental needs is 20 to 50 liters for each day, yet more than one out of six individuals do not approach such measures of potable water. Generally household water supply in Africa where only 62% of the number of populations in urban approaches to gate improved water supply. The rural zone has more difficulties in condition as it covers only 47% of the total country populations. In this way, the rural and urban individuals are more vulnerable to neediness and illnesses and also causes passing of more than a huge number of individuals consistently. More defenseless affected are children and elderly people's (Kefale et al, 2014). Furthermore, as obviously demonstrated by the UN-Habitat a family is considered to approach improved drinking water on the off chance that it has adequate measure of water which is 20 liter per capita per day for family use, at a reasonable cost under 10% of the total families pay, accessible to family individuals without being subject which is rapid of what one hour daily for the base adequate amount, mainly to ladies and children (Akkaraboyina and Adem, 2018).

The demonstrates that worldwide around 2.6 billion persons are left without the fundamental hygienic and sanitation because of an absence of sufficient and safe residential water supply bringing about the death of more than 1.5 million persons constantly, the majority influenced are from East Africa and Sub-Saharan Africa (Ahmed et al., 2016). The sanitation inclusion in Africa all is just 60% from urban and local territories.

Domestic water supply is basic in various ways, these including household water supply and profitable employment of their development by an economy and social angles (Feleke et al., 2018). As per water Utility Partnership expressed that the essential objective of all water supply utilities is to give consumers a personal association with the funneled local water supply unite. For some public authorities, arrangement producers and government officials are viewed as the most agreeable approach to meet their essential key destinations of general health, by ensuring better quality and access of sufficient water supply for their residential purposes, commercial targets; by encouraging for price recovery and income stage, social goal; by enhancing access for the poorest and improving security and natural goal; by empowering better interest management and water protection.

Sufficient drinkable water supply for household use particularly is frequently utilized as real estimating the dimension of the economic development and medicinal services status of the population. For help a national population by economy objectives, the necessity is to have an unfaltering supply of high quality of new water Publicly, dependable drinkable water supply gives help to those engaged with its entrance, for example, ladies and children (Aynalem, 2015). Singular, families, commercial and industrials all rely upon extensive amount, safe water access, drinkable and reasonable water supply (Rathnayaka et al., 2016). The water supply required for all person; therefore, water must be satisfactory, protected and free from any unsafe smaller scale living beings, mixture substances and radiological dangers that may establish a risk to a man's wellbeing. It must be likewise worthy as far as shading and smell so personality will pick it instead of dirtied options that may look more attractive water.

Subsequently, satisfactory and protected drinking water supply is one of the essential for individuals to live on the land, will medicinal services and be profitable from their work. In any case, huge quantities of the total population meet deficiencies of this important need. This problem happened from both urban and rural zones, especially, from less developing countries networks still under the most extremely serious circumstance. Preferences, Ethiopia individual person absence of adequate, safe drinking water supply and appropriate clean and sanitation (Ermias, 2016).

When we notice, by the Joint Monitoring Program (JMP) explained in 2016, local water supply in Ethiopia is affected individuals' health, education, generation, keeping the country from achieving its development by various ways, since expansive quantities of a population as yet

drinking and uses for different local exercises hazardous water sources (Kumar and Desta, 2018). In this manner, access to improved residential water supply in Ethiopian is for the most part least, which was evaluated as 37% of total inclusion for urban and country regions. Thus, related diseases, for example, waterborne and related pollutions, poor clean and sanitation; these are the real regular disease and passing. Most time this influence ladies and children of the country.

2.3.1. Domestic water supply in developing country

One of the fundamental issues of the Millennium Development Goals (MDGs) is expanding access of adequate and safe household water supply combined with water resources management and development in urban and rural areas (Dagnew et al., 2017). Household water will be water which is comfortable for drinking, cooking and showering for every residential action.

According to the United Nations World Water Assessment Program, demonstrates that is basically well-established truth the water is unequally conveyance for all through the world (Mactaggart et al., 2018). The significant issues are environmental change, monetary status, human obstacle being developed exercises, worldwide monetary and nations, specialized issues, water consumption, water sources and money related are influences water administration direct or indirect. The significant poverty in underdeveloped countries including Ethiopia can be specifically connected with the absence of openness of water supply.

As the equivalent as expressed by WHO and UNICEF all around 1.2 billion persons got to improved satisfactory and clean drinking water sources beginning periods (Marson, 2016). In any case, the worldwide population has been expanding quickly consistently; this causes increasing of local water supply consumption in each year, particularly in Africa and South Asia where their introduction to the world rate is hugely higher contrasted with the rest countries of the world. Consequently, the comprehensive number of individuals without satisfactory access to an enhanced drinking water supply source reduced to 118 million. There was not any development set aside a few minutes outline in Sub-Saharan Africa, subsequently, the number of individuals without access to satisfactory and safe drinking water supply expanded with 23%. Then, around 900 million individuals by 2015 will be without access to competent improved water supply sources. Along these lines, the extraordinary feeling must be given Sub-Saharan, comparably, demonstrates that population and fast urbanization in Africa have expanding

weight on local water supply resources (Schleich and Hillenbrand, 2009). Now day Africa has the home almost one billion individuals or about 15% of the worldwide population. Projections to 2025 that water deficiency in countries of Africa will be reduced in some numbers.

Likewise, "without satisfactory and proficient water supply, where there are water destitution and measures to decrease pay neediness are probably not going to be fruitful". That is the reason the significance sufficient and safe water supplies for neediness decrease have pulled in consideration of governments and distinctive world association. It is essential to see the connection between water supply and neediness (Adane et al., 2017).

Among these African countries are enriched with common water resources, yet most noteworthy quantities of the population, fast extension of urban areas, and absence of access to satisfactory and protected and drinkable water supply earlier its accessibility there are political and regional problems that anticipate better dispersion arrangement of this water supply administrations. This circumstance as a quick and relentless development of the population in and around the city has constrained it to give appropriate and favorable reaction to urban domestic water supply management's request rapidly (Farah and Yonis, 2015). This expansion which is foreseen to develop more with the rise of different government, non-legislative association and private areas and distinctive commercial and industrial parts and to deliver work for transients for future time implies rising requests for extra urban administrations, for example, sufficient and safe water supply, appropriate hygienic and sanitation.

2.4. Experience of Developing Countries

The developing population in most developing countries is disproportional in their urban area; this spot significant weight on officially over concerned spending plans to build sufficient and safe water supply and wastewater foundation. Additionally, almost no resources are left to supply and improve better urban domestic water supply. To add to this problem, money is hard luck on concentrates that would not be actualized, schemes are developed but instead never been implemented (Hassan et al., 2016). Subsequently, sufficient and safe water supply and appropriate hygienic and sanitation in developing countries are still extremely insufficient. In Africa for instance over 47% percent of urban families are without access sufficient and safe water supply, clean and sanitation, this condition is far more fearful in the country and pre-urban areas (Kabiso, 2015).

Worldwide water supply and sanitation Assessment Report in 2016 additionally evaluated that more than 33% of urban water supply in Africa, Latin America and the Caribbean and the more significant part of Asia, work discontinuously (Adane et al., 2017). Discontinuous water supply framework is a huge imperative to the accessibility of water for cleanliness and uplifts the low salary urban population to punch to choices, for example, water merchants. These water sellers regularly charge ordinarily more than the formal water duty for water that frequently is less quality and not accessible in sufficient quantity.

In India, the administration additionally attempted to give water supply dependent on the interest of the population. The India foundation report, current legitimate store on ways to deal with framework arrangement in the nation recognizes the advantages of an interest population in foundation arrangement comprising enhanced appraisal of customer's requirements for the administrations and consumption administration. In rural water supply and sanitation, the consumption responsive methodology is as of now being actualized in a few sections of the nation with components, for example, self-determination of administrations types, support of NGOs, CBOs and expanded investment of women in the population (Zewdu, 2014). Nevertheless, in the urban areas, the consumption responsive methodology has been restricted to a couple of projects, for example, the organizing program focusing on the poor living in rural and squatter settlements.

Consumption projections are made by past patterns of water demand and population development. While these give quantitative evaluations of the water supply required, different elements of interest stay disregarded. Subsequently, willingness to pay (WTP) and uncovered disposition examines for new or improved management have been discovered more helpful popular evaluation although the weaknesses of the unexpected valuation techniques (CVM) after that they depend (Gelame, 2014). Over this, the Organization for Economic Cooperation and Development (OECD) in recommends making more prominent use of;

- Anticipating the future consumption for the water supply system
- Proper sources esteeming for water and reassessment and transferability of water right
- Different non-value request administration measures and incorporated controlling action to create and actualize successful water consumption administration approaches.

The essential water deficiency is proficient when the populations have no more effects on domestic water supply, for instance, the absence of proper access to water-related management and powerlessness to the water-related impacts, like waterborne and water-related diseases.

2.5. Sources of Drinking Water in Developing Countries

The developed countries have not been problems with water supply, either in urban or rural areas. There has been adequate utilization of water treatment plants to guarantee the strength of individuals; for example, water is possible to drinking (Iraj and Rao, 2016). Therefore, the level of medical issues since of waterborne and water-related infections are surprising low in developed countries. Nevertheless, in developing countries, individuals are pushed to use conventional water supply from untreated and unprotected sources, which are affecting the health of communities. Subsequently, more than thousands of populations pass on consistently because of unsafe drinking water supply. In this manner, it is not considering the quality parameters together with natural quality in connection to sources of water. Anyhow, the origins of urban domestic water supply in developing countries are rainwater, river, spring, groundwater, surface water, and traditional hand dug well water. These are: -

Rain Water: it is one of the dependable sources of water supply during rainy seasons in which the water is gathered and put away from the rooftops which are used to drink purposes. Contingent on the amount of the rainfall in the specific region, the span of the water storing holder can be developed. It is evaluated that 50-80% of the water can be gathered from rainfall if there are suitable canal and downpipe framework. Nevertheless, if the capacity tanks are not developed legally and if there is contaminating of putting away water with other mixture from the dust, at that point there may be causes some health issues (Khwairakpam and Abraha, 2015).

Spring water; are gotten from an aquifer which is not just the release of a stream that has gone underground for a short separation. Water from the spring is as a rule of good quality for drinking except if human and creature faces pollute them. Hence, it is critical to assure the encompassing of the spring by fencing and some check dams with the end goal to keep it from avalanche if there should be an occurrence of overabundance precipitation. Something else that must be heated over is that the gathering tank must be built to cover the eye of the spring and avoid trash washed into the supply (Haziq and Panezai, 2017).

Surface water; it starts from water sources. It is basically from land, for example, wells, spring, and so it will result in generally difficult microbiological quality (having experienced ordinary

soil filtration). At any rate, it is usually hard to remove. More innovation and energy are required contrasted with other water sources with carrying water from the earth up to the surface (Singh and Turkiya, 2013).

Traditional Hand dug well water; it is one of the conventional strategies for water supply framework in both urban and local regions from creating nations and still most basic these days. These dug wells are made by hands, for example, mud's, sands, rock and mixed soils where just a little stone run over. These days, talented labor is utilized by the networks, where a few individuals from networks are prepared as artesian. Yet at the same time in some urban and rural areas removal is done under the supervision by the residents themselves. The volume of the water in the well underneath the standing water table goes about as a supply, which can meet its requests during the day. Also, water is itself renewed during periods where is no planning. Irregular chlorination must be done to protect from the pollution but it is not safe (Girmay et al., 2017).

2.6. Equitable Accessibility of Water

Availability must be seen inside the setting of the simple with which persons can get the administration of a facility and purpose, availability increments with diminishing requirement both physical and social. And furthermore, openness is between the interest for and the supply of customer benefits over a topographical space and narrowing any interference between geographic areas of management (William et al, 2015). The sources and economic advantages of private water supply, sanitation to family units and people and mainly to children are significant. Uncommon the most significance for poor to spare time, ease and pride that improved water and sanitation. Without access to these are the poorest and smallest unbelievable. Access for the poor is a critical factor in enhancing sources and economic profitability and a fundamental part of any push to reduce neediness. Having water point closer the family unit will decrease the separation women and children need to walk each day, along these lines permitting time for different exercises, including preparing, childcare, developing sustenance and incomes production. The last could incorporate the development and management of rural domestic water supply and sanitation offices (Manoj and Junil, 2015).

Access to the water supply of adequate quality is necessary for every human, creature and vegetation, overexploitation of common resources and high population development present honest difficulties to limited hard water resources and delicate biological systems (Rathnayaka

et al., 2016). Successful administrations of these resources on a practical premise are critical in the event that we need guarantee manageable improvement. Comprehensively there is sufficient water accessible. At any rate, taking care of the demand necessitates that water is provided when and where it is required. The spatial, fleeting and subjective attributes are the most critical difficulties in taking care of the rising demand for water in all segments (Bekele and Leta, 2016). Effective management of these resources on a sustainable foundation is dynamic if we want to ensure sustainable development. Globally there is enough water available. But not meeting the domestic water consumption in most developing countries, like Ethiopia.

2.7. Access to Household Water as Observed by International Association

There has been an impressive measure of writing recording problem identifying with water resources, management, strategies, supply, evaluating and use in all fields of life. A few global and national gathering, discussions and discoursed are likewise hung on water on account of its fundamental significance to humankind. Partner groupings including administrative authorities, controllers offices, public utilities, representatives of poor population, worker organizations, commercial analysts, environmentalists, non-governmental organization (NGOs), global money related organization, specialists, academicians, understudies and market women all gathering together and speak and expound on problems of water (Mactaggart et al., 2018). That consistent as previously mentioned, water has dependably has been a vital problem on the United Nations motivation. When characterizing the Millennium Development Goals (MDGs), water was likewise considered as one of the viewpoints for guaranteeing ecological support ability. The objective of the UN is to lessen considerably the extent of persons without feasible access to sufficient and harmless drinking water supply by 2015. Since it began to now in 2006, nine years from the focused-on time, yet it is not clear what has overall has been done in the different locales towards the accomplishment of the objective of course (Akkaraboyina and Adem, 2018).

As concerned by Global water association as seen that though most countries give first need to the fulfillment of fundamental human requirements for water, one-fifth of the total population is without access to adequate and harmless drinking water supply, and the management insufficiencies influence the poorest portions of the community in most developing countries. It proceeds to state that "water supply and sanitation for both urban and rural areas in these countries speaks to a standout amongst the most genuine difficulties in the years ahead" (Jeandron et al., 2015). Ledge this persistent inside its presentation of the water supply and

sanitation on the earth urban communities, shown that many urban areas challenge correct water deficiencies and that a great many urban residents have the insufficient arrangement of water, sanitation, and leakage, which improves to vast disease weights and a huge number of unexpected losses consistently. It expresses that; "not exactly a large portion of the population in urban territories in Africa, Asia, and Latin America have funneled to their homes and short of what 33% have great quality sanitation" (Ismaila, 2016).

Recorded by World Bank Regional Reports-Africa Region in 2018 referred to in expressed that there is a linkage between fast population development and urbanization on one side and absence of access to water on the opposite side (Mactaggart et al., 2018). This is more articulated in developing countries. For instance, this archive demonstrates that rates of urbanization in Africa are the most astounding in the world while rates of urban economic development are the least. In many African countries 40 to 70 percent of urban occupants live in low salary settlements and for the most part absence of access to essential sufficient and safe water supply since interest for exceeds amount.

This and related circumstance prompt the poor pay ordinarily the sum of wealthy persons pay for water supply regarding the unit rate and the total expense since they purchase from the water sellers while wealthy individuals pay less because they have piped water explicitly connected to their homes. The truth to him is that; "poor people might will and can bear to pay the full expense with the end goal to get the normal stream of water". He again recognizes that; "absence of self-sufficiency of water organizations is one of the center reasons prompting absence of responsibility of management, which is less skillful and unfit to perform above standard in the rendering of its administrations to the general population" (Ermias, 2016).

2.8. Water Supply and Sanitation Policy in Ethiopia

There are significant 12 river water in Ethiopia with an annual volume of 122 cubic meters of water and an expected 2.6-6.5 billion cubic meter of groundwater potential (Kumar and Desta, 2018). Subsequently, there is a huge volume of water accessible per individual every year which relates to a normal of 1575 cubic meter of water. Nevertheless, as referred to above, because of country landscape and geology alongside contrast in spatial and worldly varieties in rainfall and absence of capacity, water is not adequately available where and when required. Out of collective water potential, just 3% of water resources have been utilized, which is about 11% (0.3% of the total) has been used for residential water supply purposes. Along these lines, to

take care of this water problem the household water supply and sanitation strategy started in Ethiopia in the during 1988. Around these arrangements of the government was to give water and sanitation through its very own open water segment foundation with the supply side methodology. In such manner with the end goal to quality the government possessed organizations, the military government nationalized the private part driller and their equipment previously consumed by Ethiopia water works development Agency, which was later used to set the up the self-ruling Water Well Drilling Agency. The Ministry of Water Resources distinguishes the entire water division was, for the most part, visualized as a provider of "free" administrations which neglected to think about the rare idea of water resource in the country (Rathnayaka et al., 2016). Duty and cost recovery additionally not get complete consideration because of the communist economic arrangement executed in the state. Similarly, sanitation part of the Water Resources Management arrangement sets the general system along which sanitation is given the destinations of upgrading the prosperity and efficiency of the general population through the provision of satisfactory and hard sanitation administrations. The new sanitation procedure centers out in the open area contributions around development and public offices as opposed to financing at the family unit level of households of urban and rural areas.

The approach observes the firm idea of water supply and sanitation and solicitations of developments of both a coordinated and reasonable system. Along these lines, as indicated by this approach all water supplies institutional setups have a lawful ideal to actualize the incorporated water supply and sanitation arrangement. Notwithstanding these since the foundation of a Ministry for a water segment in 1995/96, a vital and participatory methodology has been a presentation by bringing into place key division change activities (Feleke et al., 2018). The National Water Resources Management Policy likewise requires urban focuses to cover their speculation, activity and upkeep costs, while local WSS is needed to take care of task and support costs, with a few expenses sharing up to 10% for introductory venture cost. The National Sanitation Strategy requires a move towards financing "sanitation advancement and utilizing assets", and far from sponsorship for equipment and offer need to ease, professional poor arrangements. The financial necessities to accomplish WSS targets are prefaced on the ability to execute the methodologies delineated in approach (Marson et al., 2015).

Like this sufficient water supply and sanitation, the strategy is a fundamental piece of the country's water administration arrangement. In connection with the arrangement report, the

strategy is accepted to 23 give and material to the development of water supply for human and creature demand (Chalchisa et al., 2017). It centers on expanding the inclusion, amount, consistent quality and satisfactory quality, taking the current and future materials of the country though. Upon execution, the strategy is required to accomplish the goal of the Ethiopia individuals to achieve sufficient, compact and clean water benefits that take care of the water customer's consumption. The strategy of providing free water supply to any gathering except an emergency, principals practically speaking to an unjustifiable circumstance. Since there are not enough resources to give such free administrations, the country and urban poor are the first to tolerate. A superior and the substantially more impartial way is gathering water charges from buyers and after that improve and extend the framework. So also, as expressed by the arrangement imagines providing water administrations for urban territories with duty structures that are set dependent on "full cost recovery and confidence". Opportune this problem, expressed that a full price recovery program has the benefit of giving motivating force to appropriate use, reduces spend and extreme demand of water resources (Khwairakpam and Abraha, 2015).

2.9. The States of Urban Water Supply in Ethiopia

The water supply area in Ethiopia is one of the least developed and generally described by administrations lack of physical framework and besides by insufficient administration ability to deal with an arrangement and managerial problem and to arranged, work and keep up the administrations. As to, World Bank Group expressed that however Ethiopia is regularly mentioned to as the "water tower" of East Africa, but only a fourth of the country's population has improved access to domestic water sources. Flooding streams from the Ethiopian are great countries from tributaries of surely understood Blue Nile, Tekeze, Awash, Omo, Washable, and Baro-Akobo rivers which river transversely over edges to neighboring countries (Girmay et al., 2017). Six billion cubic meters of come up short on Ethiopia as the Blue Nile river to Sudan and Egypt. Nevertheless, as repetitive dry spell drives increasingly and local persons from their conventional farmlands to urban focus Ethiopia challenge developing urban water emergencies. Ethiopia has one of the most raised urbanization development rates in the producing or developing scene.

As indicated by information got from the focal measurable specialist, the country's urban population was developing at 4.8 percent annum between 1995 and 2000. The urban population in Ethiopia in 1984, the main registration time frame was 4.3 million shaping 11 percent from

total population. In 1994 the second registration time frame was 7.4 million. Add up to urban population had expanded by 12 percent from 1984. As far as urban focuses in 1984 Ethiopia had 312 urban concentrations with a population of more than 2000. In 1994 the second enumeration time frame the urban centers in the nation developed to 534 enrolling an expansion of 71 percent over that of 1984 however the meanings of the two censuses are not the equivalent (Kibret and Tulu, 2014).

The quick development of urban population has set massive weight on the administration limit of regions for administrations conveyance and neighborhood economic development. This exciting development has additionally concerned many districts with the problem of insufficient housing, poverty and joblessness, insufficient domestic water supply and power supply and poor hygienic and sanitation frameworks (Kabeer, 2016).

Accessible information additionally demonstrates that in the following 25 years (1994-2020) almost 30 percent of Ethiopia's population will live in urban areas (Dagnew et al., 2017). These types of agile urban population development will include an unavoidable call for hug interests in housing, urban framework, water supply, and power supply, sanitation frameworks and ecological insurance projects and projects to lighten poverty and unemployment in the urban areas. This suggests the test will require very much prepared city administration and resources limit, responsive municipal administration and all around prepared and propelled staff and continuing administrations, for example, water, power supply, nearby income gathering and organization to take care of the consistently developing demand for better and higher quality administrations and foundation (Wade, 2012). As a result of these population weights and different factors according to authority's measurement, the inclusion of domestic water supply and sanitation benefits in Ethiopia is very poor. Among the most minimal on the world, particularly for local regions, among the key markers for common improvement objective, Ethiopia's execution on "supported" access to sufficient and safe water sources and sanitation administrations is one of the most noticeably bad in the area (William et al., 2015).

In Ethiopia, impacts were rolled out to improve the circumstance through decentralization. In any case, there have not been improvements in domestic water supply and sanitation part. Addis Ababa water supply Authority's poor implementation can be reflected by the reality it can fulfill just 60% of the recede and flow request. As to the appropriation arrangement of water supply,

the welfare checking overview of 1996 assessed that 36 percent of the families utilize public tap while 61% use public tap or "Bono water" (Eytan and Dorothee, 2018).

The previously mentioned data shows that because of the low dimension of improvement a critical extent of the total urban population of Ethiopia individually and add up to people of Ethiopia when all is said in done have no entrance to adequate and safe potable local water supply. Despite everything they use water from elective sources, for example, spring, stream, lake, lakes, customary hand-dug wells and rainwater which is unsafe, cause water-borne diseases and are at impressive separation from their family units. The manageability of water supply offices, for the most part, relies upon suitable and standard support and activity of the framework. At any rate, in most developing countries, including Ethiopia, it has been discovered that operation and maintenance of water supply offices are in a poor condition of and the maintainability of the plan is in question.

As to, MWR recognized the basic supplementary issues; inappropriate tax setting without attention on full cost recovery, absence of clear rules for urban tax setting including problem identified with respect and money related supportability, incorrect or absence of institutional motivations for urban WSPs to accomplish financial suitability and improved operational execution, poor specialized and financial limit among the urban administrations suppliers that prompts irregular amounts of unaccounted for water (UFW) and poor customer administrations and complaint taking care of framework that prompts an absence of ability to pay customer charges (Jeandron et al., 2015). For the most part, a condition of urban water supply in Ethiopia has many problems because of deficient and risky residential water supply and ill-advised hygienic and sanitation, because absence of skilled labor, expert, money related, fast development rates of town population and there is not appropriate arranging and furthermore task and support of domestic water supply administrations.

2.10. Water Sector Policy and Goals in Ethiopia

The general objectives of the Federal Water Resources Management Policy and Water Sector Strategy are to advance national activities towards productive, equitable and ideal use of the accessible. Water Resources of Ethiopia with the end goal to accomplish critical financial improvement on supportability base of the nation (Misgena, 2015). Some portion of significant standards of the planning by Water Resources of Ethiopia are; -

- creating possession to bring down levels and upgrading administration of self-rule to the most reduced possible measurement,
- advancing inclusion everything being equal, including the private part
- Moving towards full price recovery for urban water supply frameworks and recovery of operation and maintenance costs for local plans
- Improving urban water supply through self-ruling bodies

In addition, the government popularity-based republic of Ethiopia has adjusted a national water resources administration approach, water supply and sanitation methodology and a water area improvement program, setting sub-sectoral goals of water supply and sanitation, water system and hydropower. The general destinations of water supply and sanitation approach is to upgrade the prosperity and efficiency of the Ethiopia individuals through arrangement of sufficient and clean water supply and sanitation administrations and to encourage its substantial commitment to economy by given water supply benefits that meet the domesticated animals, industry and other customers' consumption (Haziq and Panezai, 2017). Moreover, as concerned to this strategy in Ethiopia all water supplies institutional setups have lawful appropriate to execute the incorporated domestic water supply, hygienic and sanitation arrangement system.

CHAPTER 3
METHODOLOGY OF RESEARCH

3.1. Description of the Study Area

The study was conducted at Injibara Town, Amhara Regional State of Ethiopia. Its relative location is southwestern portion of the region and north western portion of the country, Ethiopia. It is around 447 km far from the capital city of Ethiopia, Addis Ababa and 118 km from Bahir Dar, the capital town of Amhara Regional state. Geographically, Injibara is found in 10059'N and 36055'E longitude. The most height and least height of Injibara are recorded to be 3000 m.a.s.l and 2540 m.a.s.l respectively (Zewditu, 2017). As indicated by the town's organization the total area of the city was 28.3 km^2. It is isolated into five urban kebeles under the town organization; these are 01, 02, 03, 04 and 05 kebeles. The present improvement plan for Injibara town was set up in 2004 by the National Urban Planning Institute. The improvement plan demonstrates that are area assigned for housing, commercial, industrial and administrations of organizations. The map of study country and specific location of area is show below Figure 3.1.

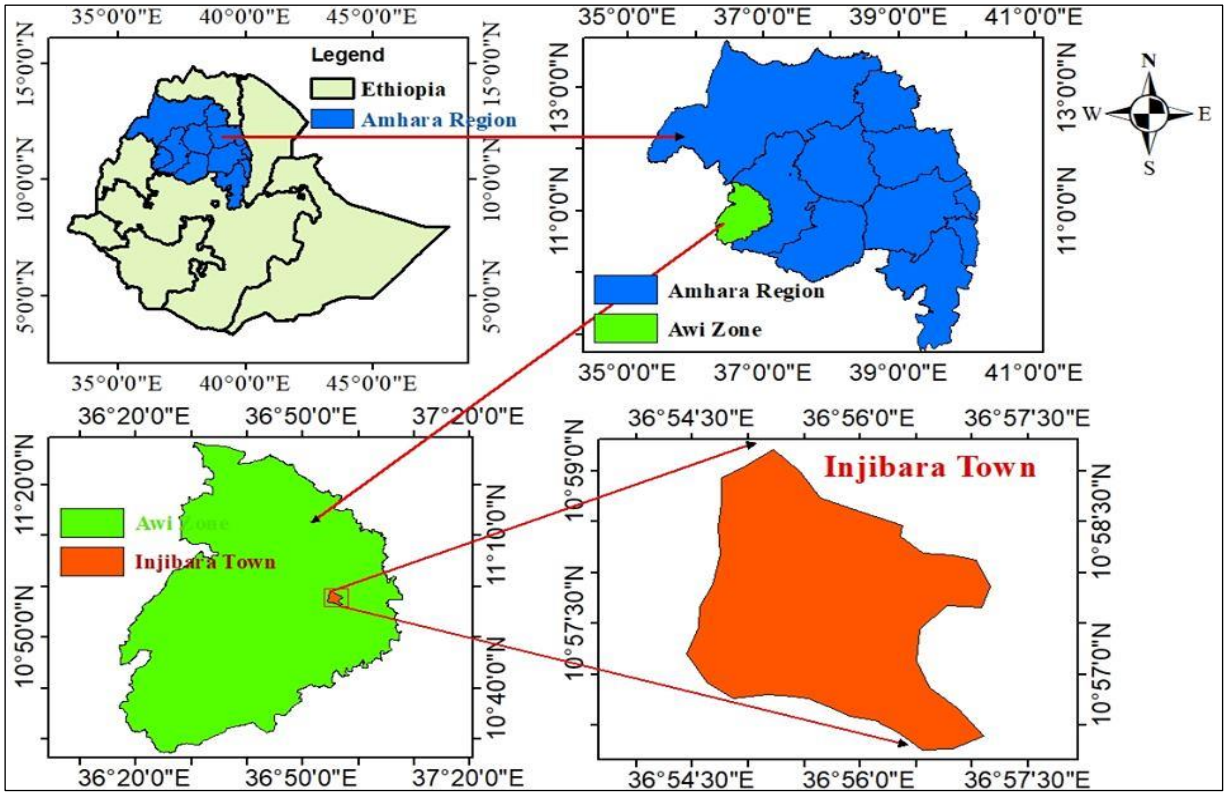


Figure 3.1: Map of Ethiopia, Amhara Regional State, Awi Zone and Injibara Town

3.1.1. Climate and topography

According to the metrological information acquired from the National Metrological administrations Agency, the maximum yearly precipitation at study town is 1813mm and its minimum monthly precipitation is 38mm.

The maximum most extreme monthly temperature is 25-29.90C^{o} while the minimum temperature is 2.6C^{o}. The greatest temperature is happened from February to Aril and the most minimal temperature is recorded during Decembers and January months (Meteorological organization, 2018). As indicated by the climatologically arrangement, Injibara town is known as "Dega" Temperate Rain atmosphere.

3.2. Population of Injibara Town

The population number of Injibara town is huge compared to its area and investments of infrastructures, like domestic water supply. The number of people in the study town is expanding rapidly because of moving from rural to urban and pre-urban to urban, and also regular population increment inside the town. The people move into town is to find a better job, better education and health facilities, transports and better living standard and also the town is the capital town of Awi zone, due theses reason the total population of the town was rapidly expanding. The total numbers of population in 1994 and 2007 Central Statistical Agency (CSA) of town has 5129 and 21065 respectively and furthermore as now in 2015, 2016, 2017 and 2018 are 35846, 39654, 41735 and 43777 respectively. these shows rapid growth rate of town population year to year.

3.3. Existing Water Supply of Town

The primary source of water supply in Injibara town is spring. The spring source is referred to locally as sutang spring which is developed in 1985. The spring is placed on the west said of the town boundary and this source of water supply is increased with the spring water built by town municipality and water office, its discharge rate is 9 liters for each second. Water from the spring is collected in 10 cubic meter gathering chamber and pumped into 75 cubic meters existing stone masonry reservoir and distribution to consumers by the gravity system. The water is conveyed to the customers through houses, yard connection, yard shard connection, and public points.

The water deficiency is the significant issue with an existing condition, as indicated by the data from the water supply office during an information gathering visit by the specialist, every one

of the households is dissatisfied with the amount of water supplied, while every one of them thought about the quality is good. Additionally, all hotels and commercial are dissatisfied with the quantities of water. Domestic water supply is improved from a secondary source such as rivers, small springs, and traditional hand dug wells. However, at present, there is extra two boreholes are functioning cumulative discharge rate is 36 liters for each second (i.e. singular release is 18 liter per second); these boreholes are constructed in 2014-2015. The combined discharge rate of spring and two boreholes is 45 liters per second. Right now, the existing water supply of study town is not sufficient to population, due to the quantity and quality of water. The consumption and supply are not relative to numbers of the population of the town because of this reason the system of water supply is the intermittent system, the water is coming 3 to 4 day for 5 to 6 hours in the week with low quantity and quality.

3.4. Methodology of the Study

The general methodology of this study uses two techniques. These are descriptive and qualitative methods, which are used to collecting the most important primary and secondary data from sampled households (HHs) and some offices by using different data collection methods. After data collection to analysis by using frequency analysis on table and figure by cross-checking, detail explanations of the methodology of the study is from the next section.

3.5. Research Design

The research design of the study was used descriptive method and qualitative technique that suggests every HHs answer and the significant data was collected through questionnaire and interview depends on current water supply situation in the study area and on variables that suggested the arrangements of protected and sufficient water supply and furthermore this study strategy would have hoped to gate an appropriate description of the present condition of domestic water supply consumption in study town.

Description method: it sets out to describe and interpret existing condition of water supply in and around study town the strategy used with the end goal to represent the conditions of problems and the changing components. The end goal to look at, compare, contrast, classify, analysis and interpret the data and the events that compare to different fields observation, it helps to describe the states of the domestic water supply problems depends on existing water.

Qualitative method: qualitative analysis was involved in distinguishing water supply structures, to accumulate household water use practices and to summarize socio-economic information depends on qualitative data, this data was collected from sampled households and selected some offices from study town.

3.6. Data Source and Type

There are two types of data for this study. These are primary and secondary data sources, which are collected from different sources, such as sampled households and some selected offices.

3.6.1. Primary data sources

Primary data is collected from sampled households, the total amounts of sampled HHs are 5% of total households of the town in each kebele (closer), which is 01, 02, 03, 04 and 05 were taken as the sampled HHs for this study. The total numbers of sampled households are 680 were selected and collected from others, such as: -

Community elders and religious leaders: related to the sampled households' elders and religious leaders of Christian (Orthodox, Protestants, Catholics) and Muslims were tasked with using unstructured questionnaires.

Institution and organization: governmental association and organizations, for example, health center, different education organization, administrative school, and hospital were interviewed using unstructured questionnaires. Addition to this, private institution, for example, colleges universities and clinic medicals and furthermore NGOs were interviews. More various authorities and experts were interviewed during the field study, for instance, WSS office.

3.6.2. Secondary data sources

Secondary data: was collected from related sources of study, for example, books, published journals papers, yearly report and other specialist documents, plans of town, and other related materials were gathered with applicable quality.

3.6.3. Sampling size and sampling technique

A systematic random selecting system was used to choose the representative sample from a total population of study town and total households of the town. This assessment is better utilizing sample households because to consider all population and households of the study town would be impossible. Because the total numbers of people and households are huge.

According to administrations of Injibara town, the total town populations is 43777 and total HHs of town is 13601, yet this town is separated into five closers (kebeles). Therefore, out of total households for this study take only 5% of the total HHs of study town for sampled households, which is 680 households as total, this household that represented the remaining total households of town. When the sampled measure was determined, the sampled HHs from each closer were chosen by random sampling techniques. The exact random selection is the most practical way method for sampling is selecting from each i^{th} things on a rundown in each kebele. In this way, the components of randomness were brought into this type of sampling by getting random numbers and the sampled HHs were chosen in reference to the first number in every group. Therefore, the sampled were taken from each kebele considering families gender and their position, the sampled measure is taken from each sampled group were relative to their quantities of households, which is shown below Table 3.1.

Table 3.1: Division of sampled HHs family units by kebeles(closers)

No	**Kebeles**	**total population**	**total households**	**sample size**	**Percent**
1	01	15248	3191	160	23.45
2	02	17334	3628	181	26.69
3	03	2700	566	28	4.12
4	04	12289	2572	129	1.89
5	05	17409	3644	182	26.76

Source: Injibara town administration offices and 01, 02, 03, 04 and 05 municipal offices, 2018
According to able 3.1, 160, 181, 28, 129 and 182 households from each kebele respectively 01, 02, 03, 04 and 05 were selected. In this manner, the sampled estimate was 680 households as the total. So also 16 samples were chosen by non-probabilistic purposive inspecting strategy, picked from various offices, for example, Injibara town water supply and sewerage offices, municipal office of the town, health center and woreda water and mine energy office and some peoples from different working places especially Hospital, college and university in the town. This show below Table 3.2.

Table 3.2: From choice of respondent official institution for interview

No	offices from where K1 were selected	officers	Selected Sampled
1	Injibara water supply and sewerage services	42	4
2	Banja woreda water and mine energy offices	37	4
3	Banja woreda municipal offices	32	3
4	Banja woreda Health sector	48	5

*K1-key informants

3.7. Data Collection Methods

The methodology of data collections of this study are questionnaires, interview, field observation, group discussion and written document analysis related to the aims of the study.

3.7.1. Questionnaires

Both open and closed questionnaires were prepared to collect data depends on purposes of research and previous study which are related to this study about the availability of domestic water supply in study town. With the end goal to accumulate the proper data about the issues under study, questionnaires were distributed to sampled households, chosen respondents and some offices to collect relevant and solid data depend on domestic water supply consumption, adequacy, and availability and the hole about water and health states of the town. First prepared by English language all questions and translated into the Amharic language because to make accessible and understandable for sampled households and chosen respondents of the town community. This was done purposely for simplicity, acceptability, and decrease of duplication of ideas during data collection time. After completion of data collection translate into the English language to analysis and interpretation and also to solve the problems of study. These questions are shown under Appendix 1.

3.7.2. Interview

Open-ended, semi-structured and structured interview were produced and used to create applicable information from sampled households and chosen offices for meetings and discussing with them specifically eye to eye contact with these peoples and officers which are head of organization and human resources management of the workplace, these were chosen because of their position and the problem more concern in various means, the meeting is concerned about the urban domestic water supply facilities like water quality and quantity, health situation that was connected with water especially availability, sufficiency and reliability to recognize the

situation of the town. The explanation of using a semi-structured interview was used to create favorable conditions, in which new question was forwarded during the meeting dependent on the reactions of the interview. The interview was commanded in the Amharic language to avoid language obstacle and supported by sound recorders due to reducing losses of sound data. The recorded information was divided dependent on similarities of reactions and converted into English language during the interpretation. This was helped to get significant and more solid data from sampled households and some selected offices during data collection from the study area. The questions of these interview are shown under Appendix 2.

3.7.3. Field observation

The field observation is requirement of getting to be parts of the chosen grouping and see how they obtain, bring water and asking explanation was utilized by the agents with the end goal to acquire further or extra data to approve the data from the planned meeting with households and some selected offices depends on the existing domestic water supply of the studying town.

3.7.4. Group discussion

Group discussion is used to produce appropriate data in two contextual analyses, men and women focus meeting conversation on selected discussion objects which is conduct associated to the domestic water supply of the town, for example, water supply production, quantity, quality, availability, water tax and water-borne diseases on town communities.

3.7.5. Document analysis

Document analysis was used to gather suitable data to explore the current issues of town with household's domestic water supply, Because of its support's quality consistency of planned questionnaires and interview information and also other essential methods. Especially, for this assessment, the investigator was utilized total residential water supply issues and composed materials in the sector of the town and other related written documents from other sources like a published journal and previous research papers which are related to the aims of this study.

3.8. Methods of Data Analysis

After completion of data gathering, coded, arranges, explain, interpreted correctly and describe accurate techniques by using percentage, tables, figures, frequency and rank request were used as methods for data analysis of both descriptive and qualitative methods. Also, the information was collected by using various data collection methods. Moreover, qualitative information

gathered through open and closed-ended questionnaires, semi-structured and structured interview, field observation and document analysis.

Generally, data analysis methods of questionnaires data of this thesis are using frequency analysis of statistical package for social science model {SPSS-25) program which is used process, analysis and interprets the results of collected data of argument. SPSS Statistics is a software package used for questionnaires and interactive data, or batched, statistical analysis. Long produced by SPSS Inc., it was acquired by IBM in 2009. The current versions (2015) are named IBM SPSS Statistics. The software name originally stood for Statistical Package for the Social Sciences (SPSS), ... SPSS-25 adds new and advanced statistics, such as random effects.

Data analysis of interview questions are analyzed by using four phases. These are coding data, discovery of themes, organizing and defining the data by the code and interpretation of results.
1.Coding Data: After the completion of the interview data, the information got from the members was broke down and isolated into important parts and which make up a critical segment of their significant, were named and coded. Next this information was coded, a code list was shaped and it was utilized as a key rundown for analyzing and altering this information. At that point, the coding key and meeting transcripts were perused independently by individual analysts, and "agreement" and "contrast of assessment" issues were talked about and fundamental plans were made.

2. Discovery of the Themes: By this phase, the codes established in the stage of encoding were gathered underneath certain groups and themes were recognized. In this study there are seven total dimensions to determining the existing condition of Injibara town domestic water supply and its major challenges and also possible solution of its for future times in the town.

3.Organizing and Defining the Data by the Codes and Themes: By this phase, the views of the applicants were described in a language easily understood by the reader and ideas were offered to the reader direct. References were utilized to figure out which talk with notes are claimed by which member and meeting notes were given in quotes. At that point, the proprietors of the meetings were shown in enclosures.

Example-1:”.....”(G:W(4))	W:	Water supply and sewerage offices
Example-2:”.....”(G:H(5))	H:	Health center
Example-3:”.....”(G:M(3))	M:	Municipal offices

Example-4:"……"(G:WR(4)) WR: Water resources and mine energy offices

4.Interpretation of Results: At this phase the answers explained and introduced in deeply were constructed and give to researcher in proper way. Gathered data were interpreted through the phases needed by qualitative research methods and a number of results were distribution.

The questionnaires and interview questions of this thesis are placed under Appendix 1 and Appendix 2 respectively. Appendicitis is an inflammation of the appendix, a finger-shaped pouch that projects from your colon on the lower right side of your abdomen. The appendix doesn't seem to have a specific purpose. Appendicitis causes pain in your lower right abdomen.

CHAPTER 4
RESULT AND DISCUSSION

This section mostly focuses on data that has been gathered through questionnaires, field observation, group discussion, and document analysis. These information discussions and results were mainly focused on the characteristics of the sampled households and some selected offices depends of current situation of domestic water supply services of study town, such as outcomes of water shortage, water consumption, distribution networks, water tax, willingness to pay and participation of stakeholders and in additional activities undertaken to improve better services of town water supply than the existing condition of water for future time by considering the current numbers of population and forecasting future population of the town.

4.1. Institutional Set Up of ITWSS Office

The urban water supply and sewerage administration of the Injibara town is the dependable government organ for the conveyance of water supply services for the town community. The hierarchical limit of WSS office, as well as the limit of the municipality of the town, is an essential factor in realizing significant cover-up in the area under communication. But the town did not include in water supply exercises except the head of the office who filled in as board members and specialized pioneer of the expansion of pipelines according to with the master plans of the town. The maintainability of water supply plans is essentially dependent on the administration plans to the operation and manage the implements of better water schemes.

The Injibara town water supply and sewerage administrations office (WSS) is manufacture, treat, transmit, distribute, sales of drinkable water supply, maintenance, operation, the establishment of new pipelines, administrate and built new water supply structure of the town.

The office of town WSS had presently 5924 cumulative consumers from 13601 total households of the town. This shows how much the supply of water services insufficient in the town. In this way, the data gathered by questionnaires from sampled households and selected offices persons demonstrated that restricted effort and consideration influenced the administration to solve the current issues of town domestic water supply services.

The WSS office does not preservation all works of water supply structures without the required unique devices and skilled man power. For the important maintenance works the WSS office

reports to the regional WRMEDO, that implies requirements of specialized and money related supports for operating and maintenance of the town water supply systems. The manageability of water support facilities primarily depends on the task and support of the framework. But it has been discovered that the operation and maintenance of the facilities are in poor condition. In this connection, the supplementary situation was recognized as issues identified with operation and maintenance of elements WSS office of town. Such as: -

- Lack of extra water supply materials
- Deficiency of laboratory apparat for maintenances and operations
- Lack of qualified personnel who fully be aware of have to work the system.
- Insufficient planning of service storage and circulation system of distribution.

The study town WSS office is separately administration and staff limit requirements for management and distribute adequate quantity and quality of water supply. Salary rates and motivating forces are extremely poor and not focused with income and advantages. Due to these reasons the works does not fulfill the interest of town households of adequate quantity of water for all parts of town and does not work operation and maintenances of water supply services correctly because the total numbers of works are limited. The overall numbers of human resources profiles of the WSS office of Injibara town in 2018 is shown below Table 4.1.

Table 4.1: Human resources profile of WSS office of town 2018

No	Structure of utility	Staff number requirement	occupied	Education level	Gender
1	Main Manager	1	1		
2	Main vice Manager and water production main process head	1	1	Degree	M
3	Executive Secretary		vacant		
4	Internal Audit	1	1	Level-4	F
5	Driver	1	vacant		
6	Plumber II	4	6	12-Leve-3	M
7	Plumber I	1	1	Level-4	M
8	Senior Mechanic	1	vacant		
9	Senior electrician	1	Vacant		

	Continuous page 37					
10	Junior electrician	1	1	10+2		F
11	Surveyor					
12	Operator and Guard		vacant			
13	Operator	9	5	Level 3	4m	F
14	Water Quality control officer	1	1	Degree	M	
15	Water meter reader	As per requirement	2	1degree	M	
16	Technique secretary	1	vacant			
17	Procurement, Finance,& property Administration					
18	Process Head	1	1	Degree	M	
19	Junior finance officer	1	1	10+3		F
20	Casher	1	1	Level 4	M	
21	Bill processing officer	2	1	Level 4		F
22	Bill seller	As per requirement	1	10+3	M	
23	Purchaser officer	1	1	Level 4		F
24	Property Administration	1	1	Level 4		F
25	Human Resource management					
26	Process Head		vacant			
27	Human resource officer	1	1	Level 4	M	
28	Documentation revenue collection officer	1	1	10+2		F
29	Officer cleaner	1	1	10+3		F
30	Guards	As per equipment	11	0 level-4	M	
31	Customer service and planning process head					
32	Planning process Head	1	1	Degree		F
33	Customer officer	1	1	10+3		F
34	Planning officer	1	vacant			
	Total	**37**				

According to Table 4.1, the town WSS office has wasteful and inadequate human resources for successful management and administration of domestic water supply. There are only 42 lasting workers a large portion of whom do not have proper education and preparing in water supply administrations conveyance. Eight (8) of the activity positions in the WSS office of town are empty. The empty positions include process head and planning officer, and others are more experienced workers by different waterworks. This indicates the WSS office does not do correctly all works on time and does not give good services for all consumers of town.

4.2. Financial Limit of ITWSS Office

The financial limitation is one of the major problems for water supply and sewerage office to manage and distributes of successful services for all community of study town. This is due to lack of basic facility of fund and public services because there is no any types of fund support from any organization and government to operation and maintenance services of existing water supply system starting from sources up to distribution systems of consumers and also to pay good salary for all workers offices starting from daily labor up to higher skilled manpower to work appropriately and identify the significant problems and to solve these problems. The major problems of low-level incomes of town WSS office are: -

- Limited income of sources
- Incomes do not gather effectively because of the absence of prepared staff
- Deficiency of fund support from government and other organizations
- Small and flexible income taxes

The additional problems for the town inefficient water supply, distribution and interruption daily water supply is a deficiency of income of the WSS office to cover expenditure deficit and fund that expand channeled water facilities for all families of the town. Income is implying facilities of water supply activity and maintenance and also development of new installation of pipelines. The WSS office should raise sufficient income and fund for water supply benefit of town communities. Because the absence of fund and required material types and machines are a major issue. The significant income source of WSS office for financing water supply benefit is the income produced from water sales and meter lease including administration charges, this is shown below Table 4.2.

Table 4.2: Types of sources of income gathered by Injibara town water supply office

Types of revenue	2015 performance	2016 performance	2017 performance	2018 performance
water sales + water	588984.7	725136.3	781181.75	1104278
Connection fees	573371.9	2382604	1161891	2153838
Technical services	186482.97	140760.92	231362.3	1510655
Other	138578.25	106376.99	174658.10	1182246
Total	**1487418**	**3354878**	**2349093**	**5951017**

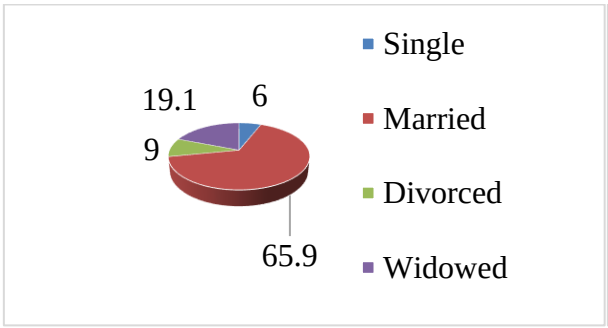
Regard to Table 4.2, the revenue is collected from different types of the source in town, the water supply and sewerage office collected revenue is various from year to year, which is an increase from 2015 to 2016 but decrease 2016 to 2017 and also increase 2017 to 2018 years. Therefore, these shows do not coverages total costs of operation and maintenance of the town domestic water supply services and new pipeline installation from a new expansion area of the studying town, because the numbers of population and households increase rapidly time to time without any types of gap and the town is expanded every year rapidly in four directions. Because the town is developing town by different industries, commercial, institutional of governmental and non-governmental, this is required high numbers of peoples to work in this industrial and institutions and also most population migrated from rural and per-urban area to find different jobs, better education facilities, health facilities and transportation rather than other around existing towns.

4.3. Characteristics of the Households (HHs) in Town

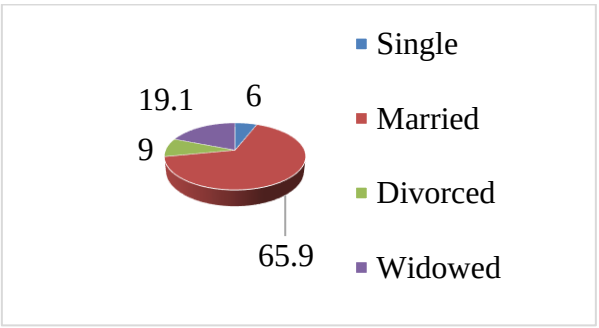
The characterized of the sampled households (HHs) are both male and female. These HHs are shown below Table 4.3 and Figure 4.1 as gender, marital status and duration of sampled households in study town.

Table 4.3: Gender, marital status and durations of sampled HHs in studying town

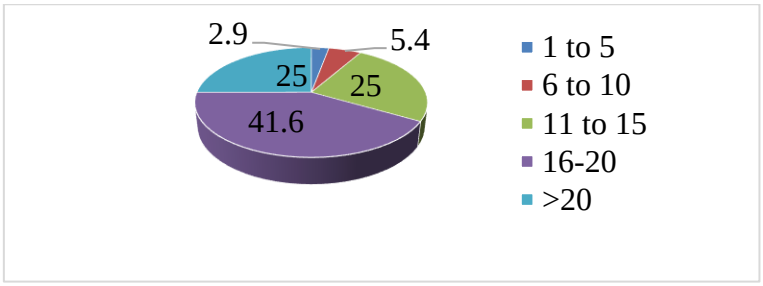
Item	Description	Categories	Frequency	%	Valid Percent	Cumulative %
1	Genders of the sampled HHS	Male	332	48.8	48.8	48.8
		Female	348	51.2	51.2	100
		Total	**680**	**100**	**100**	
2	Marital status of sampled HHs	Single	41	6	6	6
		Married	448	65.9	65.9	71.9
		Divorced	61	9	9	80.9
		Widowed	130	19.1	19.1	100
		Total	**680**	**100**	**100**	
3	Duration of sampled HHs in town	1 to 5	20	2.9	2.9	2.9
		6 to 10	37	5.4	5.4	8.4
		11 to 15	170	25	25	33.4
		16 to 20	283	41.6	41.6	75
		>20	170	25	25	100
		Total	**680**	**100**	**100**	



(a) Gender of the sampled households



(b) Marital status of sampled household



(c) Duration of sampled households in town

Figure 4.1: Gender, marital status and duration of sampled HHs in studying town

Regard to Table 4.3 from item one, 48.8% of the sampled HHs were male and 51.2% of the sampled HHs were female from total sampled HHs in the town uses of domestic water supply. The major numbers of the sampled HHs were female, this show the more water consumed by female compared with male. Because most of time the females working in house different house works such as cooking, washing close, etc by using high amounts of water consumption every day inside and outside the home in studying area.

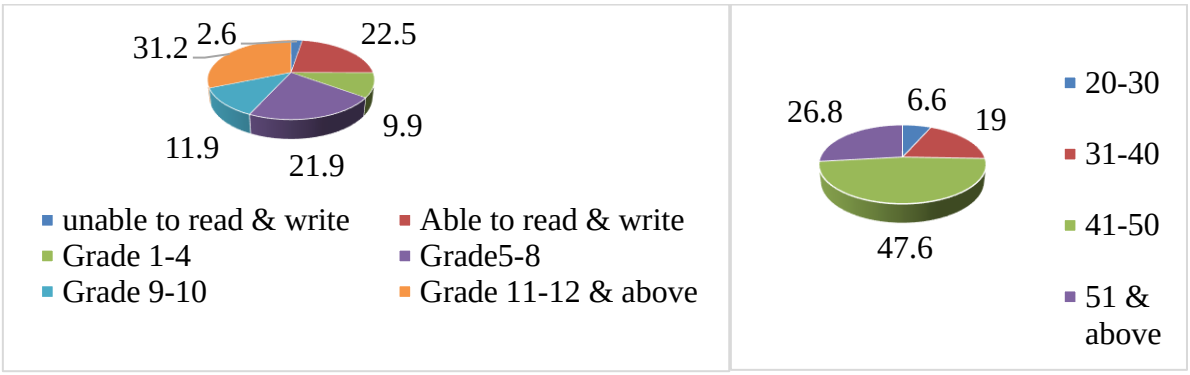
According to Table 4.3 from item two, 6% of sampled HHs were single, 65.9% of sampled HHs were mentioned as married, 9% of sampled HHs were explained as divorced and 19.1% of sampled HHs were described as windowed from total sampled households. The majority of sampled households were married, which have high numbers of family units, these affect the demands of town water supply because they are required high amounts of water quantities for their everyday for different domestic activities.

According to Table 4.3 from item three, duration of sampled households in the study area is arranged in to 1to 5, 6 to 10, 11 to 15, 16 to 20 and more than 20 years, which are 2.9%, 5.4%, 25%, 41.6% and 25% are respectively. However, the great parts of sampled HHs were live more than 16 years in study town which is 41.6%. This is good for understanding the past and current minor and major challenges and cause of domestic water supply of in studying town because the problems domestic water supply in this town is long years, which is starting before the designs of modern pipeline water supply up to now a day due to this reason who live in this town long year know the major challenges and causes of domestic water supply.

The levels of sampled HHs education, age, households head type and size of their family numbers of sampled households in studying town are shown below Table 4.4 and Figure 4.2 by their frequency and percentage.

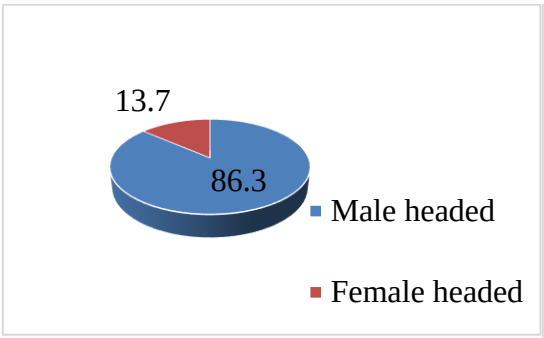
Table 4.4: The education background, Age, HHs head type and sizes of the sampled HHs

Item	Description	Categories	Frequency	%	Valid %	Cumulative %
1	Education backgrounds of the sampled HHs	unable to read & write	18	2.6	2.6	2.6
		Able to read & write	153	22.5	22.5	25.1
		Grade 1-4	67	9.9	9.9	35
		Grade5-8	149	21.9	21.9	56.9
		Grade 9-10	81	11.9	11.9	68.8
		Grade 11-12 & above	212	31.2	31.2	100
		Total	**680**	**100**	**100**	
2	Age distribution of sampled HHs	20-30	45	6.6	6.6	6.6
		31-40	129	19	19	25.6
		41-50	324	47.6	47.6	73.2
		51 & above	182	26.8	26.8	100
		Total	**680**	**100**	**100**	
3	Sampled HHs head types	Male headed	587	86.3	86.3	86.3
		Female headed	93	13.7	13.7	100
		Total	**680**	**100**	**100**	
3	Family sizes of the sampled HHs	1 up to 3	106	15.6	15.6	15.6
		4 to 6	143	21	21	36.6
		7 to 9	173	25.4	25.4	62.1
		10 to 12	201	29.6	29.6	91.6
		13-15 & above	57	8.4	8.4	100
		Total	**680**	**100**	**100**	

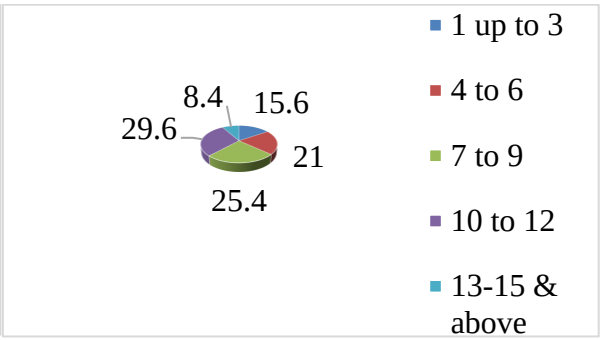


(a) Education backgrounds of sampled HHs

(b) Age distribution of sampled HHs



(c) Head types of sampled households



(d) Family size of sampled households

Figure 4.2: The education background, Age, HHs head type and sizes of the sampled HHs

According to Table 4.4 from item one, 2.6% of the sampled HHs were explained as unable to read and write, 22.5% of sampled HHs were mentioned as able to read and write, 9.9% of sampled HHs were said 1-4 grade, 21.9% of sampled HHs were explained as 5-8 grade, 11.9% of sampled HHs were stated that 9-10 grade and 31.2% of sampled HHs were explained as 11-12 and above grade of their education level. Most sampled HHs were educated that means more than half of total sampled households in studying town are educated. This is good for the response or explains the past and present situation of the existing water supply in the town. Therefore, education level is one of the major determinants that is directly related to water demand and consumption of domestic water supply of the town. However, most of the sampled HHs was higher education levels then they could understand the purposes of water for all living things on the land and developments of one town or country and also, they were to know public waterborne diseases related to the inadequate domestic water supply in the town.

Regard to item two from Table 4.4, 6.6% of sampled HHs were explained their age 20 to 30 years, 19% of sampled HHs were mentioned their age was 31 to 40 year ago, 47.6% of sampled HHs were explained their ages as 41 to 50 years and 26.8% of sampled HHs were mentioned

their ages as 51 and above years ago living in studying area. The ages of most tested HHs were between 41 and 50 years ago. These show most of sampled HHS are understand the significant challenges or problems of existing water supply scarcity for town community and they should be answering the around exact answer with related to the past and present inadequate quantity and quality of domestic water supply in study town.

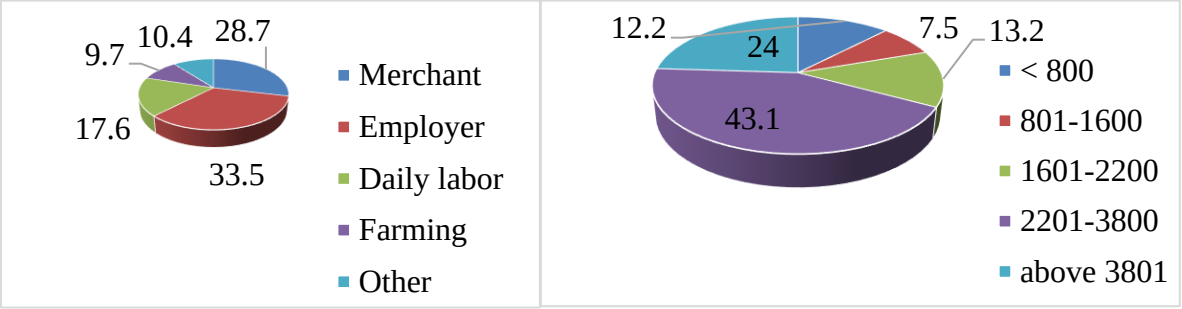
Regard to Table 4.4 from item 3, 86.3% of sampled HHs were explained as male-headed families but 13.7% of sampled HHs were mentioned as female-headed families. Majority of sampled HHs are male-headed in studying area. This indicates many numbers of tested have great numbers of family size and required high amounts of daily water consumption. In other words, this is good for developments of infrastructure in the town for example implementations of the additional distribution system of water supply and sources of water as well as any other components of tow water supply schemes starting from sources up to consumers.

According to item four from Table 4.4, 15.6% of sampled HHs were said their family size as 1-3, 21% of sampled HHs were explained their family size as 4-6, 25.4% of sampled HHs were explained their family size 7-9, 29.6% of sampled HHs were mentioned their family size as 10-12 and 8.4% of sampled HHs were said their family size as 13-15. The great parts of sampled households have more numbers of family size in the study area. The numbers of family sizes are increasing required high amounts of daily water demands, and also the high community is required more amounts of daily water consumption for their daily domestic activities. Generally, the size of family is the major factor of town water supply, due this reason consumption of town water supply depends on family size and economical levels of households, that means they have more family size and economy they could be need highest amounts of water consumption per day but their economy level is low and also required less amounts of water consumption depends on their economy levels.

The jobs and income level of sampled households of the studying town is very low, especially the income level is very low compare to other towns of the country because the town is developing as well as developing country's town, but this is detail shown below Table 4.5 and Figure 4.3.

Table 4.5: Jobs and income levels of sampled HHs of studying town

Item	Description	Categories	Frequency	%	Valid Percent	Cumulative %
1	Jobs of sampled HHs	Merchant	195	28.7	28.7	28.7
		Employer	228	33.5	33.5	62.2
		Daily labor	120	17.6	17.6	79.9
		Farming	66	9.7	9.7	89.6
		Other	71	10.4	10.4	100
		Total	**680**	**100**	**100**	
2	Income levels of the sampled HHs	< 800	83	12.2	12.2	12.2
		801-1600	51	7.5	7.5	19.7
		1601-2200	90	13.2	13.2	32.9
		2201-3800	293	43.1	43.1	76
		above 3801	163	24	24	100
		Total	**680**	**100**	**100**	



(a) Jobs of sampled households (b) Income levels of sampled households

Figure 4.3: Jobs and income levels of sampled HHs of studying town

According to Table 4.5 from item one, 28.7% of sampled HHs were explained their jobs as merchant, 33.5% of sampled of HHs were mentioned as employer, 17.6% of sampled HHs were described as daily labor, 9.7% of samples were explained as farming and 10.4% of sampled HHs were explained as they are depending on other community for their living. The majority of the sampled HHs is merchants and employees of the governments, there is the dominant section of the town population. Other is depends on daily working, agriculture and by help from other people and also migration situation they got attend trading. Therefore, their income source depends on daily working, agriculture, and trading, this kind of households are challenging to use privet pipe connection of water supply and operation and maintenance services after their

relationship of privet pipe connection. And also, they cannot financially support for new additional installation of water source and distribution system of water supply in town, because the economy is very low compared to others.

The incomes levels of studying town sampled households are very low compared to their family size. The majority of sampled HHS has 2201-3800; which is 43.1% of the total sampled HHs. This indicates most communities have not accessed the piped water supply due to their income.

4.4. Current Water Supply Condition in Town

The current sources of water supply in town is spring and groundwater (boreholes) which is developed during 1985 and 2014-2015 respectively. All components of the existing water supply in the town are sources, collection chamber, treatment, transmission pipeline, services reservoir, and water distribution systems. The current water supply condition in town, the interviewed made with the head of town WSS office that expressed, the current water supply had many challenges, which are absence of high amount of quantity, there is not great quality, absence of capacity to pump water from source to services reservoir, absence of reasonable laying of conveyance framework from service reservoirs up to consumers, high populace weight, absence of specialized skill and materials, absence of fund, absence of present daily data and insufficient of water sources. As consequence of these serious problems cause need appropriate task and repairs, resource management, distribution networks, charge accumulation, customer complains management, human asset management and legitimate planning management. In this way, the ITWSS office and municipal office must be redesign the better water supply sources, the distribution framework, water amount and quality, specialized and money related and furthermore sewerage arrangement of the town in short time by communicating with the town communities, CBO, governmental and NGOs and local and government water work and development associations, Since without great amount and quality of water for one town there is not great health services of individuals and advancements of their economy and furthermore improvements of the town by various foundations.

4.4.1. Source of water supply in town

The current primary water source for town has been spring water, groundwater, rivers and traditional hand dug well and also rain water during rain seasons.

The present water sources of town are two pipelines systems, which are one from primary source sutang spring and other from two boreholes (BH1 and BH2) that were giving water to

community. The firstly sutang spring was developed in 1985 by town municipality and anaphora water office, discharge rate is 9 liters for per second. The second water source is two boreholes which are constructed 2014-2015 by Amhara water work construction enterprise, discharge rate is18 liter per second for each borehole (i.e. 36 l/second from both BH1 & BH2). The pipe line of water supply is treated at services reservoir adding only chlorination densification, at that point water distributed to customer by distribution systems. However, it is not sufficient amount and quality for various domestic exercises of the town communities. Addition to this one borehole has salty test, this borehole influences all water quality since water is conveyed after collected from one services reservoir in the same time, and this is cause unsafe to health of the town population. Most part of the town communities are getting water by two main systems, these are piped system and non-piped systems, the piped system water supply was the protected and dependable sources of water, however not greater quality full as total. The non-piped systems were unprotected and hazardous which are including traditional hand dug well, spring, river and rainwater that implies unprotected sources.

Thus, the Injibara town was a large and quickly developing town through time to time. The households have been provided with channeled water yet not total households were used piped water supply. So also, the greater part of the sampled community in the study area are not gated daily piped water supply and also easily other alternative sources but the minority of the total households were used piped water supply system because total households of the town were 13601, from these the customers of piped system of water supply are 5924 households only other 7677 households are not having piped water connection still now. The majority of the total family units in the study area are not got piped water supply and use other elective sources yet most of the total families were not used funneled water supply system. They are used piped water from public tap and neighbors and furthermore elective sources, for example, river, spring, traditional hand dug well and rainwater. These demonstrate the particular water sources were not consistent and solid for all water customers in the town. In this manner, the total HHS units of the town used to water house connection, private yard connection, shared yard connection, public tap, spring, stream, traditional head dug well and rainwater, and after that, they are used mutual water supply system. These were appeared to fulfill the scarcity of water supply; therefore, they are using the elective sources to fulfill their daily consumptions for domestic activities. This is shown below Table 4.6 and Figure 4.4.

Table 4.6: Numbers of sampled HHs using different sources of water

No	Description	Frequency	Percent	Valid Percent	Cumulative %
1	Piped water	319	46.9	46.9	46.9
2	Hand dug well	34	5	5	51.9
3	Spring	301	44.3	44.3	96.2
4	River	26	3.8	3.8	100
	Total	**680**	**100**	**100**	

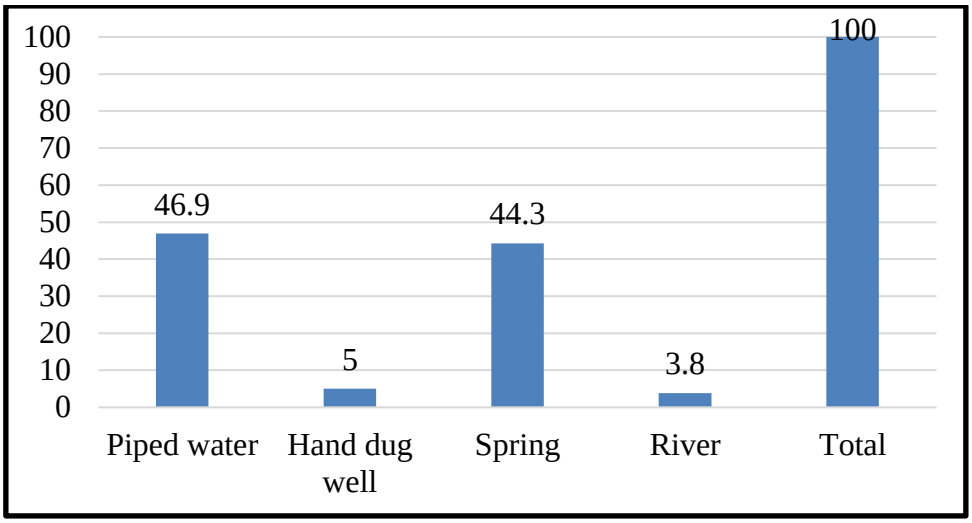


Figure 4.4: Sources of water supply for sampled HHs

Regard to Table 4.6, 46.9% of sampled HHs were explained their water sources as piped water supply that means piped water is house connection, private yard connection, shared yard connection and public tap user but they said not sufficient for all domestic consumptions, 5% of sampled HHs were mentioned their water sources from traditional hand dug well but it is unprotected sources, 44.3% of sampled HHs were explained their daily water sources is spring water but it is unprotected and far distance from their home and 3.8% of sampled HHs were mentioned their daily water supply sources as river, it is very unsafe and unprotected through the year. However, majority of sampled HHs had no use the piped water sources and also the piped water sources users said that they are not used continuously adequate amounts of water because the existing water supply is insufficient demand for domestic purposes, that means the system of town water supply is intermittent system due to shortages of sources by various means. Therefore, all town households are used alternative water sources for their daily consumption.

The great parts of sampled HHs were having not piped water supply, they said that the existing water supply system has various problems, such as: -

1. Be insufficient water sources.
2. There is not great quantity and quality of water.
3. There is a price of connection and organization issues of ITWSS.
4. There is not a new establishment of distribution system because the town is expanded.
5. The existing pipeline was old, and there is not the quality which is reduce the water quality due to burst every time.

In this manner, the sampled HHs want to use alternative sources of water, since it was the high amount and less expensive than piped water and furthermore utilized close source compared with other alternative water sources, yet it is hard to health care since it is not safely quality. This causes waterborne, water-related and water washing diseases on a community, which are influence their life and financial system and also influenced the advancements of the town.

WSS office of the Injibara town officers mentioned that the water supply issues in the town were expected various reasons. There is absence of high quantity of water, absence of financial limit of WSS office, absence of skilled labor, absence of basic technical, inadequate support of other concerned bodies like municipality of town, NGOs and privet association, water and mine energy office and other administrative bodies of the town. The major challenges of water sources shortage in this town are rapidly increasing of population time to time without any gap due to peoples migrate from rural to urban and also the absence of pre-planning or forecasting the town population by using different methods to determine exact numbers of population and to reduce the water supply challenges on the community. Addition to this, there is no coordination, participation, and support of materials between town community and other organization with ITWSSO to reduce the existing water shortage and construct the new water supply scheme in the town. Unless these cause water supply challenges in the town through the hour to hour or day to day or week to week or month to month and through the year.

4.4.2. Access of water supply in town

Regard to questionnaires of sampled HHs, access of protected water supply is a principal human necessity and an essential human right. These rights counting the right to existence, health, learning and satisfactory housing and also access of adequate water supply, that mean water is life. Therefore, each person must be gate at minimum 20 liters safe water supply every day to

fulfill his or her fundamental necessity at minimum pre-requisite for regarding the right to water. But in study town is there is not clean water access every time because the existing piped water is not having sufficient quantity and quality, this cause many types of diseases on town communities, these diseases deaths and illness of more students, children and women such as Amoeba, Guardia, Diarrhea and Typhoid. Additionally, the women and children spend their time of education and employment every day for collecting water from different alternative sources. Condition of access of existing domestic water supply of the studying town is shown below Table 4.7 and Figure 4.5 as follow.

Table 4.7: Access of water supply of sampled HHs

Item	Description	Categories	Frequency	%	Valid %	Cumulative %
1	Pipeline water connection	Yes	324	47.6	47.6	47.6
		No	356	52.4	52.4	100
		Total	**680**	**100**	**100**	
2	Access of daily piped water	Yes	34	5	5	5
		No	646	95	95	100
		Total	**680**	**100**	**100**	
3	Days of setting piped water supply in a week	Once a week	74	10.9	10.9	10.9
		1-2 day	246	36.2	36.2	47.1
		3-4 day	300	44.1	44.1	91.2
		Every day	35	5.1	5.1	96.3
		Missing value	25	3.7	3.7	100
		Total	**680**	**100**	**100**	

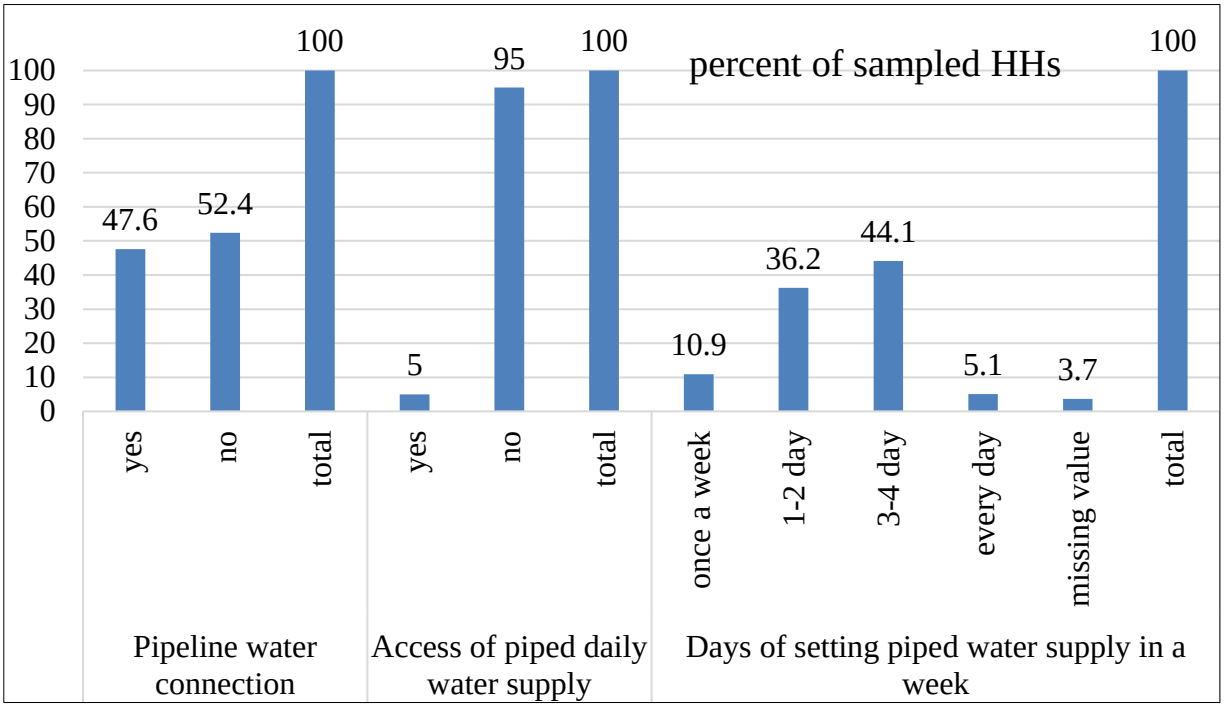


Figure 4.5: Access of water supply in studying town

According Table 4.7 from item one, 47.6% of the sampled HHs were had access of pipe connection water supply system to their house by different connection types or mode of services (i.e. house connection, private yard and shard yard connection systems) of the town but other 52.4% of the sampled HHs were had no access of piped water supply services of the town. The majority of the sampled HHs did not use relatively piped water from the primary sources of the town water supply system. This show the large numbers of the sampled HHs and other HHS did not have water coverage of their different domestic activities from piped water. Therefore, there are challenges of water access scarcity in study town. The sampled HHs said that there are many problems from town WSS office and other organization to solve the difficulties of town water supply shortages. Additionally, sampled HHs were explained the reasons of domestic water supply scarcity and lack of piped water connection as a consequence of the various factors. The major reasons of these factors are: -

1. Pipe line connection price is very high compare to their economy status
2. Distance of the main pipeline from their home is far
3. The existing distribution of water supply system is difficult because of the line is old
4. From some place there is not sufficient water pressure
5. Always bursting of pipelines by water pressure due to lack of durability

6. There are not fixed plans of the town because the town master plan is expanding

According to Table 4.7 from item two, 5% of the sampled HHs have gate every day water supply from piped water for their household activities but the quantity and quality of water is less and other 95% of the sampled HHs were not gate their domestic water supply from piped water every day. However, majority of sampled HHs were not access their daily water supply from town piped water for their various domestic consumption. This show there is the problems from existing piped water, the sampled HHs are explained main challenges of piped water supply service of existing water supply. These are: -

1. Absents of appropriate organization of WSS office
2. Topography of the town structure
3. Insufficient of electric power for pump water from sources to services reservoir
4. Insufficient of skilled labor in WSS office
5. There is not properly laying of distribution frameworks
6. Lack of reaction from WSS office, communities of town, CBO and so etc

Due to these reasons the water supply scarcity is occurred on town communities, it is complex situation to solve simply these challenges because required high amounts of budget, skilled man power and redesign the systems of water supply starting from population forecasting up to users or all components of water supply schemes.

Respect to Table 4.7 from item three, 10.9% of the sampled HHs have gotten to piped water supply once in week, 36.2% of the sampled HHs have gotten to channeled water supply 1 or 2 days in week, 44.1% of the sampled HHs have gotten to piped water supply for their domestic consumption need 3 or 4 days in week, 5.1% of the sampled HHs have gotten to pipe water supply for constantly in week yet not high quantity and quality of water and 3.7% of the sampled HHs were not understanding the entrance of piped water supply in week. However, majority of the sampled HHs have not piped water supply access every day; this indicates there is shortages of water demand in the studying area. Therefore, the sampled HHs explained that they are fetch water from other elective water sources to meet their daily domestic activities of house. Adding to this the relationships of demand and supply of water is not proportional to the numbers of town community. Due to these reasons most of the town community lost unplanned money to buy more materials for collecting water for long time once and to buy water from vender and shops by high price and others fetch from unprotected sources. Generally, these have more negative impacts on community due to socio-economy and health care. Due to socio-economy

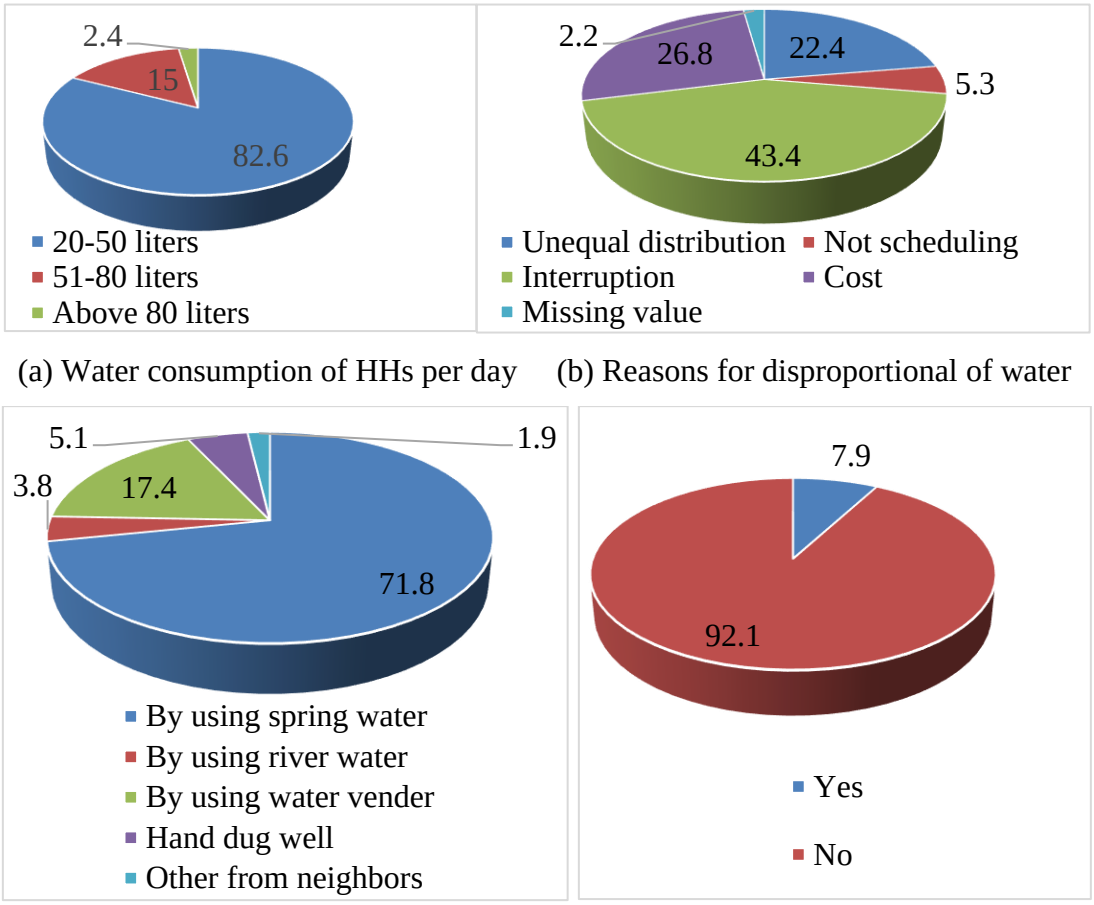
the town population lost high amounts of money to buy materials to collect water, lost much energy to collect daily water from different source and far distance, lost their times employments, trading and education for fetch water and it is very difficult for who have no money, children and energy to collect daily water supply and loss high amounts of water because the dates of water coming is not fixed due to this reason they collected more water once and they also dropped this collected water when a new water is come randomly and also collect new water, this types of action is continuous up to solves of water shortage. Due to health care, the collecting water for long time is cause numbers of water borne diseases on community and other who are fetching from unsafe and unprotected sources which is affected by water borne and water related diseases day to day in the study area.

4.4.3. Demand of water supply in town

Water demand is measures of water required by the town for residential consumption, commercial consumption, institutional consumption, industrial consumption and water losses. Domestic water consumption: household water consumption is measure by numbers of population, climatic conditions, socio-economy conditions, policy of the government and other related elements. According to designer preparation estimated water supply is 50 liters per capital per day but now day existing consumption of water is 18 liter per capital per day. This show that the estimation and actual water supply is not corresponding to their domestic demand because actual demand is very small, it is not covering their daily needed of domestic activities. The total domestic demands of the town in 2017 and 2018 is 1258 m^3/day which is constant but the numbers of population are increase rapidly by urban growth rate which is 39654 and 43777 of people respectively. Generally, domestic water consumption of town is not meet with population growth rates of the town because amounts of water demand is always fixed but numbers of population is increasing time to time by migration to per-urban to urban and rural to urban, because town is the capital town of Awi zone and good air condition to living due to this reason more people move into it to find better job, better education and health facilities and transportation, this cause major challenges on existing domestic water demands of studying town, these challenges are shown below Table 4.8 and Figure 4.6.

Table 4.8: Assess consumption of water supply services and its challenges of town

Item	Description	Categories	Frequency	%	Valid %	Cumulative%
1	Water consumption of HH per day	20-50 liters	562	82.6	82.6	82.6
		51-80 liters	102	15	15	97.6
		Above 80 liters	16	2.4	2.4	100
		Total	**680**	**100**	**100**	
2	Whether water is proportional or not	Yes	9	1.3	1.3	1.3
		No	671	98.7	98.7	100
		Total	**680**	**100**	**100**	
3	Reasons for disproportional supply of water	Unequal distribution	152	22.4	22.4	22.4
		Not scheduling	36	5.3	5.3	27.6
		Interruption	295	43.4	43.4	71
		Cost	182	26.8	26.8	97.8
		Missing value	15	2.2	2.2	100
		Total	**680**	**100**	**100**	
4	Alternatives water sources to satisfy daily water demand	By spring water	488	71.8	71.8	71.8
		By river water	26	3.8	3.8	75.6
		By water vender	118	17.4	17.4	92.9
		Hand dug well	35	5.1	5.1	98.1
		from neighbors	13	1.9	1.9	100
		Total	**680**	**100**	**100**	
5	Sampled HHs are happy on existing water	Yes	54	7.9	7.9	7.9
		No	626	92.1	92.1	100
		Total	**680**	**100**	**100**	



(a) Water consumption of HHs per day (b) Reasons for disproportional of water

(c) Alternatives water sources (d) Sampled HHs happiness on existing water

Figure 4.6: Assess of water supply consumption, alternative sources and its challenges

Regard to Table 4.8 from the first item, 82.6% of the sampled HHs were mention the daily water demands between 20 to 50 liters, 15% of the sampled HHs were describe their daily demands between 51 to 80 liters and 2.4% of the sampled HHs were said above 81 liters. However, great parts of the sampled HHs daily water demands were between 20 to 50 liters per day but not always, sometimes they cannot gate this amount of piped water consumption. This show there is water shortage in the town that means some HHs said that we could not gate 18 liters per day, they gate once in a week. This quantity of water demand is very low, due to these reasons the population of town is need more amounts of water consumption for daily activities of their domestic purposes. Generally, demands of water supply of the sampled HHs were varying from one water supply costumers to other water supply costumers or one place to other place because the distribution system does not distribute equally for all parts.

Respect to Table 4.8 from second item, 1.3% of the sampled HHs have gotten to corresponding water supply with their everyday consumption and 98.7% of the sampled HHs were not gotten

to relative water supply with their daily consumption. This show the majority of the town population was not gate corresponding water supply with their everyday domestic activities. These problems were expressed into two different ways, one from sampled HHs and other from head of ITWSS office, the major challenges stated from sampled HHs of the town regard to shortage of water demands are: -

1. Absents of enough quantity and quality of water supply
2. Lack of financial and specialized technician and also unequal distribution system
3. Lack of ability labor at office of WSS, like water supply and hydraulic engineers

Additional, other significant challenges expressed from head of ITWSS office are:

1. Its deficiencies of water demand production at sources and rapid growth of population
2. Lack of communities, CBO, government and NGOs of financially supports
3. Exchanges of employer from one place to other because of compensation and position
4. There is not appropriate laying of distribution system beginning from services reservoir up to customer services, since it cannot resist water pressure due to this reason it could be breakdown every time from different parts of town
5. There is not balance of existing water demand and numbers of town population at current time, because different types of institution are implemented additionally in the town like Injibara University, private and government colleges, and small industries, which is consists high numbers of workers addition to present and migration population.

The general problem is lack of capital for installation of new distribution networks from new expanded areas in four directions and there are not enough amounts of power to pump water from sources up to services reservoir. Due to these reasons small areas are gate continuous water consumption. However, shortages water demand in the town affects both community and office of WSS. Therefore, both could be communicating each other and offices of WSS must be create awareness from the community, government, NGOs and private institution to support financial and other supports to fixed these types of challenges starting from sources up to consumers.

As indicated by Table 4.8 from item three, 22.4% of the sampled HHs were suggest their reason behind every day water consumption is not corresponding because of unequal distribution, 5.3% of the sampled HHs were mentioned as there is not planned water supply at both summer and winter season, 43.4% of the sampled HHs were explained as interruption of water supply every day, 26.8% of the sampled HHs were specified as expense of connection, operation and repairs

and other cost and 2.2% of the sampled HHs were not know the reasons of imbalances of daily water supply. However, greater part the sampled HHs were expressed the three significant challenges which are unequal distribution, price and interruption of water supply every day, that means distribution system of town is not distribute equally for all parts of the town at the same time and high cost of new pipeline connection, operation and repairs, because of these reasons more people cannot use the piped water supply. This problem caused by increasing cost of different water connection materials which are set up from personal shops, then they can increase the prices as they like. Therefore, the persons which high income could be used piped water supply but who have low income could not use piped water supply because they cannot buy by high prices different piped water supply materials. This issue affected both low levels of salary in the town and ITWSS office to give piped water supply through all parts of the town.

Regard to Table 4.8 from item four, 71.8% of the sampled HHs have fulfilled their daily require of domestic consumption by using spring water, 3.8% of the sampled HHs have fulfilled their daily consumption of domestic activities by using river water, 17.4% of the sampled HHs have fulfilled their everyday requirement for domestic exercises by using water vender, 5.1% of the sampled HHs have fulfilled their everyday requirement for residential exercises by using from neighbors and 1.9% of the sampled HHs have fulfilled their requirements for household activities by using from conventional hand dug wells as elective source, which are unprotected sources because they are use these source to minimize the challenges of their domestic water supply. Therefore, alternative sources of water have many problems on the people, such as loss their time, energy, economy and cause water borne and water related diseases and also reductions of the town levels by different conditions compare to other town. Addition to this consumption of alternative water sources are varying by quantity and quality with season, which is not constant through the year. That means at winter season most of people have not gate enough amounts of water need to their domestic activities because amounts of water source is reduced at this season and also at summer season is most of people could be affected by different types of water borne diseases such as Amoeba, Guardia, Typhoid and malaria, because quality of water source is very low due to different types of particles are enter into water source by rainfall or flood and sewages of the town enter into sources without any types treatments at this season.

As indicated by Table 4.8 from item five, 7.9% of the sampled HHs were happy at presented water supply of the town but 92.1% of the sampled HHs are not happy from current water supply systems of the town due to different factors such as quantity and quality of water, cost of operation, maintenance and connection of new pipelines and distribution system of existing water supply systems. Addition to these lacks of technical, absents of skillful man power, frequently interruption and burst the services, like generator, distribution pipelines and fitting. Therefore, only small number of HHs may be fulfilled their domestic consumption from existing water condition but majority of the town HHs were not satisfied their daily consumption, then they use unsafe and unprotected alternative water sources for their daily domestic activities from far distances.

4.4.4. Water production of town

The water production of town at current time is one spring and two boreholes, which are all coordinated to one water supply line and managed by ITWSS office. The total production of these sources is 45l/s or 1307000 l/d (1307m3/d). But the exact production of water is less than estimated values during design periods, because the designer is estimating the working hours of boreholes (BH1 &BH2) is very long which is 22hr for each and for spring is 24hr however at present conditions working hours of the BH1, BH2 and spring is 10.45hr, 11hr and 5hr respectively, their total production per day is 557m^3/d and 654m^3/d respectively and also actual production of spring is 96m^3/day. These shows the expected yield and actual yields are not equal because the actual pumping hour is very less than from expected hours (i.e. 10.45<22hr & 11<22hr) for BH1 and BH2 respectively. Their value is shown below Table 4.9 and Figure 4.7.

Table 4.9: The installed limit, expected and real yields of spring and boreholes

No	Name of sources	Installed capacity(l/d)	Estimated yield(m3/d)	Actual yield(m3/d)	% of actual to estimated
1	Sutagna spring	9	777.6	96	12.35
2	BH1	18	1425.6	557	39.07
3	BH2	18	1425.6	654	45.88
	Total	**45**	**3628.8**	**1307**	**36.02**

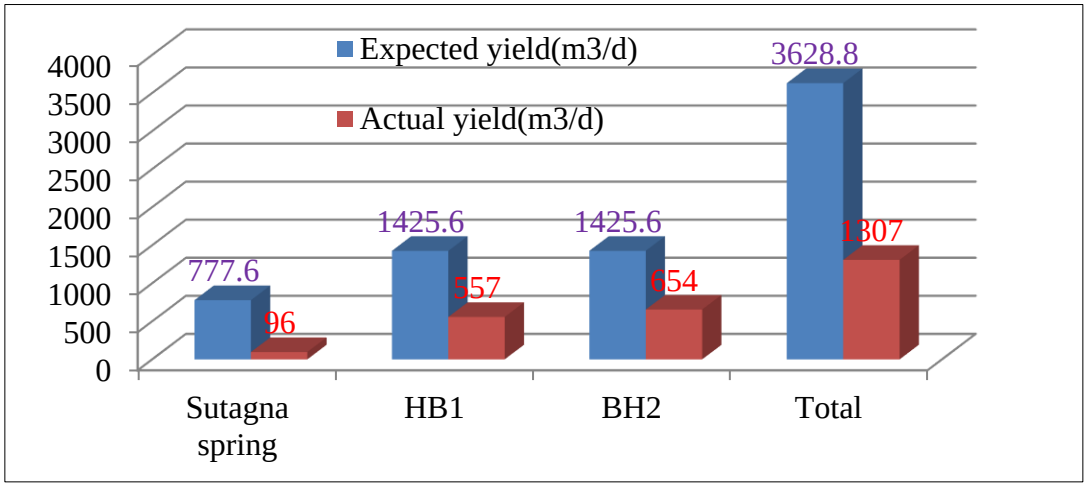


Figure 4.7: Compression of actual and expected yields of water sources

According to Table 4.9 more than half of the estimated yield is not used at current situation that means 63.98%, due to this reason problem of water shortage is occurred every day. The major challenges for this situation are lack of electric power to pump and inadequate water sources. Therefore, only 36.02% are cover from total expected demands of the water sources because 63.98% are note used, then the town population is need 63.98% of water demand to meet their daily domestic activities without considering the current numbers of the town population. As consequence of generation rate and permanent interruption is depends on working times of boreholes and spring, the real production of water is considerably less than the estimated quantity of generation and consumption of the water. The generation of water is differing with season due to occasional fluctuation of water yield and total working hours of boreholes and spring. Normally, water consumption is depending on discharge of spring and two boreholes, function time and numbers of spring and boreholes on the function. Regard to the information found from WSS office (2004/2012-2009/2017) in addition to below capability rate of generation, restricted numbers of boreholes and spring and working times of boreholes and spring which are less than the real generation of water. Comparison of production, consumption and unaccounted for water is show below Table 4.10.

Table 4.10: Water production, consumption and unaccounted for water of town

Year	water generation plan(m3)	water generation achieved(m3)	percent	water consumption soldplan(m3)	water consumption soldachieved(m3)	Unaccounted for water (%)
2012	194400	139480	71.75	139460	115492	17
2013	200000	129436	64	180000	145080	19
2014	200000	137713	69	176000	109566	20
2015	250000	150306	60.1	200000	120654	20
2016	501024	170004	29	476440	137976	19
2017	470640	259722.6	55	3858925	197234	24
Total	**1816064**	**986661.6**	**58**	**1557825**	**826002**	**20**

According Table 4.10, the generation of water accomplished was 986661.6m^3 from 1816064m^3 plans of water generation and the high rates of water loss was 42 percent. In this manner, only 58% are delivered from 100% of plan generation of water for the town. This show there is deficiencies of water production at sources of boreholes and spring because of absence of electric power supply. However, consumption of water accomplished is 826002m^3 from 1557825m^3 plans of water consumption for the town populace and unaccounted water loss is 20 percent's yet 80 percent is covering the utilization of the town populace now a day. As respect to this issue the meeting sampled HHs and distinctive segment of society recognized contradiction of the water supply with population growth rate and the increase of the town time to time and additionally everyday interruption of the water supply particularly in winter season such as January to May and the limit power of WSS office in terms of specialized man power, money related, materials, for example, machines, types of apparatus, extra parts and gate valve are considering as significant issues.

4.4.5. Distribution of water supply in town

Distribution framework is the mainly critical part of water supply in any town or city. The types of distribution framework and proficiency of water supply is significantly influenced the rate of HHs consumption. Procedure of distribution system begins from the place of sources of water supply; therefore, the starting points of this system is from the two boreholes (BH1 &BH2) and sutang spring. From the two boreholes, one borehole and sutang spring was working by using electric intensity of the town but does not work properly during their working times. Other one

borehole is working by using diesel generator but it is difficult to buy every day this oil. This indicates, there is shortages of power to pump water from sources to services reservoir every day, because the electric power in town is not available every day due to lack of enough amount of power at sources and the cost of generators and oil of generator is increasing time to time, it is not much with the economy status of the town. During field study discussion with the WSS office head, explained as there is not capacity to cover this increasing oil prices day to day, this cause lack of power for diesel generator and shortage of electric powers of town. Consequences of this cause water interruption from town every day in study area. Then to reduce problems or challenges of water interruption will be use the solar energy as a substitute of diesel and electric power to pump water from sources to service reservoirs every day when there is not electric power of town and this system is reducing the cost of diesel oil and better for economy developments of town.

The water pumped from each borehole and sutang spring through main rising pipes to elevated ground services reservoir. There are two main rising pipelines, one is running from sutang spring to the old masonry reservoir which is $50m^3$ capacity and other is running from collection chamber of two boreholes to the new constructed services reservoirs, its capacity is $1000m^3$. The total capacities of the two reservoirs are $1050m^3$. From those reservoirs the chlorination disinfectant is dropped to prevent microorganisms of water. But there is not any additional treatment before or after chlorination treatment, due to this reason most of sampled HHs said that there is not good quality that means "the water is salty", because the sources of one borehole is contaminated with Zegena Lake. These cause kidney diseases on community of the town. Therefore, it must be required desalination treatment before the chlorination treatment to reduce salty of water.

A water distribution network of the town including, sources, raising main pipes, services reservoirs and distribution pipeline (main pipe, sub-main pipes and branch pipelines). But distribution pipelines of the town have not pressure zone divisions, which is used to prevent water pressure from distribution pipelines, to known easily the problems of distribution system of each zone and easily to protect unaccounted loss for water and also to known services border line of the service reservoir and to distribute equal water for insufficient water supply parts of town. Regard to reports of ITWSS office in 2018, the total expected span of distribution network

pipelines in study area is 119km with various pipe size, types of pipes and with various duration life spans but there is not good quality to translate quality and quantity water for community. Clearly, the significance of services reservoir as a major aspect of the distribution frameworks, which is to ensure non-stop supply of water at interruption during the time spent generation. This is depending on the number, capacity of services reservoir and on the relative ground height. In the event that water is distributed by gravity system to consumer without required any types of energy from services reservoirs. Locations of these service reservoirs are, one from east part of the town and other is south of the town which is elevated ground around the town and near the boreholes. Therefore, pressures of these services reservoirs in two parts of the town, which are cause unfair distribution of water among the kebeles especially west and north parts of the town, addition to this problem the low production and required high amounts of demand currently cause shortages of water in every day and also there will not collect water in the reservoirs. Continuously interruption underway combined with controlled capability of reservoir and inequitable allocation of water for private connection and water points and also creates unbalance gap among the supply and demands of town water supply. This unbalanced gap between supply and consumption of water supply is due to various problems on town population every day, these challenges are:

- Scarcity of water supply prompted poor individual hygiene and environmental pollution
- It was forced the community to fetch water from unprotected sources of water every day, this cause different water borne, water washing and water related diseases such as Amoeba, Guardia, Typhoid etc on communities through the year specially during summer seasons.
- The town community walk long distance to fetch their daily water consumption from different alternative water sources every day, normally they walk 2km for one-way travel from their house, this affects their time, energy and production especially women and children and also affect developments of town by various way.
- Insufficient of water supply is push the community to buy water from different water vender and shops by high prices every day to meet their daily water consumption.

Generally, a shortage of water supply is affecting the community health, productivity time and economy of the community to pay unplanned payment to collect daily water for their domestic purposes from different alternative water sources by high cost and reduce attractiveness of town and developments by different infrastructures.

4.4.6. Coverage of water services in town

Coverages of water supply services distribution in town is mostly from central portion of the town and around governmental households in five kebeles, but they cannot gate every day their water consumption from piped water supply. The total coverages of this water supply are 40% only for all communities of town. According to the official information of WSS office of town has total customers are 5924 at present situation from total households of town (13601). From these 5223 residential, which is 38.4% only and others 594 business, 52 governmental organization associations, 4 NGOs association, 11 private associations, 16 religions, 7 public and 14 public water focuses. In spite of the fact that this number is expanded every now and then, still many logs behind from getting water through private meter connection. The greater part of the households units have not used the piped water supply of town, they can use their daily consumption from different alternatives water sources, such as private customary hand dug wells or gather from spring or river or purchase from merchant who gathering water from adjacent spring or river on karate or purchase from their neighbors or other people contain their own personal lifted store and offering it by higher cost for different community during shortages of piped water supply.

The primary condition pipeline expansion is to distribute sufficient amounts of water supply to community. The productivities of water demand are determining depends on masses of pipeline around areas and other factors, which are socio-economy status of community and physical structure of the town topography. Among these the major challenges is lack of proper distribution of water supply and less numbers of water bono for low income levels of community which live in this area. According to this expansion of pipeline the whole town is the most important to distribute adequate quantity of water supply to all community. Because most people living in town have not sufficient amounts of pipeline around their areas. Due these reasons they move long distance to fetch their daily demand for different domestic activities and loss time and energy every day through the year.

Other problems of coverage of water supply in this town, there is no any guide about the density of pipelines of distribution networks, during interview with most sampled HHs and selected official persons they are stated as the laying of current distribution pipeline network is illegally and most pipelines are found at center and old parts of town. Addition to this most pipelines of distribution network is found around governmental households and some industrial and

commercial areas and also some private institution, NGO and governmental sectors, due to these reasons the cost of new pipeline connection is very high for low level economy.

The issue of line expansion is additional problems to distribution the stable and fast for expanding region of the town. The problems that are explained from the people due to complete deficiencies of water supply because they are newly expanded and the numbers of water point is less compare to their numbers and also the quantity of water entering this area is small, due to this reason most numbers of community walking long distance to find better water point.

The piped water connection contains both households and non-household customers; these are private piped connection, water points, public connection, governmental connection, private organization connection and NGO connection in this town. The household piped connection contains house connection and yard (privet and shard) connection but the house and yard connections are relatively the same, the only different is the location of their found, then the location of yard connection taps is outside from home. But the house connection has consumed more water than yard connection because it does not require more energy and time for fetch and easy for all members of households, its cost is very high due to this the poor community cannot use this type of connection in study areas. Though, the establishment new household connection in study area is a greatly high price which does not considering all population of town because most of people living new expanded area is very poor due to this reason most community cannot use the house meter connection in this town. Generally, the numbers of house meter and private meter connection of piped water supply users are very small compare with total numbers of population or households in town but their number is increasing time to time through the year. Water coverage in studying town is show below Table 4.11 and Figure 4.8.

Table 4.11: Numbers of sampled HHs with and without piped water supply in town

No	Types of connection	Frequency	%	Valid Percent	Cumulative Percent
1	Private connection	192	28.2	28.2	28.2
2	Public connection	124	18.2	18.2	46.4
3	Without connection	364	53.6	53.6	100
	Total	**680**	**100**	**100**	

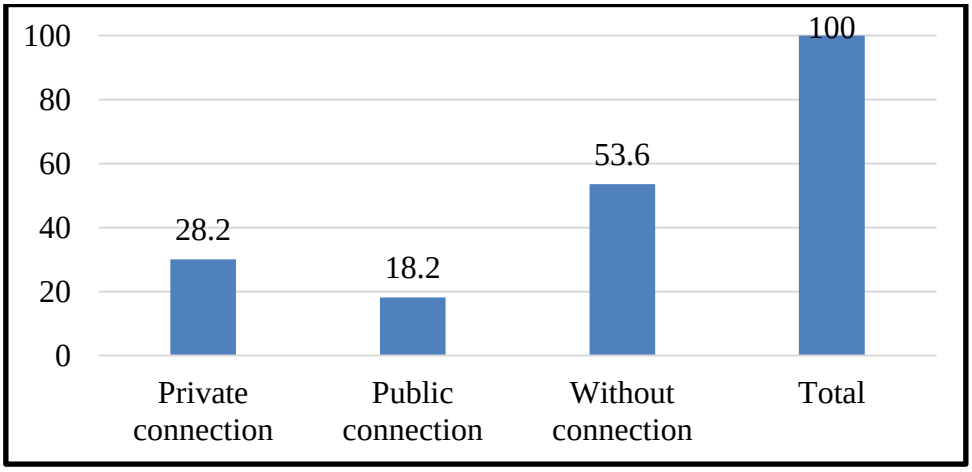


Figure 4.8: Coverage of water supply with and without piped lines

According to Table 4.11, 28.2% of sampled HHs were explained their water coverage from private connection but it is not adequate quantity and quality, 18.2% of sampled HHs were mentioned their water coverage from public water points but they said they use every day from alternative water sources due to lack of enough quantity and 53.6% of sampled HHs were not have piped water connection. The majority of sampled HHs have not used piped line water supply from water supply of town in study area, this show there is shortages of water supply due to different reasons. These are unequal access of water for all parts of town, lack of effective use of water and lack of high quantity of water sources. Other problem is lack equal distribution of water and absent of enough amounts of distribution pipeline network proportion to population numbers in all portions of town especially new expanded areas considering the next expedition numbers of population around it. This cause insufficient amount of water distributed to most town community. However, the great parts of population are not gate sufficient amounts of water from piped water supply to meet their different domestic activities every day due to these reasons most people fetch water from other elective sources every day which is unsafe or unprotected source.

The consumption of piped water supply is different from one household to other households and also from closer to closer, they use the same connection types. This different is occurred by various reasons, such as their salary levels of HHs, density of pipeline network, location of sources and quantity of water. Due to these challenges the serious scarcity of water is happened in study town. As a result, most people could be gathering water from different types of other

sources and buy from water venders and private shops by high prices. This affects their economy, time and energy and also productivity, especially women and children.

The greater part of the town population gather water either from one or more than one sources for their domestic uses. This indicates there is not fixed water supply nearby from their house. The total coverage piped water distribution is only 46% for all town population; it is insufficient amount to meet their daily consumption. In this town the private connection rate of water supply is depends on their economy and numbers of their household persons. Due to this reason who has high numbers of households and high economy can use more rates of water supply. Generally, types of water supply system (mode of services) depends primarily on financial status of the population to be served and on the amounts of water available for supply.

A greater part of population has low payment and the consumption also reach insufficient, But the proficiency of the water points depends on number of users and amounts water distribute from one water point every day. The numbers of water point at current time is 14 from total parts of town, but it is very small compare to with numbers of total population in town at current time, dominant part of community is absence of private piped connection of the town water supply.

The predetermined number and discriminatory distribution of public water focuses combined with constant interrupts of water supply is decrease the quantities of public tap consumers. This unfair and far place of public water point from house makes burdens for customer of HHs in order to their time, power and their financial system and also influenced developments of town. In this way, persons in town regularly using other elective sources, the most water coverage of town water supply depends on different types of alternative sources. An alternative source of water supply in town is very hard before and after fetching. The places of these sources are difficult for fetching, especially for old women and child. Because far from their home and located at difficult surface for fetching easily and also hard for health of communities. These water sources cause many types of diseases through the year because it is unsafe and unprotected sources. Majority of town communities, which is around 53.6% of sampled HHs using from these sources to meet their daily domestic needed for different activities, such as for drinking, cooking, washing and bathing and ketch purposes every day. These alternative water sources are show below Figure 4.9.

Figure 4.9: Alternative water sources of town

Therefore, Injibara town WSS offices must use shifting system of water supply to decrease these kinds of challenges from a few sections of town population and distribute equal amounts of water for all population. In any case, exchanging system of water supply has both merit and demerit. Its merit of shifting is used to solve the challenges of deficiencies water supply from all parts of town by exchanging their time of water flow, especially better for total absent of piped water supply areas because they may be gate a few day in a week at least their drinking purposes, when there is a lack of water from service reservoirs, Addition to this to create awareness from community to collect enough amounts of water for their domestic activities up to their turning periods. Its demerit is affecting some community, which they are use alternative sources from water venders buying by high cost and other use unprotected sources because during their turning time water interruption may be happened. Moreover, the most ideal arrangement of water supply to meet such a developing necessitate will be during extending the quantities of pipe lines with proficient arrangement of distribution by taking thickness of the population into thought and separation between stand channels during designating water points and sufficient demand from the sources. In such condition it is imperative to portability the populations, CBO and self-improvement with gatherings that can help the establishment of public water point through work and money contribution or material support to improve the better public water point from different parts of town to cover shortage of water supply.

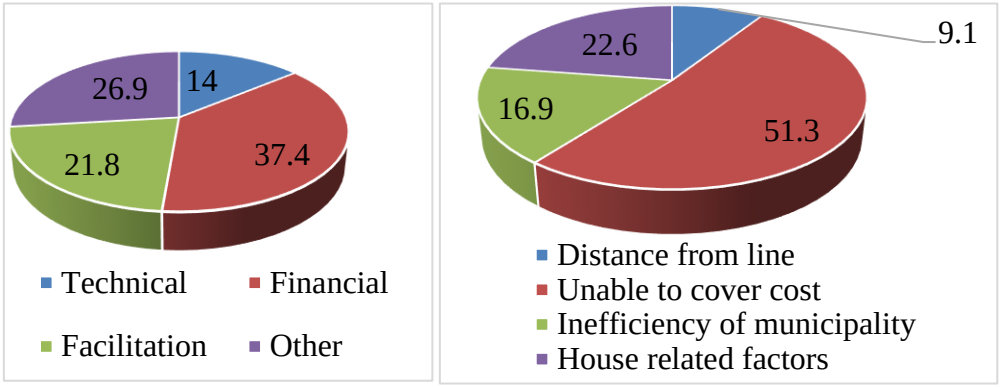
4.5. Challenges Related with Water Supply and Delivery in Town

Absence of access to protected and clean water supply is major challenges of the distribution system (Emenike et al., 2017). Despite the fact that the challenges of water are seen as a

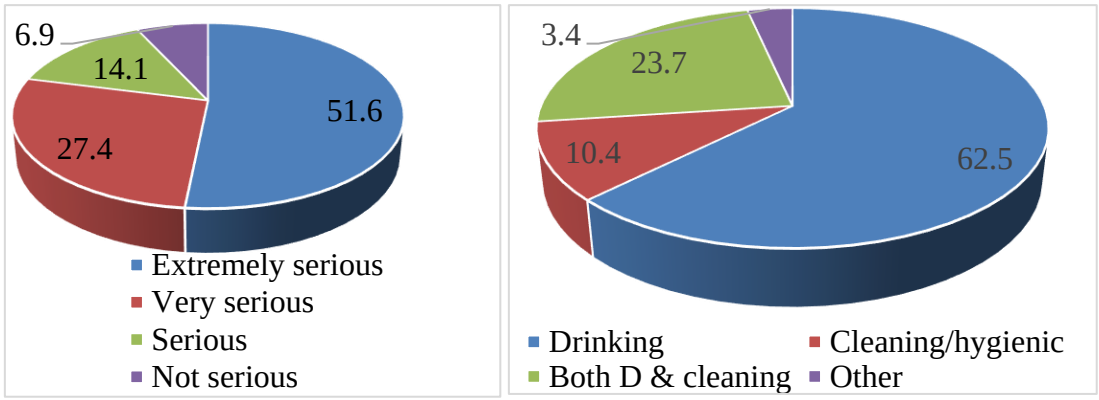
universal issue for both the urban and rural population, especially ladies and children are more affected due to loss their time, energy and productivities to gathering water from far distance for their family unit. Therefore, in study area the ladies and children are affected by water borne diseases and have limited their productivies and women cannot participate social and political issues. These challenges are stated below Table 4.12 and Figure 4.10 as follow.

Table 4.12: Challenges related with delivery of water supply in study area

No	Classification	Description	Frequency	%	Valid %	Cumulative %
1	There are the challenges of water delivery	Yes	653	96	96	96
		No	27	4	4	100
		Total	**680**	**100**	**100**	
2	What are problems of water supply delivers in town	Technical	95	14	14	14
		Financial	254	37.4	37.4	51.3
		Facilitation	148	21.8	21.8	73.1
		Other	183	26.9	26.9	100
		Total	**680**	**100**	**100**	
3	Why there is no private pipeline connection	Distance from line	62	9.1	9.1	9.1
		Unable to cover cost	349	51.3	51.3	60.4
		Inefficiency of municipality	115	16.9	16.9	77.4
		House related factors	154	22.6	22.6	100
		Total	**680**	**100**	**100**	
4	What is degree of the water supply problems in town	Extremely serious	351	51.6	51.6	51.6
		Very serious	186	27.4	27.4	79
		Serious	96	14.1	14.1	93.1
		Not serious	47	6.9	6.9	100
		Total	**680**	**100**	**100**	
5	Which types of domestic consumption is very serious	Drinking	425	62.5	62.5	62.5
		Cleaning/hygienic	71	10.4	10.4	72.9
		Both D & cleaning	161	23.7	23.7	96.6
		Other	23	3.4	3.4	100
		Total	**680**	**100**	**100**	



(a) Problems of water supply (b) Why there is no private pipeline connection?



(c) Degree of water supply problems (d) Which types of consumption is very serious?

Figure 4.10: Challenges related with delivery services of water supply in study area

According to Table 4.12 from item one, 96% of sampled HHs were mentioned as there is water supply and delivery services challenges in town at past time and current time every day but 4% of sampled HHs were explained as there is not the challenges of water supply and delivery services in town at current time. However, the great parts of sampled HHs explained that there is a water supply and delivery service challenge in town every time, the water supply of town is inadequate quantity and quality. Majority of the town community is not happy on current water supply and delivery services, especially by quantity of water. The town water supply and sewerage office technicians are mention that scarcity of water supply in this town is not current situation it is long period problem in both quantity and quality of water. The problems water supply in town happened not only numbers of population rapidly increasing by migration and by nature condition this problem is existed before the numbers of population is increasing. Addition to this inadequate quantity and quality water and also there were not properly laying of distribution network and cost of connection of private pipeline are major challenges in town time to time. Hence, this situation had made weights on foundations usually on household water

supply services in study area. Consequently, this absolutely demonstrated that the water supply deficiency is affected the development of the town and country by different means at past and present times. Because all activities of human being are depending on water quantity and quality for both urban and rural areas.

Regard to item two from Table 4.12, 14% of sampled HHs were distinguish the current water supply challenges as technical, 37.4% of sampled HHs were explained the water shortage as challenges of financial, 21.8% of sampled HHs were mentioned as shortages of facilitation and 26.9% of sampled HHs were explained the scarcity water supply as there is other challenges to influence the water supply in town rather than technical, financial and facilitation. The great parts of the sampled HHs were stated the challenges of the town water supply as lack of financial capacity from community and WSS offices of the town, due to this reason the water supply is inadequate in quantity and quality every year. This indicates there is a challenge of domestic water supply services in town to distribute sufficient quantity and quality of water for all community depends on their needs of daily consumption for their domestic activities. During field study, interview the head of ITWSS office, he explained the problems of water shortage in town as financial and technical issues, these two are the major problems to affects water supply to supply efficiently for all households of town and also lack of skilled man power to solve this problem easily with short time. Besides this the landscapes of the town are complicated to develop the better water supply services in town, that distribute sufficient water supply for all town community every day and this cause water pressure effects on distribution pipelines and required water balance or pressure breakdown mechanisms.

According to item three from Table 4.12, 9.1% of sampled HHs were cannot use pipeline town water supply because the distance between from their home and the main pipeline around their villages is very far, 51.3% of sampled HHs were not use the pipeline due to incapability to cover the cost of pipeline connection, operation and maintenance before and after connection, 16.9% of sampled HHs were cannot got the pipeline water supply of town because inefficiency of municipality to solve the challenges of inadequate water supply in town and 22.6% of sampled HHs were cannot use pipeline water supply because there is different house related factors to connect pipeline water supply. However, the great parts of sampled HHs were stated that the problems of cannot using piped water supply system is lack of ability to cover the costs for pipeline connection and after connection the costs of operation and maintenance and some

sampled HHs were identify the problems of pipeline water supply as inefficiency of municipality to improve the problems of town water supply. Addition to this town has the problems of effective managements of the town master plan because absent of per-managements of the town master plans, because numbers of population is increasing rapidly time to time, it is developing town. This condition causes everyday interruption of water supply in town in both seasons, which is in summer and winter season in every year.

Regard to Table 4.12 from item four, 51.6% of sampled HHs were explained the problems of existing water supply system of pipeline as extremely serious challenges, 27.4% of sampled HHs were mentioned the current piped water supply system challenges as very serious, 14.1% of sampled HHs were explained the present challenges of town water as serious and 6.9% of sampled HHs were mentioned that the existing pipeline water supply have not the problems. However, the great parts of sampled HHs were explained that the current water supply of town have many problems which is extremely serious problems for all community to get their required consumption for their daily domestic activities in study town through the year. This influence their time, energy and productivities and also developments of town and reduce the quality of town compare to another town.

According Table 4.12 from item five, 62.5% of sampled HHs were explained the existing water supply is very serious insufficient for drinking, 10.4% of sampled HHs were mentioned the current piped water is inadequate for cleaning, 23.7% of sampled HHs were explained the current piped water supply is serious insufficient for both drinking and cleaning and 3.4% of sampled HHs were mentioned the shortages of existing water supply for other domestic activities. The majority of the sampled HHs was explained the existing water supply is insufficient for drinking and also cleaning purposes in town and the quality is very low. This shows that the scarcity of piped water supply in town is very serious problem for all town community for their daily consumption of domestic purposes. This problem is the major problem of the whole town during summer and winter season at past and current time in various portions of the town. Because the existing distribution pipeline is distributing insufficient or inefficient quantity and quality for all communities in town. The rate of water supply is very low at summer and winter season as whole town through the year, this caused by low production of water at sources, no proper laying of distribution system and interruption of water occurred more than one week in month. Thus, the majority of community in town using daily water supply

from alternative sources, which is unsafe or unprotected source it is difficult for their health and some community using water from venders and private shops buy by high cost, they loss their money, time and energy and also reduction of their economy.

Other challenge of existing water supply in study area is inefficient efforts and trying was not conducted from concerned bodies of the town WSS offices and members of water board in town. Because the whole communities give the responsibility for these body to improve and solve the problems of water supply in town, but they are not taking the responsibility.

4.6. Dissatisfaction of HHs on Present Condition of Water Supply

The fundamental access can be characterized as the accessibility of drinking water not less than 20 liters for every day per individual, a gap is not more than 500meter from the sources to home and a greatest time taken to gather water from source for round walk is 30 minutes. And also, the UNDP said the base ultimate daily water requires per individual every day is 50 liters which include: 5 liters for drinking, 20 liters for sanitation and clean, 15 for showering and 10 liters for cooking (Kumar and Desta, 2018). But from study area there is shortages of water for all types of domestic activities day to day to meet their need, due to this reason they cannot gate adequate quantity and quality of water supply for their needs per day and they loss more than half and an hour to collect daily water supply for different domestic activities. As per this outcome wasteful conveyance of the arrangement water supply benefits under a framework is more difficult in the town. Because of this reason totally absences of water supply around the new grow portion of the town. The reason of unhappiness of sampled HHs on the current water supply is shown below Table 4.13 and Figure 4.11.

Table 4.13: The reasons of sampled HHs disaffection on existing water supply of town

No	Reason of dissatisfaction	Frequency	%	Valid Percent	Cumulative %
1	Pipeline connection problem	47	6.9	6.9	6.9
2	Water interruption problem	299	44	44	50.9
3	Distance & location of main pipe	71	10.4	10.4	61.3
4	Distribution system issue	157	23.1	23.1	84.4
5	Poor quality & quantity issue	80	11.8	11.8	96.2
6	Cost & unskilled worker problem	26	3.8	3.8	100
	Total	**680**	**100**	**100**	

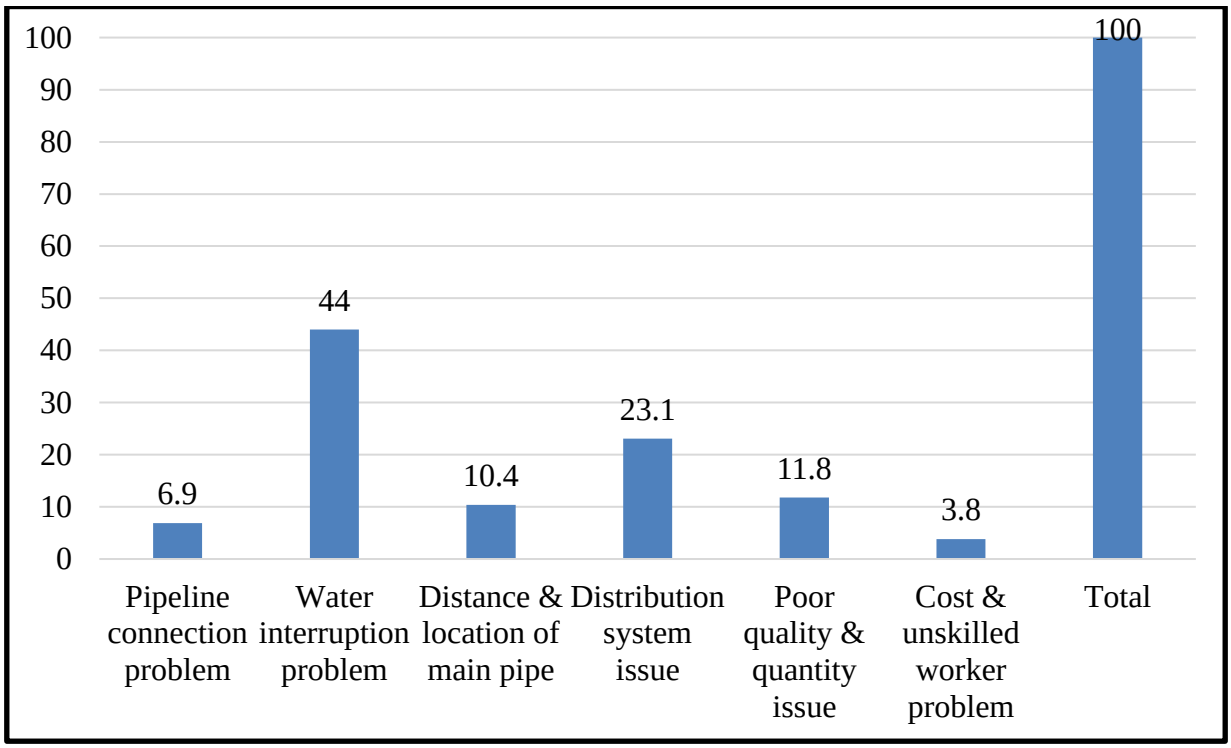


Figure 4.11: Problems of current water supply in study town

According to Table 4.13, 6.9% of sampled HHs were explained as unhappy on existing water supply system due to distribution pipeline connection problems, 44% of sampled HHs were mentioned as unsatisfied on present water supply system due to water interruption day to day, 10.4% of sampled HHs were explained not satisfied on existing water supply systems due to distances from main pipeline to their home, 23.1% of sampled HHs were said not satisfied on present water supply due to distribution system challenges, 11.8% of sampled HHs were explained as unhappy on present water supply because of poor quality and less amounts and 3.8% of sampled HHs were not satisfied on existing water supply system due to cost and lack of skilled worker labors. However, more than half of sampled HHs was said that unsatisfied on existing water supply system due to water interruption and distribution system. Among these two problems water interruption is the major challenges of water supply in study town which interrupts more than one week in a month. This show the total households of town population are unsatisfied on existing situation of water supply system.

4.7. Causes of Water Supply Shortage in Town

There are many problems to causes water shortage in study town. According to study, which are result from sampled households interviewed are show influences of water scarcity or insufficient

of water are numbers of people forced, nature of landscape of town, urban expansion speed, interruption of water, seasonal exchanging or climate condition, financial growth and behaviors of the population consume water supplies are major factors. Due to these factor consumptions for water supply is increasing every day; therefore, this cause scarcity of water supplies from study town for various domestic demands. Especially rapid population growth is affecting the system of water supply distribution and creates various types of job for WSS office workers to repairs every day breakdown of pipeline by high water pressure during peak hourly flow at the same time. Therefore, the reason of water shortage in studying town is shown below Table 4.14 and Figure 4.12.

Table 4.14: The causes of water supply shortage for HHs of town

No	Reason of dissatisfaction	Frequency	%	Valid %	Cumulative %
1	Poor and inefficient distribution	72	10.6	10.6	10.6
2	Financial issue	43	6.3	6.3	16.9
3	Rapid growth rate of people	238	35	35	51.9
4	Frequent burst of pipelines	219	32.2	32.2	84.1
5	Fluctuation of water power	108	15.9	15.9	100
	Total	**680**	**100**	**100**	

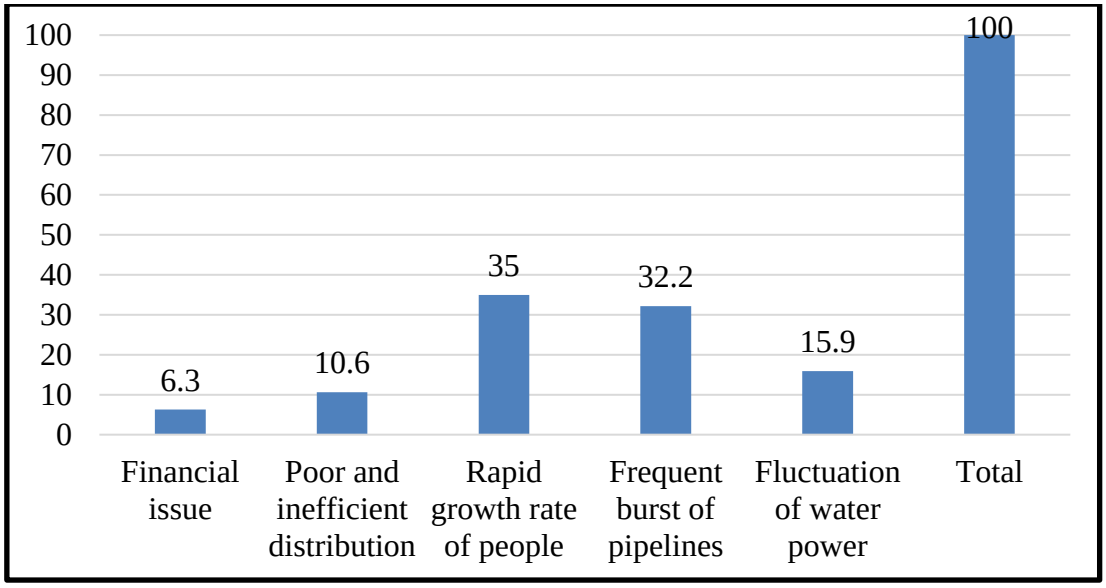


Figure 4.12: Causes of water supply shortage in study town

According to Table 4.14, 10.6% of sampled HHs were explained the causes of water supply shortage in town is poor and inefficient distribution systems problems, 6.3% of sampled HHs

were described the shortages of water supply in study town as financial issue, 35% of sampled HHs were mentioned the scarcity of town water supply as rapid growth rate of people problems, 32.2% of sampled HHs were explained the shortages of water supply in study area as frequent burst of pipelines of distribution network time to time by different factors and 15.9% of sampled HHs were mentioned the scarcity of water supply as fluctuation of water power on distribution networks.

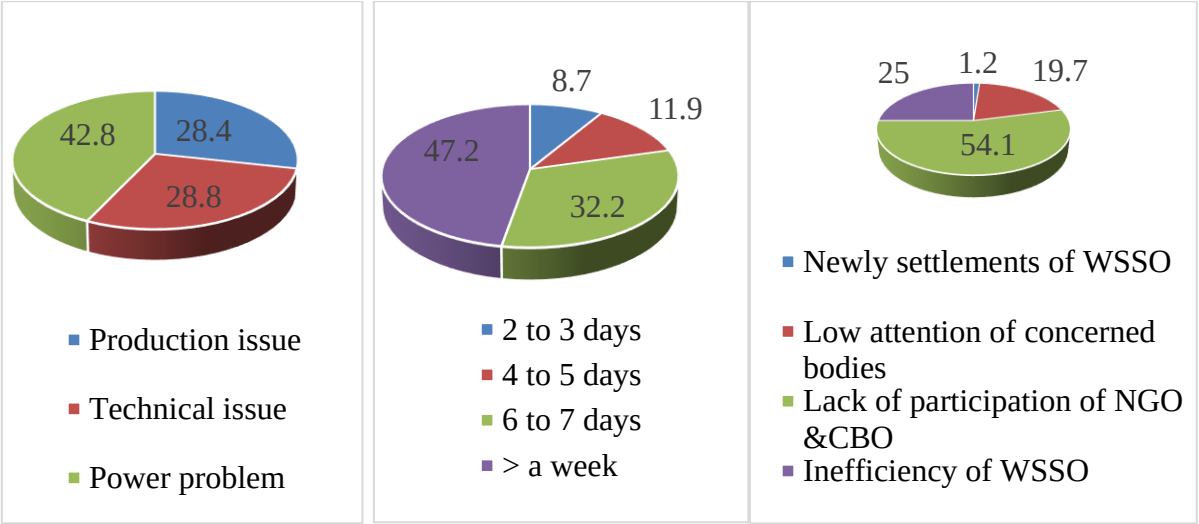
However, greater part of sampled household explained the shortages of water supply in study town cause as rapid growth rates of population and regularly burst of distribution network every time. Because, the numbers of town people are increase rapidly due to migration of people from rural to urban and sub-urban to urban area. Hence, Injibara town is capital town of Awi zone. Therefore, many people inter into studying town to fining different job and air condition of this town is better to live rather than other around towns. Other one is regularly burst of distribution networks by different factors such as, lack of good quality of network pipelines, increasing of water pressure to increase peak hourly demand of the town at same time and absences of water pressure breakdown at different place of distribution network are major factors to cause water shortages in town. There are two other major causes of water scarcity in study towns are interruption of water demand and seasonal exchanging.

4.7.1. Causes of water interruption in study town

The interruption of drinking water supply either through irregular sources or coming due to engineering aspects are an important determinant of the entrance and nature of drinking water supply. Daily or weekly interruption is caused by water force, when such unexpected power failure is cause completely reduction of water from town, this faced different challenges on HHs such as less productivity, low income, poverty and also resultant danger of in pipe recontamination, reduce durability and water quality, reduces consumption of users and which leads harmful influence on cleanliness or sanitation in town. Water interruption in town appropriately a large problem for past and current time and influencing the life of population from multiple points of view in the event that it is increase constantly at present time and may be for future time because the numbers of population rapidly increasing time to time without any gap and also the town is expanding rapidly. The problems of this water interruption are listed below Table 14.15 and Figure 4.13.

Table 4.15: Causes of water supply interruption in town

Item	Category	Description	Frequency	%	Valid %	Cumulative %
1	Cause of water supply interruption	Production issue	193	28.4	28.4	28.4
		Technical issue	196	28.8	28.8	57.2
		Power problem	291	42.8	42.8	100
		Total	**680**	**100**	**100**	
2	When interruption occurred in month	2 to 3 days	59	8.7	8.7	8.7
		4 to 5 days	81	11.9	11.9	20.6
		6 to 7 days	219	32.2	32.2	52.8
		> a week	321	47.2	47.2	100
		Total	**680**	**100**	**100**	
3	What is the reason of ITWSSO cannot solve the problems	Newly settlements	8	1.2	1.2	1.2
		Low attention	134	19.7	19.7	20.9
		Lack of participation	368	54.1	54.1	75
		Inefficiency WSSO	170	25	25	100
		Total	**680**	**100**	**100**	



(a) Cause of interruption (b) When interruption occurred (c) What is the reason of ITWSSO

Figure 4.13: Cause, reasons and duration of water supply interruption in studying area

Regard to Table 4.15 from item one, 28.4% of sampled HHs were explained the reason of interruption of water in study town as challenges of production, 28.8% of sampled HHs were expressed the reasons of water interruption as technical problems and 42.8% of sampled HHs

were mentioned the reasons of water supply interruption as failures of power. The greater part of the sampled HHs was expressed the water supply interruption in town as insufficient power consumption. During field study, interview the WSSO of town were stated that the cause of water supply interruption is absences of enough amounts of electric power and increasing cost of generator oil time to time and also difficulty of topographic structure of the town master plan. Addition to this absence of attention from individual community of town about use of water in town and forestation of trees around the spring make extra issue at the sources. Besides, technician issues affect the supply frameworks through unequal supply of water for various portion of town. Some region of town which established the new pipeline system of distribution network, they can get water for some time through the year but after some time stop. However, some region of the first time built up and other official areas such as governmental offices, NGO and private institution in town are get water someday.

Regard to item two of Table 4.15, 8.7% of sampled HHs were explained interruption of water supply in town occurred 2 to 3 days in month, 11.9% of sampled HHs were mentioned failure of water supply in town at least occurred 4 to 5 days in month, 32.2% of sampled HHs were explained interruption of water supply occurred 6 to 7 days in month and 47.2% of sampled HHs were mentioned interrupts of water is more than a week in one month through year. Great parts of sampled HHs explained the interruption of water supply in town as interrupted more than one week in one month through every year, the degrees of interruption of water supply in town by ascending order as 2 to 3, 4 to 5, 6 to 7 and more than one week in one month respectively increasing. Most of time this water interruption is happened in study town by many problems, such as absents of skilled man power to solve this problem of water supply interruption by easily in short time and lack of enough amounts of daily electric power and generator oil and also shortages of water at sources to meet the rapid population growth rates of the town. This cause the shortages of water supply in study town every day through the year and it is hard to solve this challenge by easily with short period because it required huge amounts of money and special skilled manpower.

Considering to item three from Table 4.15, 1.2% of sampled HHs were explained the reasons of ITWSS office cannot solve interruption of town water supply as newly organized office, 19.7% of sampled HHs were mentioned the reason as low attention of selected person working for solving the problems, 54.1% of sampled HHs were explained the reason as lack of participation

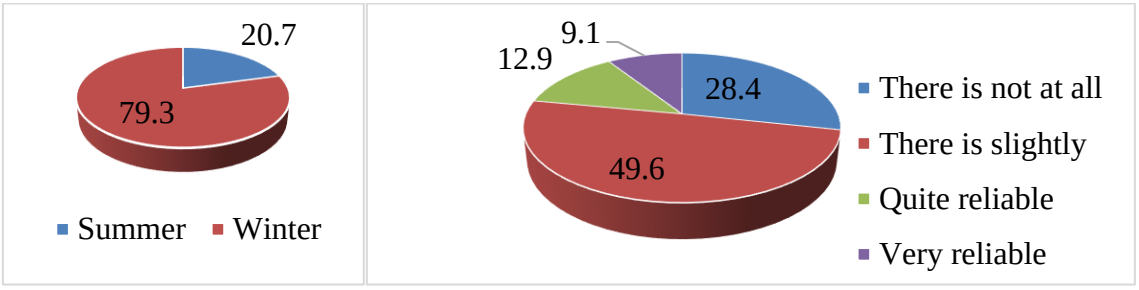
of NGO and CBO to identify and solve the challenges of the town water supply and 25% of sampled HHs were mentioned the reason as inefficiency of WSSO to solve and working with communities of town and different governmental organization to capture easily the problems of water supply interruption with short time. The great parts of sampled HHs were explained the reasons of ITWSS office of cannot solve the water supply interruption in town is lack of participation of governmental organization, NGO, CBO and other private institution to find and solve main challenges of water interruption in town and immediately to reduce this problem. And also, the WSS office have not force to find, identify and solve causes of water interruption time to time in town, due to less contribution of governmental, CBO and NGO to solve the issue and a few people have not idea regard to the challenges of water shortages and interruption in town every day. During field study, interview the ITWSS office head, he explained the interruption of water supply and total shortages of water supply in town is deficiency of money, absence of financial support from government organization, NGO and private institution to fulfil the required materials and skilled manpower. Due to this reason the interruption water supply is occurred every time.

4.7.2. Seasonal variation on water supply

Season variation has many impacts on town water supply consumption time to time through year. Regard to interview, the residential water supply was mostly influenced by seasonal varieties in both summer and winter season, particularly during the dry season. Seasonal variation frequently forced customers to fetch water from unsafe sources from far distance. During dry season the communities of town had not get enough amounts water even other alternative sources such as spring, river and hand dug well are reduce their capacity due to absence of rainfall at dry season. However, at summer season there is high quantity of water demand from alternative water sources but their quality is very low due to different particle enter into the sources by flood. As general seasonal variation has more challenges on domestic water supply, especially at winter season in study area, this cause many effects on communities for example it affects their production, energy, time, economy, education level and reduction of life particularly women and children of communities. The effects of seasonal variations are shown below Table 4.16 and Figure 4.14.

Table 4.16: Seasonal variations of water and reliability of water during winter seasons

Item	Description	Categories	Frequency	%	Valid %	Cumulative %
1	When seasonal variation occurred on water supply	Summer	141	20.7	20.7	20.7
		Winter	539	79.3	79.3	100
		Total	**680**	**100**	**100**	
2	Reliability of water supply during winter seasons	There is not at all	193	28.4	28.4	28.4
		There is slightly	337	49.6	49.6	77.9
		Quite reliable	88	12.9	12.9	90.9
		Very reliable	62	9.1	9.1	100
		Total	**680**	**100**	**100**	



(a) Seasonal variation (b) Reliability of water supply during winter seasons

Figure 4.14: Seasonal variations of water and reliability of water during winter seasons

According Table 4.16 from item one, 20.7% of sampled HHs were explained the seasonal variation on water supply during summer season but 79.3% of sampled HHs mentioned the seasonal variation mostly happened during winter season. Majority of sampled population stated seasonal variation at winter season because in this season there is not rainfall and quantity of alternative and piped water sources is decreased rather than summer season but the summer season have high quantity of water from alternative sources with low quality, therefore winter season is difficult situation for water supply in study town.

Regard to Table 4.16 from item two, 28.4% of sampled HHs was said the reliability of domestic piped water supply during winter season as there is not at all, 49.6% of sampled HHs was explained reliability of residential piped water during winter season as there is slightly, 12.9% of sampled HHs were mentioned reliability of water at winter season as quit reliable and 9.1% of sampled HHs were explained reliability of domestic piped water supply at winter season as

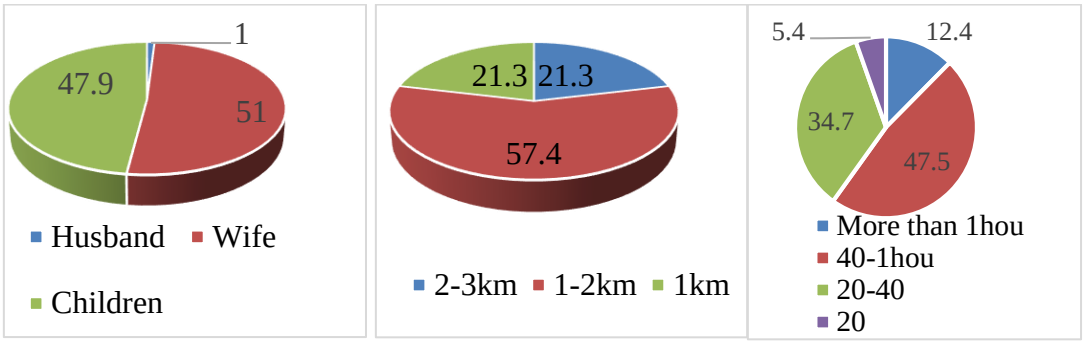
very reliable. Most of sampled people explained reliability of water at winter season as slightly available but not enough for all community do their domestic activities every day.

4.8. Consequences of Insufficient Water Supply Condition in Town

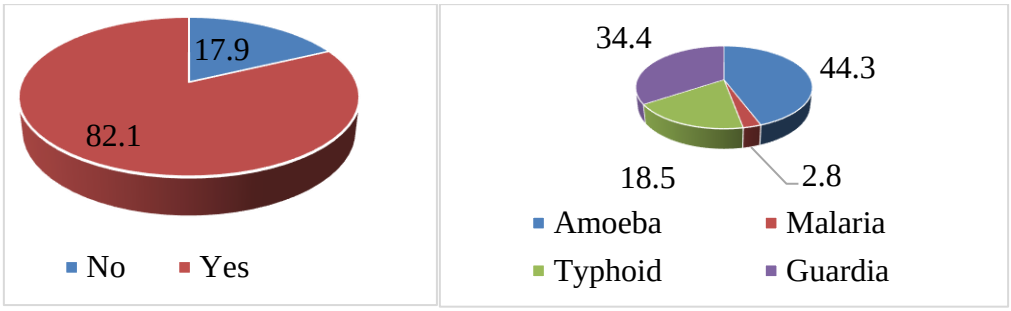
From study town the ladies and children were mainly accountable for looking and gathering domestic water in order to fulfill the problems of water shortage and sometime husbands gathering water when his children or wife is ill and they were crashed around water sources, this condition of problems was seen in the study town, the consequence of insufficient water supply in study town are shown below Table 4.17 and Figure 4.15.

Table 4.17: The effects of water deficiency in study town

Item	Description	Categories	Frequency	%	Valid %	Cumulative %
1	Accountability of persons to gather water	Husband	7	1	1	1
		Wife	347	51	51	52.1
		Children	326	47.9	47.9	100
		Total	**680**	**100**	**100**	
2	Location of water sources from house	2-3km	145	21.3	21.3	21.3
		1-2km	390	57.4	57.4	78.7
		1km	145	21.3	21.3	100
		Total	**680**	**100**	**100**	
3	Time required for gathering daily water	More than 1hou	84	12.4	12.4	12.4
		40-1hou	323	47.5	47.5	59.9
		20-40min	236	34.7	34.7	94.6
		20min	37	5.4	5.4	100
		Total	**680**	**100**	**100**	
4	HHs ill by waterborne	No	122	17.9	17.9	17.9
		Yes	558	82.1	82.1	100
		Total	**680**	**100**	**100**	
5	Which Types of diseases are happened	Amoeba	301	44.3	44.3	44.3
		Malaria	19	2.8	2.8	47.1
		Typhoid	126	18.5	18.5	65.6
		Guardia	234	34.4	34.4	100
		Total	**680**	**100**	**100**	



(a) Responsible person (b) Location of water sources (c) Time required for gathering



(d) Is there water borne diseases? (e) Types of water borne diseases

Figure 4.15: Consequence of inadequate water supply on town community

Regard to Table 4.17 from item one, 1% of sampled HHs were described accountability of looking and gathering domestic water supply as husband, 51% of sampled HHs were mentioned accountability of daily domestic water supply looking and gathering as wife and 47.9% of sampled HHs explained the accountability of looking and gathering daily water supply consumption for domestic activities as children. Majority of HHs were explained as wife and children could be take high responsibility to looking and gathering daily domestic consumption of water supply from study town. But sometime husband has moved out to gather and looking elective sources far away and when the source is hard for ladies and children to gather and fetch water. This type of accountability was occurred from in very small households, while more youthful households, however every one of the children, women and husbands in the family unit must be participated in water looking and fetching daily water consumption for their different domestic purposes from both piped and alternative sources. In this manner, the women, husbands and the children were the accountable to gather and looking water for daily domestic activities. Unless this is influence women and children by direct or indirect, either their energy, health care and times of education from school and their productivities from houses and outside their home.

According to Table 4.17 from item two, 21.3% of sampled HHs were explained location of water sources as 2-3 kilo meter far from their house, 57.4% of sampled HHs were described distances of water as 1-2 kilo meter far from their home and 21.3% of sampled HHs were mentioned location of water sources as 1kilo meter far from their houses to fetching and collect every day. Great parts of sampled HHs were walk 1-2 kilo meter to collect and looking water every day from their home, but this water sources have not good quality for drinking because unsafe and unprotected sources due to different particles enter into sources during summer and winter season by different means. This happened due to absences of enough amounts of electric energy to pump water from sources to services reservoir, lack of properly laying of distribution networks and absences of skilled manpower in town water supply services. These cause different types of factor on communities such as health care problems, education and physical challenges on children and women by direct or indirect effects. In addition, these also affect their financial status and reduce developments of town. Generally, the distances of alternative water sources are varying from one household to other household and also vary their quality and quantity from one alternative water sources to other water sources every season.

Regard to Table 4.17 from item three, 12.4% of sampled HHs were mentioned as loss more than 1hour to bringing water every day, 47.5% of sampled HHs was explained wasting of their time to collecting water every day 40minutes up to 1hour, 34.7% of sampled HHs were described as loss 20-40minutes time to bringing water every day sometime wasting up to an hour and 5.4% of sampled HHs were said up to 20 minutes wasting to bringing water from sources up to home every day. However, majority of sampled households mentioned 40minutes to 1hour loss their time for once bring the water from alternative source to fulfill their domestic consumption for different activities every day. This indicates the whole communities of town spent more time every day to fetching water from different sources depends on their activities, this affect their productivity times and energy of all town communities through the year.

According to Table 4.17 from item four, 17.9% of sampled HHs were explained as no the existing water supply ill their household regarding to water borne diseases but 82.1% of sampled HHs were mentioned as yes, the existing water supply have ill their family members regard to water borne diseases many times through year. Majority sampled HHs were explain as more numbers of family of households ill by water borne and water related diseases through year. Therefore, this condition affects communities of town by different means, such as by their health

status, financially and public actions of the whole study town, these indirectly affect the country economy status and affects the town expected values.

According to Table 4.17 from item five, 44.3% of sampled HHs were explained types of diseases happened by deficient of water supply in town as Amoeba, 2.8% of sampled HHs were mentioned as Malaria diseases which is happened due to current water supply shortage, 18.5% of sampled HHs were described types of diseases happened due to scarcity of water as Typhoid and 34.4% of sampled HHs were stated types of diseases happened due to lack of water is Guardia. However, great parts of sampled HHs were explained as Amoeba and Guardia as consequence of inadequate situation of water supply in town. Accordingly, the shortages of water supply are due to its price and absence of understanding of communities regarding result of using elective sources of water, this cause different health challenges on household members of town population and also affects their economy and developments.

However, water is significant for person continued existence and financial development. Then arrangement of sufficient supply of potable water in urban region in both developed and developing countries are the most important. For example, in developing countries the arrangement of satisfactory potable water supply for drinking, hygienic and sanitation, to enhances their health by decreasing frequency of water related diseases, for example, Typhoid, Amoeba, Diarrhea and Cholera. This additionally decreases the death rates, the numbers of working days lost and decreasing the frequency of sickness.

4.9. Water Taxes Setting Situation in Town

Water tax is the main measurements of water simple access. There are three kinds of water taxes duties, which are new pipeline connection tax and water consumption tax. The first tax holding establishment, material and connection works, second operation and maintenance costs while third depends up on the quantity of water used per month addition to prices of new pipeline connection. The main goals of water taxes are economic sustainability and price improvement, well-organized distribution of water resources, construction new sources and water prerequisite for low income communities.

The large price of water can influence community to use little amounts of water and elective sources of low quality which is difficult to health, especially for low income level community. The current cost of the water supply services is 8 Ethiopian birr per cubic meter for private

pipeline users. This is sated by Injibara town WSSO and water board members of the town. The current situation of water taxes of town is shown below Table 4.18 and on Figure 4.16.

Table 4.18: The current situation of tariff setting in study town

Description of tariff	Category	Frequency	Percent	Valid %	Cumulative %
Tariff setting rules	High	522	76.8	76.8	76.8
for current users and	Adequate	149	21.9	21.9	98.7
new connection	Low	9	1.3	1.3	100
pipelines	**Total**	**680**	**100**	**100**	

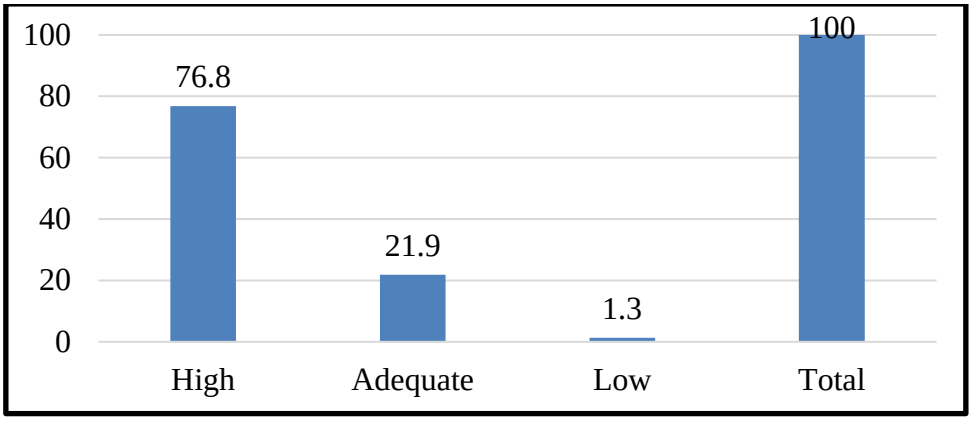


Figure 4.16: Tariff setting structure of water supply in study town

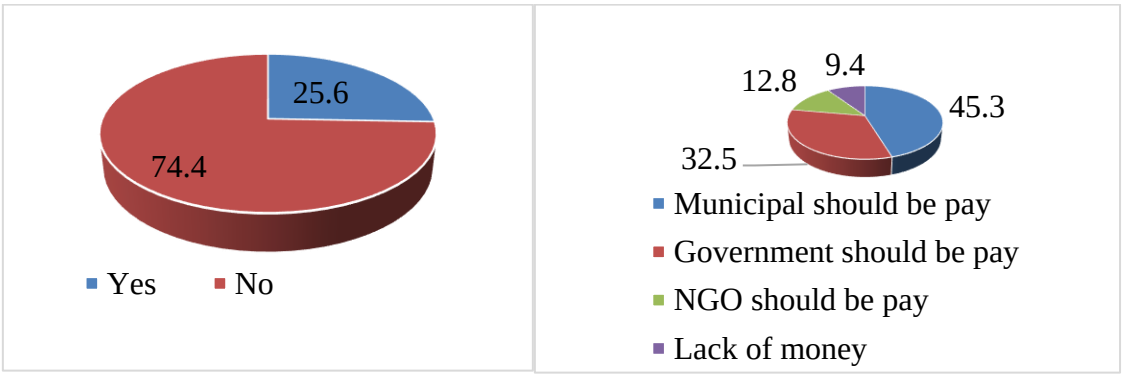
According to Table 4.18, 76.8% of sampled HHs were explained the tax setting rules for current user and new connection installation communities as high prices, 21.9% of sampled HHs were mentioned as adequate prices and 1.3% of sampled HHs were mentioned the current condition of water supply taxes as low cost. The great parts of sampled HHs were explained as the cost of water supply tax is very high for present users and who install a new connection pipeline in study town up to now, it is difficult for poor economy group community in town. Due to this reason more communities cannot use piped water supply because the most people live in this town is low level income, which cannot much with taxes setting rules of the town. But ITWSSO mentioned as the cost of new installation pipeline connection is very high because there are not any types of fund to support this activity inside or onside from town This affects the community uses enough quantity of water, which is various from one household to other households depends on their economy levels.

4.9.1. Willingness to pay any amounts of money for improve water supply in town

Willingness to pay any amounts of money to improving better water supply than existing water supply by both quantity and quality is depends on volunteer of town communities. This types of improving is required all communities, CBO, NGO, and governmental organization participation actively to paying and support money and different idea. Willingness to pay any amounts money and reason of unwillingness to pay is shown below Table 4.19 and Figure 4.17.

Table 4.19: Willingness to pay any amounts of money to improve better water supply

Item	Description	Category	Frequency	%	Valid %	Cumulative %
1	Prices of one jerican (25liters) for private connection	0.25	6	0.9	0.9	0.9
		0.5	507	74.6	74.6	75.4
		0.75	125	18.4	18.4	93.8
		1	28	4.1	4.1	97.9
		1.5	14	2.1	2.1	100
		Total	**680**	**100**	**100**	
2	Willingness to pay money	Yes	174	25.6	25.6	25.6
		No	506	74.4	74.4	100
		Total	**680**	**100**	**100**	
3	Reason for unwillingness to pay	Municipal should pay	308	45.3	45.3	45.3
		Gov'nt should pay	221	32.5	32.5	77.8
		NGO should pay	87	12.8	12.8	90.6
		Lack of money	64	9.4	9.4	100
		Total	**680**	**100**	**100**	



(a) Willingness to pay money (b) Reason for unwillingness to pay

Figure 4.17: Willingness to pay any amounts of money and reason for unwillingness to pay

According to Table 4.19 from item one, 0.9% of sampled HHs were mentioned prices of private connection as 25 cent for 25liter water, 74.6% of sampled HHs were explained as 50 cent, 18.4% of sampled HHs were explained as 75 cent for 25 liters, 4.1% of sampled HHs were mentioned as1.00 Ethiopian birr and 2.1% of sampled HHs were explained the prices of private piped water supply as 1.50 Ethiopian birr. The great parts of sampled HHs were mentioned the price of private piped water supply is 50 cent is enough for 25-liter water because it is much with economy status of the town communities. Through field study the price of water supply varies from region to region, especially around new expand area and there are not alternatives water sources around their and also whole town during interruption of water is occur due to break downs of pipelines of distribution system and unfair distribution areas. Due to these reasons the price of water and pipeline connections are increasing time to time from place to place. This affects the economy of the community by direct or indirect situation.

Regard to Table 4.19 from item two, 25.6% of sampled HHs were explained as yes, motivation to pay any amounts of money for water supply services to develop better water supply system than existing water supply system but 74.4% of sampled HHs were mentioned as no because we cannot pay any amounts of money to develop better water supply than existing water supply services. The great parts of sampled households were explained that they would not motivation to pay any amounts money to improving the existing water supply service of town. Therefore, to improving the better water supply services than existing water supply services first to create awareness from communities of the town regard to aim of willingness to pay money and fix the amounts of money depends on their economy status because the economy is varying from one person to other persons and their working job.

According to Table 4.19 from item three, 45.3% of sampled HHs were explained the reason to unwillingness to pay money as municipal should be pay, 32.5% of sampled HHs were mentioned as government should be pay, 12.8% of sampled HHs were said as NGO should be pay and 9.4% of sampled HHs were explained the reasons of unwillingness to pay money as lack of money willingness to pay any amounts of money for improving water supply services. Majority of sampled HHs were explained the reasons of unwillingness to pay any amounts money to improve the better water supply services rather than existing water supply services as the municipal office of the town must be cover to improve the better water supply for

communities of town. This is occurred due to lack of awareness of people about purposes water for their life and low responsibility of the town WSS office concerned bodies.

4.9.2. Coordination and participation of stakeholders to improve water supply

Coordination and participation of stakeholders are play a great rule to improve existing water supply by better way and to identify and solve easily the shortage of water in town easily and all communities understand the problems of inadequate water in town. But in study area there is no coordination and participation of stakeholders related to shortages of water supply through the year, the causes of less participation of the stakeholders to improving better domestic water supply, this shown below Table 4.20 and Figure 4.18.

Table 4.20: The causes of less participation of households from domestic water supply

Description	Reasons	Frequency	Percent
The causes of less participation of households for drinking water supply services	Absence of encouragements from concerned bodies	364	53.5
	Absences of plan for this service	298	43.8
	No volunteers of households	18	2.6
	Total	**680**	**100**

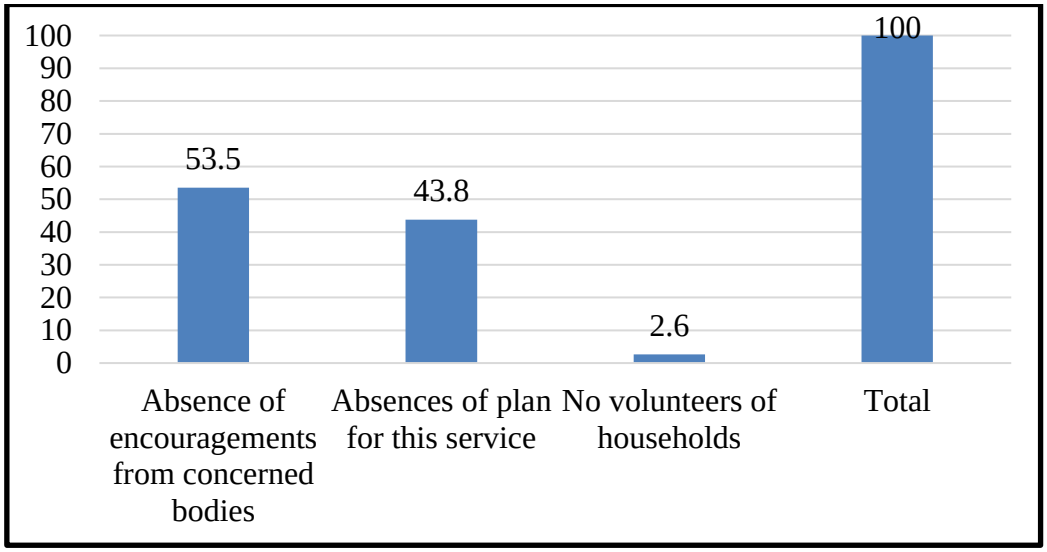


Figure 4.18: Causes of less participation of households from domestic water supply

According to Table 4.20, 53.5% of sampled HHs were explained the reasons of low participation of households for domestic water supply services due to absence of encouragements from concerned bodies in town for improving the current water supply systems, 43.8% of sampled

HHs were mentioned the reasons of less participation of town community as absences of plan for water supply services to participates all households to improve the existing water supply and 2.6% of sampled HHs were described the reasons of less participation of town community as no volunteers of households to participate improving domestic water supply. The majority of sampled HHs was explained as absences of encouragements from concerned bodies and lack of plan to participate the whole households on shortages of water supply services in this town due to improve the better water supply services than existing water services. The concerned bodies must be participating all households and all communities of town depend on the challenges of existing situation of water supply in and around town and plan the program at least two times through a year to meet with town community to solve the problems of water supply in town. Because different people or communities have different idea to solve the scarcity or inadequate quantity and quality of domestic water supply in town and many rich people may be support more money to improve the existing water supply system to get better water supply for their different household activities.

CHAPTER 5
RESULT AND DISCUSSION OF INTERVIEW

This section mostly focusses on data that has been collected by using interview questions. This interview questions were applied to four selected offices in study area. These offices are water supply and sewerage offices, health center, municipal offices and water resources and mine energy offices of Injibar town in Ethiopia**.** The results and discussion this data is depends on improved domestic water supply, the relation of demand and supply of domestic water, access of domestic water supply, challenges and causes of domestic water supply, interaction of water supply and sanitation and water borne diseases in study town.

5.1. Dimension of Interview Questions

DIMENSION I: How many households have access to improve water sources?

In this segment, the answers and clarifications of analysis results of the data gained from interviewers, answers of the above question are show below Table 5.1.

Table 5.1: Access of Improved Water Supply

	Participants Status		
	Ethiopia (Injibara WSS office)		
Themes	**Total number of participants**	**Number of Participants Who Answer Questions**	**%**
5450	4	1	25
5223	4	2	50
5924	4	1	25
Total	**4**	**4**	**100**

First person answer the first question, *"*general there is no access of improved water supply for all numbers of the communities, but some households using improved water supply for some time in a week because the systems of town water supply is intermittent system due to lack of adequate amounts of water quantity and quality in the town, then from total households only 5450 households are used improved water supply (I: A (1))".

Second person answer the same question, *"*in the town totally there is no adequate amounts and safe domestic water supply system for all town households at currents time because there are the main challenges starting from sources of ware up to distribution system on existing water

supply system, some of challenges are rapidly growth of population, reductions of water production at sources, interruption of water, power problems and budge shortages. Therefore, the improved water users less than half of the total households, these are 5223 (I: K (2))".

Third person answer the same question, " from Injibara town there is not adequate water supply system, because most community can fetch daily demand from alternative water sources which are unprotected and unsafe such as river, spring and traditional hand dug well, but some people fetch their domestic water consumption from improved sources once, twice or three time in a week these households are almost 5924 households from total 13601 households of the town which are less than half of total households (I:D(1))".

According to Table 5.1, less than half of total numbers of town households uses improved water sources but not gate always they are gate once or twice a week due these reasons more than half of the total households are not used improved water system because the existing water supply system is not good quantity and quality for all households in study area. Most communities of the town fetching daily water consumption from unsafe alternative water sources such as river, spring, traditional hand dug well and other sources from far distances, this affects their time and energy and also reduction of their productions and developments.

Demand and supply of town is not match with numbers of total households in town that means demand is more than supply of the town water. Because the numbers of town population are rapidly increasing time to time, therefore 50% of interviews said most households fetch water from unsafe or unprotected sources to meet their daily needed of domestic water supply.

DIMENSION 2: What do you think the demand and supply condition of improved water supply to the households? The answers of the above question are show below Table 5.2.

Table 5.2: Existing water demand and supply conditions

Themes	participants status		
	Ethiopia (Injibara WSS office)		
	Total number of participants	**Number of Participants Who Answer Questions**	%
It is very hard	7	5	71.43
It is good	7	1	14.3
Not match with no of HHs	7	1	14.3
Total	**7**	**7**	**100**

First person answers the second question, “demand and supply condition of improved water supply is very hard, because they are not match each other. In town the numbers of population is increasing very fast without redesign of water supply system, due to this reasons high amounts of water demand is required to meet their daily consumption but there is not adequate amounts of water supply in the town starting from before 15 years up to now, therefore demand and supply of improved water supply of households are very hard condition still now because there is no any redesign the systems (I: B(5))”.

Second person answer the same question, “the existing condition of water consumption and supply is good but it is not meet the whole numbers of population in study areas because there are not continuous flows of water supply system (I:M (1))”.

Third person answer the same question, “the town water demand and supply is not matched with numbers of total households of the town starting from more years ago because the numbers of households and population is increasing rapidly time to time without any types of redesign or addition of water supply in the town, this causes shortages of water supply in town every day, due to this reasons most households fetch daily water consumption from unsafe water sources (I:H (1))”.

According to Table 5.2, the existing conditions of water demand and supply is very hard because 71.43% of sampled interviews are explained. Greater numbers of households are fetching daily water consumption from alternative sources of water which is unsafe and from far distances because the existing water supply is not match with numbers of current population of the town. These causes a number of challenges on town community such as loss more time to collect water, energy and also affects their productivities, especially women and children because, they are fetching domestic water supply for different activities from both piped water and alternative water sources from far distance every day in study town. Totally there is not balances of improved water demand and supply with existing numbers of total households and total communities of town, because the numbers of population increasing every time but the water demand and discharges of water is decreased every time by different mechanism, especially in winter seasons.

DIMENSION 3: Is the available water supply access and safe?

Answer of this question is show below Table 5.3, which is answered by interviews of offices

Table 5.3: Available water suppl accessible and safe

Themes	participants status		
	Ethiopia (Injibara WSS office)		
	Total number of participants	**Number of Participants Who Answer Questions**	**%**
No, b/c it is not safe	7	6	85.8
yes, some times	7	1	14.2
Total	**7**	**7**	**100**

First person answers the third question, "totally there is not access of safe drinking water supply in and around the study area because most of time the town community fetching water supply from river and spring which is unprotected sources due to this reason most people are affected by water borne, water related and water washing diseases (I:D (5))".

Second person answer the same question, "the available access of safe drinking water is safe in some portions of town because their elevation of topography is suitable flows of water supply and good for distribution system of pipelines due to this reason the available of water supply access and safeties of water is good in some places of town (I: W (2))".

Regard Table 5.3, access of safe drinking water supply in town is not safe and access easily because 85.8% of interview explained as unsafe domestic water supply in study area, therefore great parts of the community use unsafe domestic water from unprotected sources because the improved water supply is not always available and good quality for all community and also there is not all parts of town installation of distribution systems because the existing distribution system is old but the town master planned increasing time to time due to numbers of town households are increasing rapidly every time without any redesign of water supply components starting from sources up to distribution of consumers depends on numbers of present and future forecast population of studying town. Therefore, the water supply and sewerage offices must be redesigning all components of water supply starting from population forecasting up to distribution system of water supply depends on current numbers of population and by calculating maximum daily demand and peak hourly demand to calculate all components.

DIMENSION 4: What factors facilitate more the problem of water supply in the town? Answers of this question are show below Table 5.4, which is answered by sampled offices.

Table 5.4: The challenges of water supply in study town

Themes	participants status		
	Ethiopia (Injibara WSS office)		
	Total number of participants	Number of Participants Who Answer Questions	%
Rapid growth of population	7	3	42.86
Lack of budge	7	2	28.57
Interruption of water	7	2	28.57
Total	**7**	**7**	**100**

First person answers the fourth question, "there are numbers of factor in Injibara town water supply systems, such as rapid growth rate of population, financial, technician, water production and electric power to pump water from water sources. The major factor is rapid growth rate of town population time to time without any gap every time because the water demand of the town is forecasting depending on before 20 years numbers of population but now a day the numbers of population more than double (I: T ((3))".

Second person answer the same question, "the problems of domestic water supply in study area is lack of adequate budge to improve the better water supply than existing system and for operation and maintenances of existing and new installation of distribution system (I: F ((2))".

Third person answer the same question, "the major factors of domestic water supply in town is interruption of water day to day because most of time there is not daily water consumption through the whole parts the town (I: L ((2))".

According to Table 5.4, more than half of interviews explained the challenges of existing water supply as rapid growth rate of town population without any water redesign and addition of water sources which is matched with numbers of population in town. But there is a number of problems in the town addition to numbers of population such as lack of adequate budge for improve better water rather than existing one and interruption of water day to day due to electric power and technician problems. General the water supply and sewerage offices and municipal offices must be finding the better water sources than existing one and to solve the major

problems staring from existing water sources up to distribution system of consumer and also to communicate with community at least six month or twice a year.

DIMENSION 5: How many percentages of households have access to sanitation?
This question is answered show below Table 5.5 by sampled interviewees of offices.

Table 5.5: Access of sanitation in study area

	participants status		
	Ethiopia (Injibara Health office)		
Themes	**Total number of participants**	**Number of Participants Who Answer Questions**	**%**
20%	5	1	20
10%	5	1	20
15%	5	3	60
Total	**5**	**5**	**100**

First person answers the first question, "in study town generally there is no proper sanitation system as total because most community is disposal solid and liquid waste from open ditch, road and any open area without any treatment before or after disposal but in some area especially governments and private institution have sanitation, which is 20% (I: B (1))".

Second person answer the same question, "generally there is no sanitation system from study area not only this as whole country because there is no planed budge for sanitation in town for long time still now a day but there is some offices and hotels at least 10% of total population of the town (I: Y ((1))".

Third person answer the same question, "most of Ethiopia towns have not sanitation system because there is no fixed budge for sanitation and domestic water supply from governments and community continuously therefore total community of the town disposal the solid and liquid waste from any open surfaces and from their private pin latrine toilets but some rich persons and privet and also some government offices have separate sanitation system which are 15% of total town community but not functions always because there are a numbers of problems such as budge, daily workers and etc (I: G ((3))".

Regard to Table 5.5, there is no sanitation system in study area because there is no budge for town sanitation and adequate domestic water supply of the town due to this reason most of

households' disposal the solid and liquid waste on open surfaces such as road, ditch and anywhere without treatment before or after disposal, but 60% of interviews explain as there is 15% from some areas. These areas are some hotels and governmental offices but there are not households of community used this system, the one problem is there is no adequate amounts of daily domestic water supply in studying town.

DIMENSION 6: Is there integration between water supply and sanitation services with your office and home? The question is answered by sampled offices show below Table 5.6.

Table 5.6: Interaction between water supply and sanitation service

Themes	participants status		
	Ethiopia (Injibara Health office)		
	Total number of participants	Number of Participants Who Answer Questions	%
Yes, some times	5	1	20
No, b/c no water supply	5	4	80
Total	**5**	**5**	**100**

First person answers the second question, "in some area there is integration between water supply and sanitation services but there is no function because there is no water supply day to day, this is difficult for offices because during absences of water to create odor (I: B ((1))".

Second person answer the same question, "there is no integration between water supply and sanitation system because there is not adequate water not only sanitation purpose there is not totally for domestic purposes in study area due to this reason more peoples using water from alternative sources therefore, there is no interaction of water and sanitation in offices and households of town as total may be there is system but not functioned (I:Y ((4))".

According to table 5.6, there is not the interaction between water supply and sanitation services because 80% of sampled interviews explained as there is not interaction between water supply and sanitation services because there is not adequate water supply in study area not only sanitation purpose for all domestic purposes for all town communities. Lack of sanitation system in town causes a number of diseases on community and quality of town through the year.

DIMENSION 7: Are there water borne diseases, what are the common types of water related diseases in 2018? This question is answered by sampled offices under below Table 5.7.

Table 5.7: Types of water borne diseases in study town

Themes	participants status		
	Ethiopia (Injibara Health office)		
	Total number of participants	**Number of Participants Who Answer Questions**	**%**
Amoeba	5	2	40
Guardia	5	2	40
Typhoid	5	1	20
Total	**5**	**5**	**100**

First person answers the third question, "there are numbers of water related and water borne diseases in study area but the major one is Amoeba, because the quality of water is very poor and it is not improved sources, some people is used from unprotected alternative sources from far distance travel every day (I: B (2))".

Second person answer the same question, "there are three common water borne disease from theses, Guardia is the most one in study town for long time up to now (I: Y (2))".

Third person answer the same question, "the most common diseases of water borne in town is Typhoid because this disease happened after all types of water borne diseases (I: G (1))".

According to Table 5.7, there are numbers of water borne diseases in study town such as amoeba, Guardia and typhoid, but the amoeba and Guardia are most common diseases which are caused by unclean domestic water supply in town, because 40% of sampled interviews are explains clearly. Therefore, the town water supply and sewerage offices could be treating and prevent the domestic water starting from sources up to users properly to reduces the water borne diseases and to create awareness from all community of town about domestic water quality and how to treat and use before and after treatments especially drinking purposes.

Generally, in study area there is not adequate and safe domestic water supply at existing conditions because most sampled household during questionnaires and interviews are explained the same causes and challenges of insufficient domestic water supply in the town. Therefore, more people are affected by different problems especially women and children to fetch water or

collect water from far distances from their houses but the water is unsafe for drinking and also affect their health by different means through the year.

5.2. Challenges and Root Causes of Water Supply in Town

There are many problems and root causes of water supply shortage from studying town at past and present condition and may be encourage for future time, because there are no immediate improvements of this causes and challenges of domestic water supply in study area.

5.2.1. Challenges of water supply in town

There are numbers of major challenges in town water supply system. These are as follow: -

Fast growth rate of population: the numbers of population is increasing rapidly by both natural and migration from per-urban to urban and rural to urban area without any gap in study town every year, because the study town is better for finding different job, better for education and health facilities, better for transportation and good air condition to live the people rather than around rural and per-urban areas. This influence on domestic water supply of the town and other infrastructures of the town like housing land for residential purposes and also create unbalance water supply and demand every day on community of town. These cause many problems on town domestic water supply consumptions time to time through a year. Such as:

- Do not balance demand and supply of town water supply system with numbers of population increasing rapidly
- To breakdown/ bursting of water supply components such as distribution network because to increasing the peak hourly demand of the town at the same time
- To create disagreements between community of the town and WSS offices due to inadequate water consumption or demands
- There are not enough amounts of water supply quantity for community of town, therefore the system of water supply is intermittent system

Generally, the numbers of population in town is the basic needed to design any infrastructures of the town. Especially the water supply components starting from sources up to consumer services (such as yields of sources, capacity of main pipe, collection chamber, booster station, treatment plant, pump capacity, demands of water, capacity of reservoir and all size of distribution pipelines) are design depends on numbers of population present in studying town.

To solve these challenges or problems in studying town

1. Redesign or forecasting population numbers of town depends on numbers of present population in town
2. To find additional water sources to meet water demands of town water supply and it must be free from any kinds of disturbances
3. To construct additional services reservoir around north-west parts of town to balance demand and supply of water in town, because more population are expanding around this area time to time every year
4. Installation of additional distribution pipeline system especially new expanded population areas around town

Insufficient water supply: insufficient water supply is limitation of water production from water sources of a spring and two boreholes, which means the actual production of water from sources is not equal to the estimated quantity of water during design period of the town water supply. This causes water shortages or scarcity in both seasons of summer and winter through the year every day and interruption of water frequently every day, especially in the dry season. Because during this season all water bodies reduce their quantity like alternative water sources due to lack of rainfall. In addition to this, there is regular breakdown of the water supply distribution networks and decreases production of water at sources; this leads scarcity of water in study town every day. Therefore, the current sources of water are not corresponding to present domestic water consumption of the town population because ground aquifer is decreased every time by different mechanisms.

Unequal distribution of Water: It is also the other major challenges in the town WSS office. The rate of distribution system and pipeline connection in the town is not meeting the consumption of the communities every day required for their domestic activities in study town, the distribution system is not installing at all parts of the town, which is install only at central parts of the town and some governmental residential areas, governmental institution, private institution and NGO but not all parts of residential areas of the town, especially new expanded area. Most parts of the border areas of the town are currently cannot reach the pipelines. This show the distribution system of the study town is unequal or unfair. Addition to these the distribution system of town has the many challenges on town water supply system at past and current situation. Because the distribution pipeline is not laying properly with topography of

town landscape, due to these reasons the water pressure burst or breakdown the distribution pipelines always through the year. This causes:

- Interruption of water supply system day to day
- Loss high amounts of water quantity
- Reduce the water quality due to different particles or wastewater enter into pipeline during before and after maintenance of pipelines
- Causes water borne and water related diseases on communities of town
- To create unplanned work for WSS offices employers and population to fetch water from alternative sources during this time from far distances
- To increase the work steers on women and children of community because they are care water collection burdens rather than men

In other ways there is not the good quality of distribution pipelines. Due to this reason the existing distribution pipelines cannot use properly through their life span periods, because

- It cannot resist water pressure during peak hourly flow of water demand
- There is not have durability
- It cannot transmit good quantity and quality of water supply
- It causes extra cost time to time for operation and maintenance and to change pipes, values, elbows and different water supply materials.

To solve these problems or challenges

1. The main pipe of distribution system must be changing the direction by some degree to balance the water pressure from each distribution pipeline of the town and protects their duration or life span of working.
2. To change good quality of pipelines with fixed diameter for old kebeles and balanced diameter for new expanded kebeles match with their daily water consumption depends on their numbers of population and considering next increasing population of the town for determine capacity of main pipe to sub-main pipe, sub-main to branched pipelines and branched pipeline to customer user pipelines.

Changing pipeline are reduces interruption of water supply day to day, increasing water quantity and quality, reduce extra cost for operation and maintenance and to buy new pipes, valves and elbow and also reduce work steers from WSS office employers and community especially from women and children, reduce conflict between community and WSS office. Totally, it is good

for developments of community economy, town level and prevents water borne, water related and water washing diseases from communities.

Lack of enough numbers of gate valves: there is not enough number of gate valves in distribution networks of town water supply system. Due to this reason causes a number of problems on town water supply system such as: to loss high amounts of water during burst or breakdown of distribution networks and cause water interruption during connect one pipe with other pipelines and control high water power.

To solve this problems or challenges: to fix a number of valves starting from sources to main pipe, main pipe to sub-main pipe, sub-main pipe to branched pipe and branched pipe to consumer user pipes and also at middle depending on their lengths of pipelines. This can be reduced water loss during burst or breakdown of pipeline of distribution network.

Lack of power to pump: in town there are not enough amounts of power to pump water from spring and boreholes to services reservoir. This is one major challenge to causes water interruption in town.

To solve this problem to set generator at each borehole and spring or from collection chamber to pump water during absents of electric power. Other better solution is using solar energy instead of generator because the solar energy is reducing the cost of electric power and buying generators and generator oil every day, then the solar energy is the best pumping power for study town water supply because it is developing town with low income.

Loss of water by leakage: The issue of water Loss is consequence of leakage of water supply in town, this cause expansion gap between water consumption and water supply in the study town. Furthermore, under limit rate of production which a drop down the real manufacture of water supply, water failure has additional decrease the quantity of water supply that achieve the consumers of the town. From field study, in town water supply framework still there are old pipelines working to distributing water that lay during the presentation of piped water supply in the town for the first time, during1985. Even if the majority of the older pipelines are removed at various times however still there are a lot of pipes that causes challenges on distribution system of water supply. This loss of water by leakage is not only distribution but from more public water points and some public institution there are many losses of water consumption due to without closings of gate valves after they use water.

Limits to water demands: there are different physical and financial variables restricts water demands by population in study town. These factors are: size of town, climate condition, insufficient demand and less quality of water, distance of water sources from home, unequal distribution, economic status of customers, numbers of commercial and institutional areas, types of water supply system, cost of water taxes and interruption of water are major challenges in town past and current situations to limits water demand. Among these elements the water interruption is more significant issue or challenges. Water supply interruption causes multidimensional issues on town households. Generally, the limit of water demand is the major challenges on community by different means, these challenges on their economy level and productivities. Because this affects their time and energy due to collect water from alternative sources walking far distances every day and their developments.

Unreasonable tax and connection charges for the poor community: The water tax set by the Injibara WSS office and the Board of town water supply for personal pipeline connection and its connection cost is unreasonable to the poor sections of the community. This is a direct result of the way that the individuals who used more volume of water pay small cost due to the value set in this way addition to high connection prices. The cost for the establishment of new pipeline connection and water uses is not reasonable for poor family units in study town. The minimum cost of the new pipeline connection is 2000 Ethiopian Birr which is extremely costly for poor community. Due to this reason more population have not private pipeline connection system inside the town because their economy status is not much with fixed tariff.

Absences of sewerage system: in study town there is not sewerage system, therefore the wastewater is following on surfaces cross on above the water supply pipeline of town distribution network without any types of treatment. Due to these reasons the sewages of town cause main challenges on water supply of town, when the pipelines of distribution network are burst or breakdown, which means wastewater enter into water supply pipeline by different mechanisms. This causes water borne diseases on community of town and reduces their life.

To solve these problems: to design and install the sewerage system of the town, to collect and treat wastewater and municipal solid waste which generates from town community, to reuse and disposal at planned areas. To create awareness from town community due to harmful of the sewage disposal at everywhere and to protect all communities of the town liquid and solid waste generation from sources before and after disposal.

5.2.2. Root causes of water supply in town

The domestic water supply services must be adequate in quantity and quality and also safe due to efficient, reasonable and available in terms of distance, time and price for all population of town before and after connect private pipelines, this required good quantity and quality of water sources, adequate materials before and after construct of water supply, funds and skilled manpower resources, progressed and state art innovation and institutional limits. As a result of the deficiency of these elements, the water supply management of town is not sustainable mean it is ineffective, unfair and unreachable important quantity of the public water supply consumption. Therefore, there are a number of factors in study town which affects water supply consumption in town, these are:

Administration issues: administration issues caused by ineffective association structure, less numbers of workers in offices, low income for worker regard to their professional and absence of workers encouragement and failure of water supply and sewerage office to keep skilled and experience workers is the major requirement to services the community of town properly.

Absence of institutional coordination: Major associates in Injibara town water supply exercises have no planned linkages among the Regional water resources, mine and energy development office, town water board members, CBO, community, governmental and non-governmental office for specialized help and implementing developments of water works and also various experts are not joined in Board but individuals misuse their specialized learning.

Inadequate financial plan and funds: Delivery of urban water supply requires a hug rank of investment. Absence of adequate funding has constrained the amount of water supply systems of WSS office. Even though, the present price of study town WSS office is not cover the costs of instruments and recovery costs to supplied good quantity and quality of water consumption satisfies the current required demands of the town community, because there are no any funds to support this office to solve the challenges from different parts of water supply components of town water supply systems.

Absence of capability: deficiency of skillful labor is the basic issue looked by the WSS office. This limitation the good managements of different workers and materials of water supply and also to distribute water properly and planned for all community of town.

Low population group cooperation in basic leadership: community and community-based organization, privet institution, governmental and NGOs have vital tasks to carry out in the implementation of water supply and sewerages activities and in achievement of water supply plans. But there are no these types group association in Injibara town to identify and solve the major causes and challenges of water supply services in town with WSS office except selected Board members of town. The WSS office is the main ordered government body to supply water for study town dwellers to fulfill their need. Consequently, it is complex for WSS office to distribute sufficient water demand for all town community individual without participation all town community and other governmental support fund and other required materials. Therefore, all community and organization must be participating to solve the problems of domestic water supply consumption starting from sources up to distribution systems of the town for current and future time to reaches good quantity and quality of water for all

CHAPTER 6
CONCLUSION AND RECOMMENDATION

6.1. Conclusion

Water is one of the most important for all living things on land, which is used for all human beings, animals and plants next to air, without water life is impossible on the land. Adequate and safe of domestic water is the fundamental requirement for all human beings or community of the town. But in Injibara town there is not sufficient quantity and quality of potable water supply at existing situation for all communities of the town every day through the year.

The majority of the town communities cannot get adequate quantity and quality of water consumption for their different domestic activities, this condition is hard for all population of the town because the numbers of the town population is increasing rapidly every year without any gap by both natural and migration.

The existing source of water supply in town is one spring and two boreholes. This water is reached to the town community through pipelines by different mode of services. But it is not meet the total consumption of the town customers every day in both summer and winter seasons, especially in dry season.

The quantity of water source is depending on discharges of groundwater, but discharges of groundwater is varying from one season to other seasons because amounts of rainfall is different from season to season, due to this reason the water demand is vary season to seasons.

The actual production of spring and boreholes discharge is very less than expected production at current time, which is only 36%. And also, there are many challenges to reduce the production of water supply in town, like loss of water by leakage, working hours of both sources and capacity the town WSS offices and total numbers of communities present in town.

The current production of water supply in town is not much with the current numbers of population in town, the numbers of population is increase rapidly at current time but the quantity of water production is reduced time to time at sources.

In study town the access of domestic water supply is not adequate in both quantity and quality of water for town community through the year. The town population cannot get easily their daily required consumption for their various domestic activities every day.

Distribution system of water supply in town is the main challenge at current situation; it is insufficient for all parts of the town and installs only some parts of the town especially in central parts and some governmental residential areas. Total coverages of town water distribution system are only 40% of town community water consumptions.

The distribution pipeline networks are always breakdown by water pressure at various portion of town, this cause frequent interruption of water and reduce water quantity of the community daily consumption. These problems are happened due to lack of quality of pipeline, limit capacity of services reservoir, landscape of the town and lack of proper laying of pipelines in town. Other problem of access of water supply in town is economy status of community, this affect individual daily consumption because tariff of new pipeline connection and prices of operation and maintenance is very high in study town. Due to this reason most community cannot use the piped water supply, from 13601 total households only 5223 using the piped water supply in town but these households cannot get every day the piped water, which is 38.4% only.

Therefore, majority of the town population use water from alternative sources and buying from water venders and private shops by high prices from far distance every day to meets their daily domestic consumption for various household activities, which is an unsafe source. From total households of town 53.6% are fetch daily water consumption from unsafe alternative sources, which is only 46.4% are using piped water but not always.

Especially the low economy level community and the new expanded parts of the town fetch daily water consumption from elective sources through the year. This causes many challenges on town community direct or indirect ways. Direct challenges are causing a number of waters borne diseases which are Amoeba, Guardia, Typhoid and Malaria through the year and indirect affects their time, energy, money and their productivities due to collecting daily water supply from alternative sources. Especially affect the women and children because 95% of daily water consumption is looking and collecting by them.

The water tariff setting is unfair for all communities of town before and after connect pipelines. It is high prices, especially for low income levels communities. This is one major factor to limit the daily water consumption of community in past and present time, because the majority of community cannot cover this high cost.

Willingness to pay any amounts of money to improve the better water supply than existing water supply for future time is very less, which is 25.6% only. Because the economy status of most

community is low level and lack of awareness to pay money and aims of water supply for their life and developments of their economy direct or indirect and town as well as country.

The coordination and participation of the town community, CBO, government organization, NGO and private institution with town WSS office is very low to identify the problem of existing water supply and solve easily and to improve the better adequate and safe water supply for future time for all communities of town.

Therefore, the existing water supply has multidimensional challenges and root causes of inadequate or insufficient quantity and quality water every day at past and present time through the year. These problems are lack of adequate sources, demand or consumption, unfair distribution system of network, lack of capacity of money and fund, unfair taxes, rapid growth rate of population, loss of water by leakage, lack of power to pump, lack of coordination and participation and lack of awareness of population about the aim of water supply for their life and developments of each community and the town by different means using water by direct or indirect and also developments of as whole country. This affects the total communities of the town and town by direct or indirect as well as country. Totally this study concludes as the existing domestic water supply is inadequate for all town communities at current time.

6.2. Recommendation

Population forecasting: the ITWSS office first forecast the numbers of population by using different methods of population forecasting methods, at least using four common methods in Ethiopia such as Arithmetic increasing, Incremental increasing, Geometric increasing and Exponential growth methods depends on present numbers of population and forecast the future numbers of population using from these methods best one by checking the percentage error and taking the smallest values considering only magnitude.

Sources of water: the ITWSS office and the town municipality are finding the better sources of water to meet the current and future demands of the town community by studying detail both surface and groundwater with their quantity and quality for present and future.

Equal distribution system: the distribution system of pipeline networks is installing all parts of town equal with good quality of pipelines to transmit adequate quantity and quality of water consumption for community without any interruption of water every day.

Water pressure breakdown: to provide water pressure breakdown to prevent or reduce water pressure from distribution pipelines bursting and reduces water interruption in case of distribution system.

Services reservoir: to construct additional services reservoir around especially north-west parts of town to balance demand and supply of town water supply and equally sharing of water for all parts of town and used to easily manage the distribution systems problems and reduces the water pressure for distribution network especially main and sub-main pipelines.

The main pipeline of existing water: the direction of the main pipeline of existing water supply is change at least bend by 60 degree starting from services reservoir up to sub-main pipelines to reduce water pressure from all distribution pipeline like sub-main pipelines, which is better.

Public tap: the numbers of public taps are increasing in all parts of town because the low-income level communities can be getting daily water supply easily; especially set more numbers at new expanded areas in three direction of town which is north, south and west parts of town is better.

Fair taxes of water: taxes of water supply are fair for all communities of town for connecting new pipeline and operation and maintenance cost depends on their economy status that means the set of cost is considering low income level of town communities.

Willingness to pay money to improve better water supply: all communities of town is pay money depends on their economy status to improving better water supply than existing water supply by both adequate quantity and quality, without money there is not sufficient quantity and quality water at present and future time in town.

Coordination and participation: all town community, CBO, governmental organization, NGO and private institution are coordinate and participate to identify the problems of existing water supply and solve easily these problems and also improve the better water supply to meet consumption of all communities of town at present and for future periods.

Reuse of wastewater: all communities of town is reuse wastewater for different purposes which generates from their houses and also the town municipality is recycling the wastewater collecting from different areas of generation depends on their quantity and quality.

Provide appropriate technology: appropriate technology is used to fulfill good quantity and quality of different distribution pipeline and fitting. However, appropriate technology is used

solar energy instead of electric power and oil or diesel generate every day and also to reduce water interruption rate from town community.

To increase the capacity of WSSO: the capacity of WSS office is increase to fulfill the quality material for distribution network for new connection pipelines and maintenance existing system and fulfill qualified workers to do work properly and distribute adequate quantity and quality water for all community.

Alternative sources: all communities, CBO, NGO and government institutions are protect the alternative water sources exist around town because these sources are used to fulfill the daily consumption for most community at present time and may be for future period when the piped water is interrupted by various means, this is used to prevent various water borne diseases from town communities, especially the low level income community and reduce the risk from women and children during to fetch water from it.

Create awareness: the water supply and sewerage office are creating awareness from all town communities, CBO, governmental institution, NGO and private institution about the aims of domestic water supply for individual and as total community of town for protecting their health and developing by using water direct or indirect.

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APPENDICES

Appendix 1

Questionnaires

Dear respondents, this questionnaire is prepared as an instrument to conduct an academic research for the fulfillment of Masters of Degree (MSc) in Near East International University School of Applied Science and Faculty of Civil and environmental Engineering, Specialize Hydraulic engineering. General aims of this studying are to assess the major challenges and causes of inadequate quantity and quality of domestic water supply in studying town, which is Injibara town in Awi Zone, Amhara Regional State, Ethiopia.

Hence, the questionnaire attempts to assess the provision and challenge that constrain effective performance. Therefore, your honest response would be vital for the effectiveness of the study. All information you provide for this academic issue would be treated confidentially. So, you are kindly requested to fill the questionnaire according to the instruction given for each item.

Please note that:

- There is no need to write your name.
- Each question has its own intervention to follow
- Return the questionnaire to the research assistant, as soon as you complete filling it.

Thank you!

Questionnaires

Part A. Respondent Background information

Note- you are required to choose the best one:

1. Gender a) Male b) Female
2. Age a) 20 -30year b) 31-40year c) 41-50year d) 51year and above
3. Marital status of household head:

   a) Single b) Married c) Divorced d) Widowed
4. Education level of household head:

   a) Grade zero or Illiterate and Write and read b) Grade 1- 4 c) Grade 5-8

   d) Grade 9-10 e) Grade 11-12 and above
5. Household type: a) Male headed household b) Female headed household
6. Family size in number or numbers of population in house:

   a) 1-3 b) 4-6 c) 7-9 d) 10-12 e) 13-15 and above
7. How long have you lived in Injibara in year?

   a) 1-5 b) 6-10 c) 11-15 d) 16-20 e) Greater than 20
8. Your job: a) Merchant b) Employer c) daily laborer d) Farming e) others
9. How much your monthly income?

   a) Less than 800ETB b) 801-1600ETB c) 1601-2200ETB d) 2201-3000ETB

   e) 3001-3800ETB f) ABOVE 3801ETB

Part B: Existing water supply, water **demand**, **adequacy and accessibility, Main challenges and coordination and participation** level of other stakeholders in water supply.

1. What is the main sources of water in Injibara Town?

   a) Piped water b) Hand dug well c) Spring d) River
2. Do you get daily taped water access for your domestic consumption? a) Yes b) No
3. If your answer for question number 2 or for previous question is no, how often do you get?

a) Once in 2-3 days b) Once in 4-5 days c) Once in 6-7 days d. Daily

4. How much water do you need on average per day in liters?

   a) 20-50 liters b) 51-80 liters c) Above 81 liters
5. Is supply of water proportional with your daily demand? a) Yes b) No
6. If your answer is no for previous question (Q5), what is the reasons for proportional?

   a. Unequal distribution b. Not scheduling c. Interruption d. cost e. Missing value
7. If your answer is No for question 5, how can you satisfy your demand?

a) By using river water b) By using spring water

c) By using from water venders d) Traditional hand dug well e) Other

8. Are you happy at the existing water supply of the town? a) Yes b) No

9. You say yes or no for previous question, which types of connection do you have?

a). Private connection b). Public connection c). Without connection

10. Can you say that there are problems with water supply and delivery services to the Injibara town? a) Yes, there is a problem b) No, there is no problem

11. If your answer is yes for question seven, what are the problems?

a) Technical b) Financial c) Facilitation d) Other

12. If you don't have private connection so, what do you think the reason?

a) Distance from pipeline b) Unable cover the cost

c) Inefficiency of municipality d) House related factor

13. How do you perceive the current provision of piped water is an issue worth discussion?

a) Extremely serious b) Serious c) Very serious d) Not serious

14. For what purpose(s) do you face serious water shortage?

a) Drinking b) Cleaning/ hygiene c) Both d) other

15. If you are not satisfied at the current water provision of the town, why are you dissatisfied?

a) pipeline connection problem b). water interruption problem c) distance & location of main pipe d) distribution system issue e). poor quality and quantity

16. What are the causes of water shortages in your town?

a) Poor and inefficient distribution b) Financial issue c) Rapid growth rate of people

d) Frequent burst of pipelines e) Fluctuation of water power

17. What are the main causes of water supply interruption?

a). Production issue b). Technical issue c). Power problem

18. The water supply service interruption lasted for

a) 2 to 3 days b) 4 to 5 days c) 6 to 7 days d) More than a week

19. Why Injibara town water supply and sewerage services have inefficient power to overcome the water supply problems? a) Newly recognized as office b). Low attention of concerned bodies c) Low participation level of NGOs and CBOs d) Inefficiency of WSSO

20. At what season the water is highly interrupted? a) Summer b) Winter (Dry season)

21. How reliable is the water supply from your sources during dry seasons?

a) There is not at all b) There is slightly c) Quite reliable d) Very reliable

22. Who is responsible for collecting and allocating use of water in your household?

a) Husband b) Wife c) Children

23. How far is the water source from your household? Please specify in kilometers (km)

a) 2-3km b) 1-2km d) Less than 1km

24. How much time do you take to get the water?

a) more than 1hou b). 40-1hou c) 20-40min c. 20min

25. Have you and your family members ever suffering any water related diseases?

a) Yes b) No

26. If your answers for question no 15 is yes, what is types of diseases?

a) Amoeba b) Malaria c) Typhoid d) Guardia

27. Does the present water tariff generate supply to the urban water supply fair for the expansion of water supply services to the low-income group's residential areas?

a) High b) Adequate c) Low

28. If you buy water outside your house, how much do you pay (on the average) for one Jeri can (25 liters) of water? a) 0.25 b) 0.50 c) 0.75 d. 1.00 e) 1.50

29. Are you willing to pay any amount of money to improve the current water supply?

a) Yes b) No

30. If your answer is no for question eight, your reason may be:

a) The municipality should pay b) The government should pay

c) NGOs should pay d) Lack of money

31. What makes the stakeholders' participation and coordination limited in the areas?

a) Absence of encourage from concerning bodies b) Absences of plan for this service

c) No volunteers of households

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Appendix 2

Interview Questionnaires to the Key Informants

A**. Interview guided questions for Injebara town <u>water supply and sewerage service</u>**

1. How many households have access to improve water sources?----------
2. What do you think the demand and supply condition of improved water supply to the households?----------
3. Is the available water supply accessible and safe?----------
4. Is there additional suggestion to improve the problem of water supply in the town?.....
5. What factors facilitate more the problem of water supply in the town? ----------

B. **Interview guided questionnaires for <u>health office</u>**

1. How many percentages of households have access to sanitation----------
2. How many percentages of households do not have access to sanitation facility?---------
3. Is there integration between water supply and sanitation services with your office?-----
4. Are there cases of illness in relation to water quality related problems, what are?.....

C. **Interview guided questionnaires for <u>Municipality office</u>**

1. What do you think about water supply condition of the Injebara town? Justify it.-----
2. Is there demand and supply of water for the household utility matched in the town?---
3. If you are working with them what challenges do you face?----------
4. If you face challenges, what possible solutions you recommend?----------

D**. Interview guided questionnaires for <u>water, mines and energy office</u>**

1. What are your constrains in the process of implementation of sustainable water supply in the town?----------
2. Do you have any provision (technical, financial and material) from your office to WSSS in order to sustain water supply of the town?----------
3. How do you describe the area in terms of water availability and supply?----------