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FACTORS DETERMINING ACCESS TO WATER SERVICES AMONG LOW INCOME RESIDENTS AND MEASURES TO IMPROVE ACCESS: A CASE STUDY OF KAPTEMBWO LOCATION, NAKURU COUNTY, KENYA

A Thesis Submitted to the Graduate School in Partial Fulfilment of the Requirements of the Award of Degree of Master of Arts in Geography of Egerton University.

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DEDICATION

This research report is dedicated to my beloved wife Prisca Mokaya and my dear sons Shedrack Mokaya and Joshua Bogonko.

ACKNOWLEDGEMENT

I wish to thank the Almighty God for His unfailing grace and strength granted to me to undertake this study.I am grateful to Egerton university for giving me the opportunity to persue my Masters Degree. My heartfelt gratitude go to my supervisors, Prof. Francis N. Wegulo and Dr. Joseph Otieno for their sterling guidance and friendly support during the entire study and more particularly in the course of writing of this thesis. Their encouragement and thoughtful comments contributed greatly to successful completion of this thesis. I also wish to acknowledge members of academic staff of the Department of Geography for their academic support during my study.

Special thanks go to my family especially my wife and children for their material and moral support. I am grateful to the residents of Kaptembwo and the staff of NAWASSCO for their willingness and co-operation during data collection. I also extend my appreciation to the National Commission for Science, Technology and Innovation for allowing me to officially undertake the research work. Most notably, I owe the greatest debt to my brother in-law Pastor Jackson Wambua and his wife ZipporahMuthama for their moral support and prayers.

May God Almighty God bless all those other people who in one way or another contributed to the completion of this work.

ABSTRACT

Access to clean, safe water is a human need and basic right. Yet, roughly half of urban dwellers in sub-Saharan Africa lack access to clean, safe and affordable water. Many factors account for this; poverty, low investment in water network as well as lack of incentives. Many urban centres face the challenge of supply adequate water to low income or informal settlement residential areas. Current water demand in Nakuru stands at 100,000 m^3/day, against a supply of 40, 000 m^3/day. This translates into a serious water deficit experienced especially by residents in some areas in the town. This study set out to explore this problem and to situate dynamics of water access in Kaptembwo location and establish measures undertaken by the water service providers in improving the provision of water.Specifically, the study objectives were:(i) to assess factors determining access to water services among low income residents of Kaptembwo location, (ii) to obtain primary data on the access to water services and (iii) to establish measures undertaken by water service providers in improving the provision of water in Kaptembwo location. The study was based ona descriptive survey design which involved a sample of 280 households from the low income residents of Kaptembwo. Data collection was done through administration of structured questionnaire, use of schedule and observation and interviews with key informants. Data collected was analyzed using Statistical Package for Social Sciences (SPSS) Version 20. From the analysis, it was established that distance to water points, water infrustracture and residents'income were key factors affecting access to water. In addition, the basic water requirementsof the study area have not been met as shown by the per capita water consumption per day of 20.86litres. This figure is by far below the minimum threshold of 50 litres/capita per day recommended by the World Bank. To try and cope with the shortfall, NAWASSCO has applied measures such as rationing water in Kaptembwo location, sinking of more boreholes and establishment of water kiosks. The study thus makes following recommendations: include; NAWASSCO should improve its piping facilities to make water services more accessible to the residents of Kaptembwo locationas well as supply water in Kaptembwo location for longer periods. There is need also for NAWASSCO to establish more water kiosks in low income areas to increase water access.WRAM and WASREB should explore means of private sector participation in improving water distribution network in the low income areas.

TABLE OF CONTENTS

DECLARATION AND APPROVAL ii
COPYRIGHT iii
DEDICATION iv
ACKNOWLEDGEMENT v
ABSTRACT vi
TABLE OF CONTENTS vii
LIST OF TABLES x
LIST OF FIGURES xi
LIST OF PLATES xii
ACRONYMS AND ABBREVIATIONS xiii
CHAPTER ONE 1
INTRODUCTION 1
1.1 Background to the problem 1
1.2 Statement of the Problem 4
1.3 Broad Objective 4
1.4 Specific Objectives 4
1.5 Research Questions 5
1.6 Justification of the Study 5
1.7 Scope and Limitation 6
1.8 Definition of terms 7
CHAPTER TWO 9
LITERATURE REVIEW 9
2.0 Introduction 9
2.1 Urbanization in sub-saharan Africa 9
2.2Water Supply in Urban Areas in sub-Saharan Africa 11
2.3 Determinants of Access to water in Urban Centres in sub-Saharan Africa 13
2.4 Policy Context for water provision in Kenya 15
2.5 Expected Outcomes of Water Sector Reforms in Kenya 16
2.6 Water Service Providers in Nakuru town 17
2.7 Perception of local residents to access to water 18
2.8 Gaps in the Literature 22
2.9Conceptual Framework 22

CHAPTER THREE 25
RESEARCH METHODOLOGY 25
3.1 Study Area 25
3.1.1 Population 26
3.1.2 Climate 26
3.1.3 Hydrology 26
3.1.4 Social Economic Activities 27
3.2 Research Design 27
3.3 Sampling frame and Sample size 28
3.4 Research Instruments 28
3.4.1 Validity 29
3.4.2Reliability 29
3.5 Ethical Considerations 29
3.6 Data collection 29
3.7 Data Analysis 30
CHAPTER FOUR 31
RESULTS AND DISCUSSION 31
4.0 Introduction 31
4.1 Descriptive analysis of the Socio-economic characteristics of low income residents in Kaptembwo location 31
4.1.1 Respondents' Gender in Kaptembwo location 33
4.1.2 Education level and Occupation of the study population 33
4.2 Perceived Factors influencing the access to water among residents in Kaptembwo location 35
4.2.1 Water Distribution infrastructure 36
4.2.2 Distance to the nearest primary water source 37
4.2.3 Residents' Income 39
4.2.4 Problems faced by Kaptembwo Residents in accessing water 40
4.3 Households' Access to Water in Kaptembwo location 42
4.3.1 The Influence of household size on water consumption per capita per day in Kaptembwo location 43
4.3.2 Water supply and demand situation in Kaptembwo Location 45
4.3.3 Improvement of water supply by NAWASSCO 47

4.3.4 Current water supply situation in Kaptembwo location as compared to a period of five years back 48
4.3.5 Meeting Residents' Water Needs 49
4.4 Measures taken by Water Service Providers toimprove access to water in Kaptembwo location....52
4.4.1 Water Rationing 52
4.4.2 Construction of boreholes 53
4.4.3 Supply of water from Vendors (Water Kiosks)....54
4.4.4 Water Provision by other Service Providers 55
CHAPTER FIVE 58
SUMMARY, CONCLUSIONS AND RECOMMENDATIONS....58
5.1 Summary of the key findings....58
5.2 Conclusion 59
REFERENCES 61
APPENDIX I: QUESTIONNAIRE FOR HOUSEHOLDS....70
APPENDIX II:QUESTIONNAIRE FOR NAWASSCO 75
APPENDIX III: KEY INFORMANT INTERVIEW SCHEDULE 78
APPENDIX IV: RESEARCH PERMIT....80
APPENDIX II: RESEARCH AUTHORIZATION 81

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LIST OF TABLES

Table 1: People not accessing safe water and coverage % in Nakuru town's low income areas. 3

Table 2: Urban access to water supply, by technology in sub-Saharan Africa. 10

Table 3: Summary of Data Analysis 30

Table 4: Summary of Descriptive statistics to show the expected mean standard errorand the standard deviation 31

Table 5: Respondent's Age....32

Table 6: Respondents Gender 33

Table 7: Respondents' Education Acheivement (Level)....34

Table 8: Respondents' Occupation....35

Table 9: Perceived Factors influencing access to water in Kaptembwo 35

Table 10: Water Sources in Kaptembwolocation 38

Table 11: Duration of Water Supply per day in Kaptembwo location....39

Table 12: Correlation between Household income and water demand per day 39

Table 13: Income levels of KaptembwoResidents 40

Table 14: Problems in accessing safe water supply among residents of Kaptembwo....41

Table 15: Main Source of Drinking Water for Kaptembwo residents 42

Table 16: Household water consumption per capita per day in Kaptembwo location....45

Table 17: Chi-Square Test 46

Table 18: Increase in Water Supply by NAWASSCO?....48

Table 19: Water rationing schedules to Kaptembwo location....53

Table 20: Boreholes and the amount of water production in Nakuru town....54

Table 21: Cost of water in Kaptembwo by Service Providers....54

LIST OF FIGURES

Figure 1: Source; Progress on Sanitation and Drinking Water (2010 USAID Joint Monitoring Programme). 12

Figure 2: Instutional set-up under Water Act 2002 16

Figure 3: Framing the Development Problem of Urban Water Services. 21

Figure4: Conceptual Framework 24

Figure 5: Location of the Study Area. 25

Figure 6: Respondents' Age 32

Figure 7: Respondents' Gender 33

Figure 8: Factors influencing access to water in Kaptembwo 36

Figure9: Access to Water Supply by NAWASSCO since Late 1990s to Late 2000s 47

Figure 10: The water supply chain in Nakuru Town 47

Figure 11: Current water supply compared to five years back in Kaptembwo location 49

Figure12: Increase in supply by NAWASSCO and meeting water needs 50

Figure 13: Distribution of Boreholes and Water Pumps in Nakuru Town 52

LIST OF PLATES

Plate1: Overview of water supply services in Nakuru Low IncomeAreas. 41

Plate 2: Residents of Kaptembwo location drawing water from a private kiosk.....55

Plate 3: A water vendor draws water from a private water kiosk in Kaptembwo location.....56

Plate 4: A vendor with a bicycle – load of water containers from a private water kiosk in Kaptembwo location.....56

ACRONYMS AND ABBREVIATIONS

AFDB	:	Africa Development Bank
AMCOW	:	African Ministers' Council on Water
CBO	:	Community Based Organization
GoK	:	Government of Kenya
JMP	:	Joint Monitoring Programme
KBNS	:	Kenya National Bureau of Statistics
LIA	:	Low Income Areas
MWI	:	Ministry of Water and Irrigation
NDDD	:	Nakuru District Development Plan
NAWASSCO	:	Nakuru Water and Sanitation Services Company
NEMA	:	National Environmental Management Authority
OECD	:	Organization for Economic Co-operation and Development
RVWSB	:	Rift Valley Water Services Board
SDGs	:	Sustainable Development Goals
SPA	:	Service Provision Agreements
SPSS	:	Statistical Package for the Social Sciences
SSP	:	Small Service Providers
UNDP	:	United Nations Development Programme
UNEP	:	United Nations Environmental Programme
UNICEF	:	United Nations International Children's Education Fund
UN	:	United Nations
USAID	:	United States Agency for International Development
WARMA	:	Water Resource Management Authority.
WASREB	:	Water Service Regulatory Board.
WB	:	World Bank
WHO	:	World Health Organization
WRG	:	Water Resources Group
WSB	:	Water Services Boards
WSP	:	Water Services Providers
WST	:	Water Services Trust
WRUA	:	Water Resources User Association

CHAPTER ONE

INTRODUCTION

1.1 Background to the problem

An adequate and dependable supply of fresh water is essential for health, food production and socio-economic development (BanerJee& Morella, 2011). Though more than two thirds of the planet is covered with water, less than 0.01% is readily accessible for direct human use (AMCOW 2008). According to UN-HABITAT (2008) many countries facing water scarcity are low income countries that havea rapidly growing population and are generally unable to make costly investments in water saving technologies. Estimates indicate that over 1 billion people lack access to safe drinking water, and two and half billion lack adequate sanitation and a fact that contributes to deaths of more than 5 million people of whom more than half are children (UNICEF 2006).

For a long time, water has been the talk in both local and international meetings, conferences, seminars and other public functions(AMCOW, 2010). In so doing, some countries have taken a step towards addressing the issue of water access among urban residents (UNDP, 2006). What most water practitioners are reluctant to tell us is that, though water may be available in enough quantities, its supply management may render it scarce. Shifting our attention to urban areas, there is an imbalance in water supply among the different income categories of people (Ibid). A notable difference exists between the high and low income groups of people residing in urban areas across the globe (Bullard, 2007).

Being one of the targets in Sustainable Development Goals (SDGs), the world has to ensure availability and sustainable management of water and sanitation for all by 2030 (UN,2015). UN-HABITAT (2008) indicates that the target of halving the proportion of people without sustainable access to safe drinking water was also met by 2010, with the proportion of people using an improved water source rising from 76% in 1990 to 89% in 2010. Between 1990 and 2010, over two billion people gained access to improved drinking water sources, such as piped supplies and protected wells(Ibid). Though this is a better change to humanity it is however rather generalized overview which does not narrow its scope to small scale levels like a town. Globally, income disparities, infrastructural development, resource availability

among other factors play a great role in determining the access to water by the urban population (USAID 2012).

The populations with access to improved water supply increased from 76% in 1990 to more than 89% in 2010globally accounting for 90% or more of the populations of Latin America, Northern Africa, and large parts of Asia as well as 61% of the population of sub-Saharan Africa (WHO 2005). Despite the progress achieved, improved domestic water supply systems are expected to continue being affected by water shortage a problem that will worsen because of the population increase, economic growth, improved living conditions and life style changes in urban areas. According to World Bank (2009) 783 million people, or 11% of the global population, remain without access to an improved source of drinking water. Such sources include; public stand pipes, boreholes, protected dug wells, protected spring and rain water collection. Many of the world cities are growing exponentially and unchecked development is spawning slum neighborhoods that lack water infrastructure (UNDP 2010).

In sub-Saharan Africa, there is a huge gap in the delivery of water services within urban areas, contributing to other in equalities in health and income (Brineno-Garmendia, 2004). UN (2010) asserts that low income residential areas in sub-Saharan Africa urban centres pose a major development challenge in delivery of services. According to Benerjee and Morella (2011), since the late 1990's, urban access to improved water supply in sub-Saharan Africa has expanded slowly as compared to the rate of population growth. World Bank(2010) postulates that efforts to increase access to improved water supply were not enough to cope with urban population growth.The percent of urban population that had access to improved water supply only increased from 67% in the late 1990's to 69% in late 2000's (Ibid). This represented an increase of 63 million urban dwellers gaining access to improved water supply from 135 million to about 199 million since late 1990's.

AMCOW (2010) indicated that insufficient production capacity and inefficiencies of service providers in the region hamper reaching universal access to improved water supply sources. The existing tariff structures benefit most the richest as these are the ones who have the highest levels of access to piped water and public taps, reflecting the limited coverage of water utilities in slums and informal settlements where many people live (Ibid).

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The provision of basic water and sanitation services to all remains a necessary and urgent need in Kenya. Kenya is considered as water scarce country with less than 647 cubic meters of water available per capita compared to the international benchmark of 1000 cubic metres per capita (UNDP 2006). According to USAID (2006), access to water is highly unequal between the high income and low income areas within urban centres. It is known that Kenya, has adopted the international declaration of sustainable development goals. The SDG target is to equitably improve access to sustainable safe water and sanitation services (KBNS, 2015). This is also linked to Vision 2030 under the social pillar which stipulates that every Kenyan should have access to clean safe water and improved sanitation by the year 2030.

According to NDDP (2010), Nakuru town is classified into three zones i.e. high income areas, middle income areas and low income areas. These areas are classified according to the population density,infrastructural facilities and social aesthetic and environmental characteristics.Kaptembwo location is densely populated, overcrowded, lacks proper water infrastructure, sewerage installation and suffers adequate support infrastructure such as roads, drainage, garbage collection, water, electricity, inadequate public space and overcrowding building (NEMA, 2011). Table 1 highlights the fact that the largest number of people not accessing safe water reside inKaptembwo location. Clean water in Kaptembwo is inadequate, sanitation and hygiene are visibly sub-standard (Ibid).

Table 1: People not accessing safe water and coverage % in Nakuru town's low income areas.

Location	No. of people	Coverage %
Kaptembwo	10,500	43%
Baruti	2,750	87%
Lanet	2,500	68%
Central	2,000	77%

Source: WASREB (2010)

Most households in Nakuru town depend on piped water from NAWASSCO. The present water demand for Nakuru town is estimated to be 100,000 m^3/day while water supply can currently only provide half of this amount (NAWASSCO, 2007). This shortage, particularly severe in the densely settled, low-income areas of the city, is seriously aggravated by the

failure of the water distribution network to expand in line with the increase in population (USAID, 2012).

1.2 Statement of the Problem

Water is an essential part of human life. As a result, it is required for day-to-day activities. Water supply in urban Kenya is characterized by low distribution network, intermittent supply, poor financial management and neglected operation and maintenance. This has led to many people lacking access to clean, portable water, with women and children in the slums most vulnerable. In Kaptembwo location, clean water is inadequate, sanitation and hygiene are visibly sub-standard. About 80% of all illness in Kaptembwo location are directly connected to poor water supply and sanitation. This situation has serious health consequences and is the main cause of Transmission of faecal-oral (typhoid, dysentery, cholera) and water related vector diseases (Malaria/yellow fever) in Kaptembwo. Three-fourth of the health problems of children in Kaptembwo location is communicable diseases arising from the environment, especially water and sanitation. Likewise sixty five percent of lessthan five years in the study area is due to diarrhea in which water related diseases occupy a high proportion.

The subject matter of limited water access in low income urban areas has attracted research attention especially in the larger towns – Nairobi, Mombasa and Kisumu. Not much has been done in Nakuru, especially in Kaptembwo, the study area. This study with a focus on determining factors which influence access to water in a low income area – Kaptewmbwo, therefore fills a significant research gap.

1.3 Broad Objective

The broad objective of this study is to provide a guided understanding of the factors determining access to water services among low income residents and measures to improve access in Nakuru town.

1.4 Specific Objectives

1. To determine the factors influencing access to water among low income residentsofKaptembwo location.
2. To analyze the water access situation in Kaptembwo location.

3. To establish the measures taken by water service providers to improve access to water in Kaptembwo location.

1.5 Research Questions

1. What factors influencethe accessto water amongst low income residents of Kaptembwo location?
2. What is the status of water access in Kaptembwo location?
3. What measures are undertaken by water service providers in improving the provision of water in Kaptembwo location?

1.6 Justification of the Study

Due to rapid urbanization in sub-Saharan Africa, majority of the urban poor have settled in informal settlements often characterized by a lack of basic services such as water and sewerage connection (World Bank,2010). In Kenya rapid urban growth in a climate of economic constraints has resulted in the majority of the residents living in overcrowded slums (KNBS, 2010). The problem of inadequate access to water exists in urban slums,inspite of the fact that increasingly, this is where a largeproportion of the poor live. Followingthe decentralized management of water provision, the area of study happens to be the target area where the issue of water supply system needs to be looked into by this study. It is against this backdrop that the study sought to find out whether majority of the households in Kaptembwo location actually benefit from the locally managed water resources.

Very few studies have dealt specifically with factors determining water access among low income residents in urban areas (Kakumu, 2002). In fact, water access situation has not been adequately evaluated nor have systematic strategies taken to improve access to water in low income areas in Kenya been developed. However, there was no previous study done in Kaptembwo location with this regard. Thus, as filling the gap of other researchers, this study was actually intended to determining factors influencing water access, analyse the water accesssituation and establish the measures taken to improve access to water in Kaptembwo location.

Information acquired on the present level of knowledge and awareness on the access of water among the low income households of Kaptembwo location is vital in designing water distribution network and infrastructure among the various departments and ministries charged

with the mandate in ensuring water is evenly distributed and accessed. Findings from this research will be instrumental in establishing whether water provider such as NAWASCO has lived to its responsibility of ensuring that water is available, accessible, adequate, safe and affordable to the low income residents of Kaptembwo and in addition help in ensuring that Vision 2030 can be achieved which requires universal access to safe drinking water to all Kenyans regardless socio-economic status by the year 2030.

1.7 Scope and Limitation

The study was confined to slum households of Kaptembwo location in Nakuru town. For the purpose of the study, the researcher focused on low income residents to provide a clear picture of access to water. With the study's focus on low income area of Nakuru townthere fore, caution would be necessary when generalizing the findings to low income areas in other townsof Kenya due to their unique individual settings.

The target population was low income household heads who were currently living in Kaptembwo location. However, during data collection, a good number of respondents were skeptical about sharing information about water access. To counter this challenge, the area chief was involved to re-assure the community of the need for their cooperation and the benefits of such a study in identifying issues that would help reduce the problems of water access among low income residents of Kaptembwo location.

Secondly, the residents were asking for a token so that they may be able to give the information. However after explaining to them the importance of the study, they were willing to cooperate and the study was a success.

1.8 Definition of terms

For the purpose of this study various variables and concepts are listed and their meanings described.

Access to domestic water source: - Means that the source is less than 1 kilometer away from its place of use and that it is possible to reliably obtain at least 20 litres per member of a household per day.

Determinants: - Refers to factors that influence access to water services.

Domestic water: - Refers to water used for domestic purposes; drinking, cooking and personal hygiene.

Household: - Refers to people who live within the same compound fenced or unfenced and share meals, have a common source of income and have a common provision for other essentials of general livelihood for example water.

Household size: - Refers to the total number of people living in a household.

Household Socioeconomic characteristics: - These include sex, age, marital status, education level and household sources of income and employment.

Improved water: -It's a drinking water source that by the nature of its construction and whenproperly used, adequately protects the source from outside contamination (WHO/UNICEF 2012)

Low income Households: - Refers to people who live in houses found in informalsettlements, lack access to piped water, sewerage installations, inadequate support infrastructure such as roads, drainage, garbage collection, electricity, inadequate public space and overcrowding where buildings often do not meet minimal building standards or other minimal social, aesthetic and environmental characteristics (NEMA 2011).

Safe water: - Refers to water that will not harm a person if the person comes in contact with it e.g. drinking water, swimming water or water for other uses.

Service delivery: - Refers to quantity and quality of water supply to households.

Sources of Improved drinking water sources: - These include piped water into dwelling, plot or yard, public tap, stand pipe, well, borehole, protected dug well, protected spring and rainwater collection.

Urban Area: -Refers to an area characterized by a higher population density settlement in comparison to areas surrounding it. Urban areas are created and further developed by the process of urbanization.

Urban poor: - Refers to urban dwellers who live under many deprivations such as

limited access to employment opportunities and income, inadequate and insecure housing and services, violent and unhealthy environment, little or no social protection mechanisms and limited access to adequate health and educational opportunities.

Water quality: - Refers to the condition of the water, including chemical, physical and biological characteristics, usually with respect to its suitability for a particular purpose such as drinking or swimming.

Water quantity: -Refers to the amount of water delivered and used for households.

Water scarcity: - Refers to lack of sufficient available water resources to meet water needs within a region.

Water service coverage – Refers to population with access to water services (either with direct service connection or within reach of a public water point) as a percentage of the/total population under utility's nominal responsibility.

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CHAPTER TWO

LITERATURE REVIEW

2.0 Introduction

This chapter reviews literature that has been done related to access to water. It presents documented literature on the factors influencing water access, water access situation and measures taken by water service providers in provision of water. The chapter identifies the gaps in literature; theoretical framework used in the study and also presents the conceptual framework that guided the study.

2.1 Urbanization in sub-Saharan Africa

According to Hardoy, Mitlin and Satterthwaite, (2001), in most Sub-Saharan Africa cities, the enormous pressure for shelter and water access has fraged the urban fabric. This has been caused by the increase in the number of people living in cities by 1.2 billion (Clammer 2008). In many countries, cities have grown far beyond anything imagined only a few decades ago and at speeds without historic precedent. Benerjee and Morella (2011) argues that countries in Sub-Saharan Africa will have to increase by 65% their capacity to produce and manage its urban water infrastructure. World Bank (2010) asserts that in many countries this must be accomplished under conditions of great economic hardship and uncertainty with resources diminishing relative to the needs and rising expectations.

Sub-Saharan Africa is the second least urbanized region in the world, after South Asia (UN-Habitat 2008). Sub-Saharan Africa is a home of 840 million people, from who around 37% live in cities. The region experiences the highest rates of urban population growth in the world (UNFPA 2007). Benerjee and Morella (2011), argues that since the late 1990's urban access to improved water supply in sub-Saharan Africa increased albeit slowly. WHO (2010) indicates that as a consequence of rapid population growth, the number of urban dwellers that gained access to improved sources of drinking water such as wells, boreholes and vendors decreased. This is evident especially in urban low income areas where there is lack of access to safe water and sanitation and increased water related disasters such as floods and droughts (Estache,Pevelmnan and Trujillo, 2005). In sub-Saharan Africa, the expansion of improved water supply in countries with high urban population growth rates is lagging behind urban

population growth. Further expansion of piped water is constrained by supply and demand factors (UN 2010). Molden (2007) explains that in the late 2000's urban population in Sub-Saharan Africa was growing 3.7% per year but only 2.9% of urban population gained access to improved water supply.

Table 2: Urban access to water supply, by technology in sub-Saharan Africa.

Type of water supply source	% of urban population			Million urban people		
	Late 90's	Early 2000's	Late 2000's	Late 90's	Early 2000's	Late 2000's
Piped water	37	37	41	74.7	91.0	119.1
Public taps	30	32	28	60.7	79.0	79.5
Wells and Boreholes	20	21	22	40.4	52.0	62.3
Vendors	7	5	5	14.9	11.0	14.7
Surface water	5	4	3	10.8	9.0	10.0

Source: "Urban Population Projections. 2010 UN Official Assessment", Population Division. United Nations, New York.

Kenya has the highest urban growth rate compared to other East Africa countries(World Bank, 1997). In Kenya, opportunities found in cities such as education, employment and business explain the reason why people move to urban centresGovernment of Kenya (GoK 2009). The rate of urban growth in Kenya is 4.2% annuallyGovernment of Kenya (GoK 2010). Urban population in Kenya constitutes 22% of the Kenyan total population.In recent times urban population in Kenya has been attributed to rural immigrants who are attracted by the opportunities that towns can offer, but often settle in slums and experience extreme poverty (KNBS, 2010).

According to research conducted by ARC(2007), rapid urbanization in Nairobi city has led to majority of urban residents to reside in slums often characterized by a lack of basic services such as water and sewerage. Consequently the urban poor often use inexpensive pit latrines, and at the same time, draw domestic water from nearby wells.Mwangi (2003), further indicates that low income residents in Nakuru town face a number of problems such as poor planning, inadequate support infrastructure such as drainage, garbage collection and water access. In the low income neighbourhoods of Kaptembwolocation the study area,

environmental hazards are increasing (Ibid). The area has inadequate water supply, poor sanitation and garbage is rarely collected (NEMA, 2012).

A study by the World Bank (2000) in Kenya's urban centres, showed that rapid urbanization and unplanned growth have placed enormous pressure on the capacity of towns in Kenya to provide adequate basic services for their growing populations. The study further found out that local authorities are overwhelmed by the rapid and unplanned development of towns and lack the capacity or resources to address the widening demand supply gap of water.

2.2 Water Supply in Urban Areas in sub-Saharan Africa

In sub-Saharan Africa, access to water is highly unequal within urban areas (Anand, 2006). According to UNDP (2006), improved access to water contributes significantly to better health outcome. Clean water is important as it reduces communicable diseases such as typhoid, cholera and dysentery.

Falkenmark(1984) indicated that rapid urbanization and urban growth in sub-Saharan Africa have consequences for water services a city can provide. Proper infrastructure and services are mostly lacking in the slums of the city and include; roads, water and sanitation, electricity and waste management. Hough (2004), argues that offering clean water, sanitation and health services are the basic needs for households to develop themselves. Molden, (2007) also notes that inadequate water supply is not because of lack of government funds. He argues that it is possible to improve the provision of water in low income settlements while charging their inhabitants less than they currently pay for inadequate provision (Figure 1).

Kenya is a country with economic scarcity of water(Kakumu, 2007).This notwithstanding the real issue seems to be the way the water is managed (Molden, 2007). The economic water scarcity in Kenya is described as low water service quality and weak financial capacity by service providers to deliver optimum services (GoK 2012). Slaymaker and Newborne, (2004) indicated that the level of water scarcity in many regions of Kenya has become a limiting factor for development activities especially in urban areas.Allaby (1996), argues that the level of water scarcity in many regions of Kenya has become a limiting factor for development activities especially in urban areas. Safe water does not match with the needs of the growing population.

Distribution of access to urban water supply in Kenya.

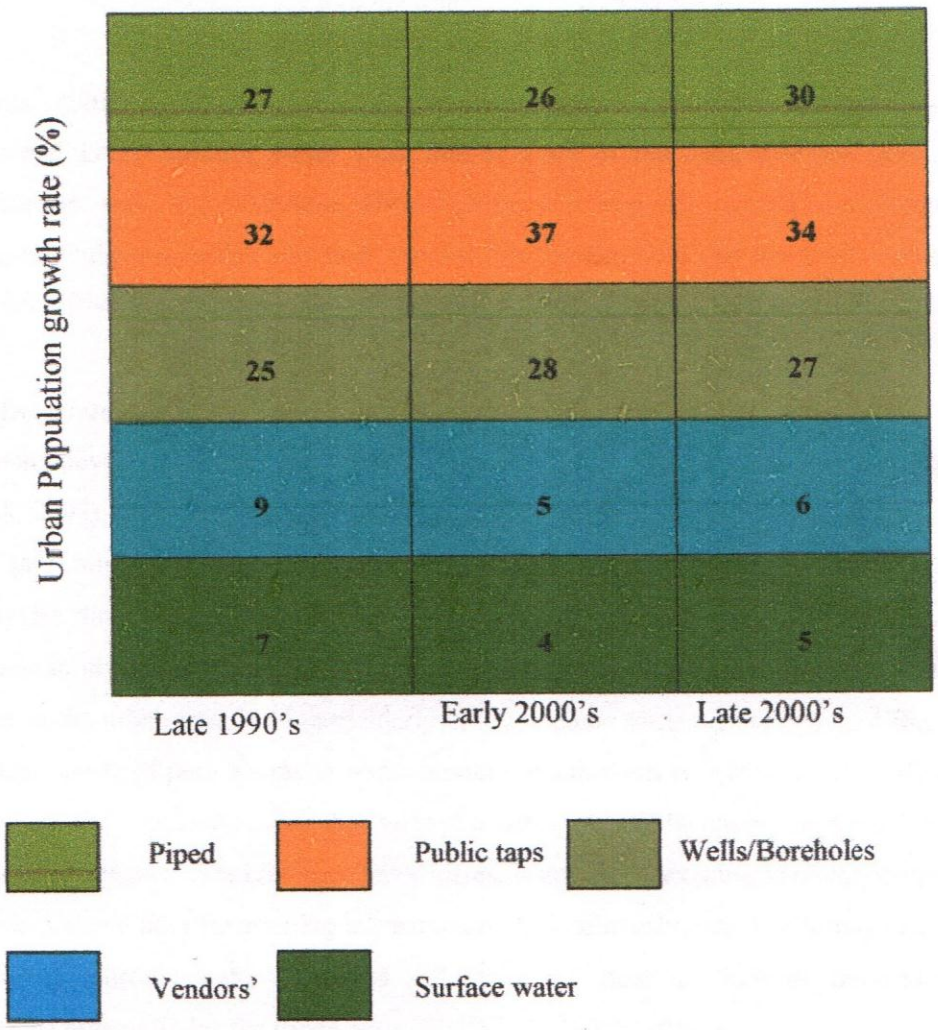


Figure 1: Source; Progress on Sanitation and Drinking Water (2010 USAID Joint Monitoring Programme).

Further studies by UN-HABITAT (2006) on access to water services in the slums of Kibera Nairobi indicated that improved access to safe and affordable water, especially to the urban poor is likely to have an impact on their livelihood directly or indirectly, for the following reasons: -

(i) It has a positive impact on health which increases time and energy to invest in productive activities.

(ii) Close proximity of water sources and increased quantity available reduces the time necessary to fetch water.

(iii) Improvements are especially relevant for women, who are traditionally responsible for looking after ill relatives and for fetching water for the whole households.

Similar studies by World Bank (2009) estimated that close to half the population in Africa, Asia and Latin America suffer from one or more of the main diseases associated with inadequate water and sanitation. These findings are consistent with a survey conducted in Nairobi's informal settlements that revealed that the prevalence of diarrhoea among children is 32%, while the infant and child mortality is 35% African Research Centre (ARC 2007).

2.3 Determinants of Access to water in Urban Centres in sub-Saharan Africa

In many developing countries access to water is highly unequal within urban centres (World Bank, 2007). UN-HABITAT (2007) argues that meeting the rapidly growing urban demand for safe and affordable water is already a daunting challenge for many countries. Dilapidatedinfrastructure, low levels of revenue collection, poor management and lack of accountability in governance are further obstacles to the sustainable improvement of access to water in the urban areas and particularly in low-income settlements (Hirji and Ibrekk 2001). A major cause of poor access to water services in sub-Saharan Africa is the inefficiencies of water utilities especially those that serve the urban areas (Makensey and ERG 2009). Many systems are characterized by high water losses, insufficient revenues to cover operating costs, dilapidated and poor functioning infrastructure, lack ofinvestments, low billing and collection efficiency, chronic water shortages and failure to meet the existing demand, and low coverage especially for the urban poor (WHO/UNICEF, 2010).

Labour is another determinant for provision of water. In general, water providers in sub-Saharan Africa are heavily understaffed (Marin, Matar and Ouibiga, 2010). Labour productivity is a major problem as the number of connection per staff of service providers is only 96 connections per employee, less that half the benchmark of 200 connections per employee. Labour productivity of water providers in countries with high urban population growth rate is negatively poor. On average, water providers in rapidly urbanization countries have only 85 connection per employee, well below the labour productivity of countries with medium and low urban population growth rates with 117 and 141 connections per employee respectively.

World Bank (2006) indicates that financing of water also influence water supply in Sub-Saharan Africa. The main sources of funding for provision of water are government tax

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revenue, aid and use fees. In addition to the public sector, water is also provided through private sector participation and community participation. The water sector is heavily dependent on funding with multiple fragmented donor projects which makes planning at the sector level very difficult (Slaymaker and Newbourne, 2004). The poor pay higher prices for water, as they are not connected to the network and thus have to rely on water vendors. High connection fees and the difficulties related to connecting people living in informal settlements restrict the expansion of piped water to poor households (AMCOW, 2006). According to Thoenen (2007) the watersector in sub-Saharan Africa receives limited private investment partly due to non-favourable business climate and unclear regulations. Private sector involvement in water utility provision has shown that private participation has to be achieved by adequate regulation and competition in order to increase efficiency (Estache *et al,* 2005). Many African countries have more than 50% of urban households served by smaller scale private water suppliers (Kariuki and Schwarz, 2005). In the provision of water, higher spending might not lead to a proportional increase in quantity of water supply as leakages from dilapidated pipes are quite high(Briceno-Garmendia, Estache and Shafik, 2004).

Water supply in Kenya is characterized by low levels of access, particularly in slums and low income areas as well as poor service quality in form of intermittent water supply (KNBS, 2010). Only 9 out of 55 water service providers in Kenya provide continuous water supply. Estimates from the joint monitoring programme for water supply and sanitation show that in 2008 59% of Kenyans in urban areas had access to improved drinking water sources (WHO, 2010). According to National Bureau of Statistics (2008), access to improved water sources in urban areas decreased from 91% in 1990 to 83% in 2008. In Kisumu, Citizen Report Card Survey showed that users of water kiosks in cities fetch water 4-6 times per day. This meant that a poor household spent 112 minutes per day to fetch water at normal times and as much as 200 minutes per day during times of scarcity (Maina, 2011). In the same Citizen Report Card Survey (Maina, 2011) indicated that in 2008, in Kisumu over 40% of households in low income areas connected to water mains reported scarcity. The greatest difference between the poor and non-poor was recorded in Nairobi where the poor households were more than twice as likely to say they experienced scarcity (Maina, 2007).

Research by African Population and Health Research Centre, on urbanization and water access among the urban poor, majority of urban residents in Kenya live in low income areas characterized by a lack of basic services such as water and sewerage (Kimani

2007).Consequently the urban poor often use inexpensive pit latrines and at the same time may draw water from nearby wells.

2.4 Policy Context for water provision in Kenya

The water sector in Kenya underwent far-reaching reforms through the Water Act No. 8 of 2002. Previously water service provision had been the responsibility of a single National Water Conservation and Pipeline Corporation as well as of a few local utilities established since 1966 (Maina, 2011). After the passage of the Act, water service provision was gradually decentralized to 117 Water Service Providers (WSPs) Government of Kenya (GoK 2002). Water service providers are linked to (8) regional Water Service Board (WSBs) in charge of asset management through Service Provision Agreements (SPAs). The Act also created a national regulatory board, the Water Services Regulatory Board (WASREB) that carries out performance bench making and is in-charge of approving SPAs and Tariff adjustments (KNBS, 2003).

Regulation and monitoring of urban water service provision is carried out by the Water Services Regulatory Board (WASREB), established in March 2003 on the basis of 2002 Water Act (Kakumu, 2008). Water Services Regulatory Board (WASREB) issues licenses to water services boards and approval of Service Provision Agreements, developing tariff negotiations, setting standards and developing guidelines for service provision and publishing the results of sector monitoring in the form of comparative reports. As a result of water and sanitation services provision has been devolved to 8 regional Water Services Boards (WSBs). Water Service Boards are responsible for asset management that is, for the development and rehabilitation of water and sewerage facilities, for investment planning and implementation. Another important body in the water sector reforms is Water Resource Users Association (WRUAs). WARUAs provide a forum for conflict resolution and cooperative management of water resources in designated catchment areas. In other words, it enables the public and communities to participate in managing water resources within their catchment area. Water service provisions operative in urban areas are companies owned by one or more local authorities. They provide both water and sewerage services (KNBS, 2003).

It is expected that the clear roles and responsibilities allocated to water sector actors will result in improved water sector performance (Kakumu, 2008). At the policy formulation level the sector reforms are expected to improve coordination in the water sector, enhance clear

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policy accountability and give more attention to water resource management. At the regulation level the sector reforms are expected to set in place a clear regulatory framework, enhance monitoring and evaluation, and improve performance of water undertakers. KNBS (2007), indicates that the expected outcomes at the service provision level include improved management of water resources (quantity and quality), skilled manpower, improved and efficient service delivery, increased coverage, ability to attract investments, and improved infrastructure.

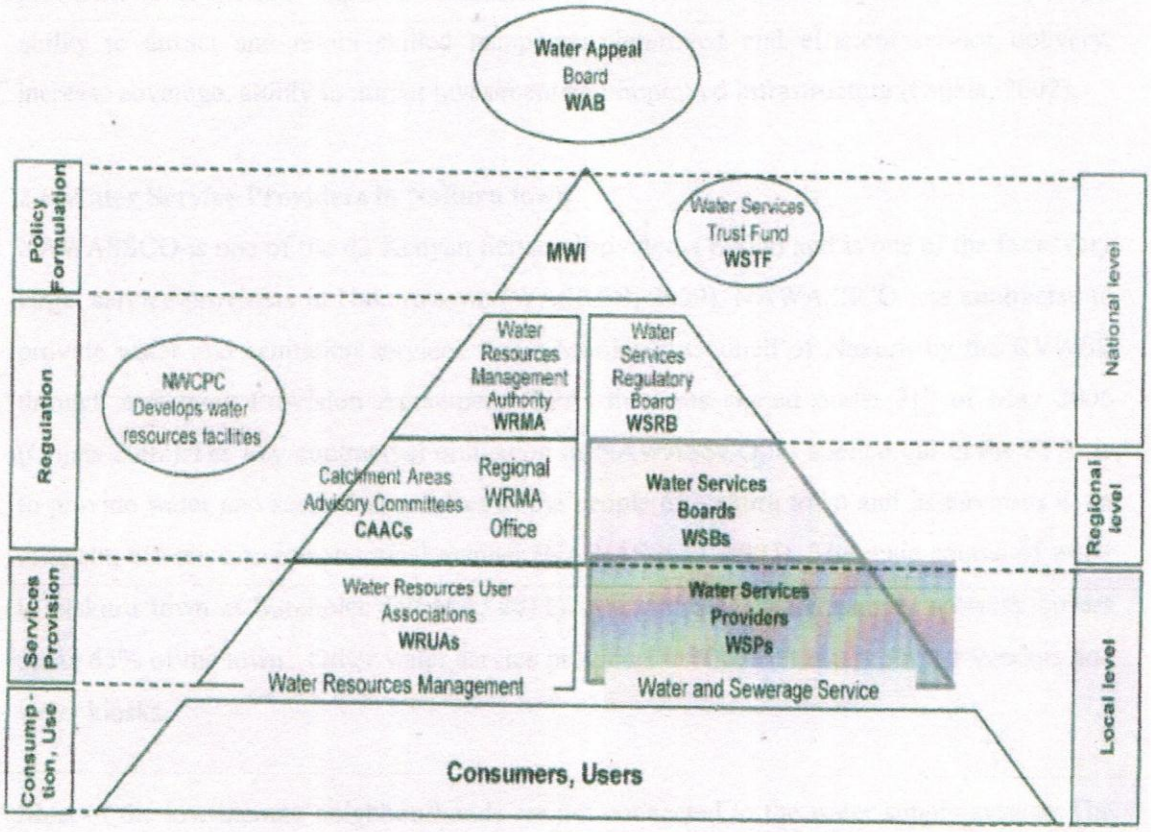


Figure 2: Institutional set-up under Water Act 2002
Source: WSREB 2009.

2.5 Expected Outcomes of Water Sector Reforms in Kenya

The Kenyan government through the MWI is in charge of setting national policies for the water supply sector, sector coordination, monitoring, financing and supervision (WASREB, 2009). Under the Ministry is also WRMA which is incharge of Regulation of water resources management through developing guidelines and procedures for the allocation of water resources, regulating and protecting water resources and determining water user charges and fees from source.

It is expected that the clear roles and responsibilities defined to sector actors will result in improved water sector performance. At the policy formulation level the sector reforms are expected to improve coordination in the water sector, enhance clear policy accountability and give more attention to water resources management. At the regulation level the sector reforms are expected to set in place a clear regulatory framework, enhance monitoring and evaluation and improve performance of water undertakers. Lastly, the expected outcomes at the service provision level include improved management of water resources (quantity and quality), ability to attract and retain skilled manpower, improved and efficient service delivery, increase coverage, ability to attract investment and improved infrastructure (Onjala, 2002).

2.6 Water Service Providers in Nakuru town

NAWASSCO is one of the 62 Kenyan Service Providers (WSPs) and is one of the four 'very large' service providers in Nakuru town (WASREB, 2009). NAWASSCO was contracted to provide water and sanitation services to the Municipal Council of Nakuru by the RVWSB through a Service Provision Agreement (SPA) that was signed onthe 31st of May 2006 (Onjala 2002).The key contractual obligation of NAWASSCO, as spelled out in the SPA, is, to provide water and sanitation services to the people of Nakuru town and its environs in an efficient, effective and economical manner (NAWASSCO, 2007). The main source of water in Nakuru town is boreholes (NEMA, 2011). NAWASSCO water supply network covers about 65% of the town. Other water service providers in Nakuru town are water vendors and water kiosks.

Most of the low-income neighbourhoods are not connected to the water supply system. The worst affected areas are Kiti, Kiratina, Free Area, Mwariki, Kaptembwo and Kwa Rhonda Estates, which have no water connection systems (Kimani, 2007). NAWASSCO has constructed water kiosks to serve the low-income estates of the town. These water kiosks are managed by community based organisations. A majority of the informal settlements residents consume piped water, but service delivery varies (Meijer, 2005). Approximately 6% of all LIA residents have a household connection, 66% use a yard tap connection, 16% a water kiosk, an estimated 2% receive water from a prepaid meter (yard tap), while an estimated 10% purchase their water from water kiosks (NAWASSCO, 2007).

2.7 Perception of local residents to access to water

Water access has been one of the most pressing challenges that people have been and continue to face especially in developing countries, and in populated urban slums where population growth and associated rising water demands will occur over the next few decades(WHO/UNICEF, 2006). Water management can therefore no longer be just about increasing water supplies through traditional hard paths of infrastructure construction or exploitation of new water sources, but about how to more effectively manage available water resources and factors including physical shortage and improve performance of existing systems (WASREB, 2009). Understanding urban low-income residents' perceptions access to water is a prerequisite for effective water management considering that public perceptions will have significant influence in shaping or reshaping people's behaviours and responses(WHO/UNICEF, 2012). This view is intandem with research by Gleick (2003) among low income residents in India in whichhe found out large disparities in the perceived and actual water use among residents across gender, age, education and income groups. Females and elderly users easily over estimated their water consumption in comparison to males and younger people. This is probably because the former group performs more water activities in urban households than the latter.

Taylor, Steward and Downton (1988), argues that personal experiences, water needs and residents' own definition of water shortage levels as low, medium or high will have a profound effect on their perceptions of water shortage. In other words, water shortage or the intensity of water shortage can mean different things to different people. It is clear then that people can have very different water use and management experiences (Ibid). This is also consistent with studies by Gleick (2000) which showed that people's former experiences can have a great impact on their water attitudes and behaviours. According to UN-Habitat (2007), comprehending water resource users' perceptions helps indentify reasons for different stakeholders willingness to co-operate or resist during the implementation of certain policy interventions as well as providing suggestions on appropriate planning and interventions in the future. OXFAM (2009) argues that without grasping these perceptions, water professionals, officials and even practitioners may misapprehend local residents as ignorant and conservative, may neglect the importance of local contexts in addressing these problems, or may even implement programmes which are locally inappropriate and thus highly unlikely to work or be enforced as planned.

Studies on factors impacting people's perceptions and attitudes towards water issues have shown that several variables are directly related to social and demographic variables including age, gender, income levels, education, residence, occupation and social class (UN-Habitat 2008). Studies by Hutton , Haller and Bartram (2007), show a negative relationship between age and water perceptions, suggesting that younger people tend to have better water access awareness than older ones. Slegers (2008) on the other hand argues that, residence or locations also have been considered as key factor in explaining differences in people's water access concerns and attitudes.

Many studies have confirmed that attitudes and behaviour regarding water use are closely related (UN-UNICEF, 2012). Some studies have revealed that residents with positive water use attitudes may not always exhibit positive behaviour towards water consumption. Studies by Corral-Verdugo, Frias-Armenta, Perez-Urias, Orduna-Cabrera and Espinoza-Gallego (2002), emphasized the importance of public perception on water consumption because this helps develop attitudes and behaviour that lead to proper water use practices. If residents have false perceptions of water consumption, water-saving methods such as proper education to change behaviour and the use of water saving devices to improve efficiency will be unsuccessful (Ibid).Studies on public perception diversity in different water use groups show that there are differences of local water access between urban low income residents and among individual households (Mehta, 2000). Firstly, there are significant perception disparities regarding local water shortage situations. For example, people without yard tap water believe that their water shortage is more serious than those with yard tap. Even in the same location and water user groups, some residents consider the water shortage as extremely severe while others consider it not severe at all. Secondly, despite a general agreement on the existence of local water access problems, individuals have different perceptions on aspects of water problems. Some express local water problems as physical shortages while others propose that it is about water access, control and affordability (Ibid).

Moreover, factors influencing low income residents' perceptions of water access problems can vary significantly among different subjects (Upadhyay, 2005). For instance, research by Wutich (2009) in Indian urban low income areas found out that, location, direct personal experiences in the local socio-economic and political contexts have the most significant impact on people's water perceptions followed by land area and income levels while gender, age and education were not significant determinants. Instead of being physically determined,

water access is locally lived and constructed within specific social, economic and political situations. This means some of these perceptions may not be accurate reflections of local water situations.

2.7 Theoretical framework on multi-dimensional consequences for the urban poor on water services

This study draws significantly from the concept of multi-dimensional consequences for the urban poor. A clear understanding of water use patterns and the factors that affect water consumption is critical to effective management of water supply and effective design of related public policies. Water use patterns are highly complex processes that are influenced by many factors including seasonal variability and water availability, water supply restrictions, tariff structure and policy, household characteristics and attitudes and intentions regarding water conserving (KNBS, 2010).

Multi-dimensional consequence for urban poor as postulated by Kjellenand McGranahan(2006), describes the multi-dimensional challenges the urban dwellers in need of clean water and sanitation are facing. The model sums up the most important factors for understanding the causes and consequences of poorly performing urban water services (Ibid).

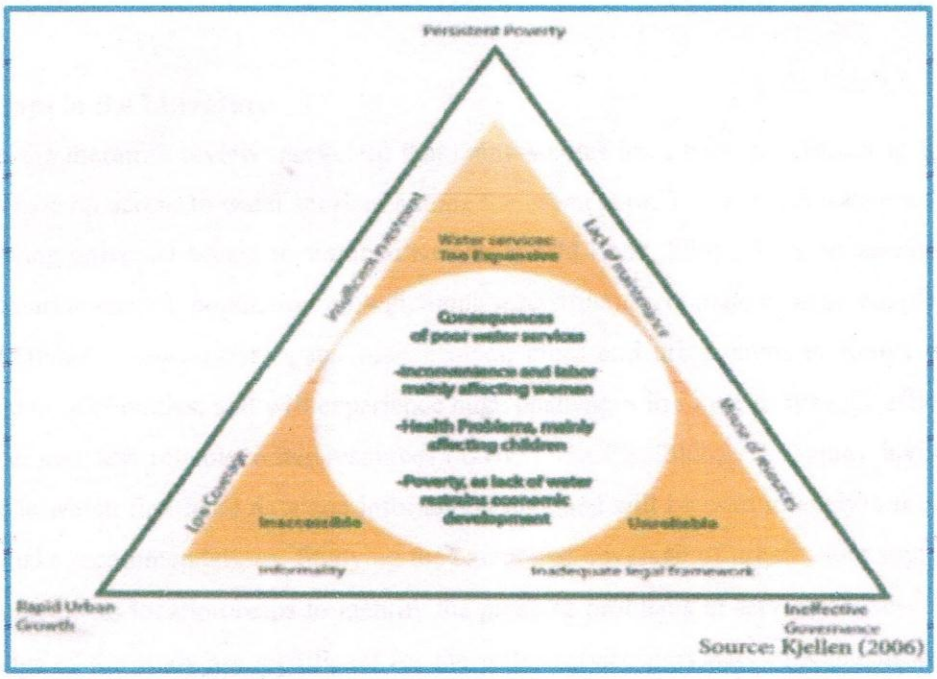


Figure 3: Framing the Development Problem of Urban Water Services.
Source: Kjellen and McGranahan (2006).

Multi-dimensional model approach is centred on governance and ownership, legal framework and consequences for the poor people. Kjellen and McGranahan (2006) studied how the lack of investment subsequently leads to low service standards and inadequate cost recovery. Access to safe drinking water can be a matter of life and death, depending on how it occurs and how it is managed. It can be an instrument for poverty alleviation lifting people out of the difficulties of having to live without access to safe water and sanitation, while at the same time bringing prosperity to all. However, when it is inadequate in either quantity or quality, it can be a limiting factor in prosperity and economic development.

The multi-dimensional model approach demonstrates that successful enhancement of access to water is essentially a process that require understanding the causes and consequences of poorly performing urban water services that create problems of accessing water and attempts to identify pathways through which water access can be realized in the low income areas. Hence the study will highlight the main challenges of increased water self-sufficiency for

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water managers in ensuring high quality and quantity water to the low income area of the Kaptembwo.

2.8 Gaps in the Literature

From the literature review, it evident that many studies have been carried out in Kenya and elsewhere on access to water services among the urban poor. There is still a long way to go in achieving universal access to water in Kenya (World Bank, 2005). With increasing pressure due to urbanization, population growth, aging infrastructure, climate change, coupled with an unsustainable conventional water management, cities and urban areas in Kenya are facing enormous difficulties, and will experience huge challenges in future to manage efficiently the scarcer and less reliable water resources (WHO/UNICEF, 2006). This study involved field work in which first hand data and information obtained will be used to analyze the problems and make recommendations. Studying the extent and coverage of urban water supply service in Kaptembwo location helps to identify the pressing problems in service delivery. Thus, the findings of the study are significant for the water service providers in Kaptembwo location for designing more effective method of water supply by narrowing the information gap between supply and demand. However focus on the contribution of access to domestic water, by households is minimal.

Most studies carried out to determine access to water among the urban poor have largely focused on supply and demand, economic and environmental costs of water. This research therefore aimed at establishing water access situation and measures taken by water service providers to improve access to water in Kaptembwo location, Nakuru County, Kenya. Findings generated from this study will be of great importance to policy makers, in ensuring proper and comprehensive policies have been formulated and are adhered to in order to increase water supply and reduce the problems of access to water.

2.9 Conceptual Framework

Water is a basic need and human right and as such the bodies governing water in Kenya have the responsibility of ensuring that it is available, accessible, adequate, safe and affordable. Despite the critical shortage of clean water in Kenya's urban slums, there is poor water distribution efficiency and inequalities in service provision between different sections of the town (Haedoy *et al,* 2001). A high level of knowledge on the factors determining access to

water among low income households in urban set up is expected to increase access to water services.

In this study the independent variables that influence access to water are; structures governing water, water distribution network in Kaptembwo location, maintenance of waterdelivery infrastructure in Kaptembwo location, water pumping schedules, number of water service providers in Kaptembwo location. All these factors influence the quantity of water accessed and consumed by individual household. The intervening variables include; income of household heads, price of water, user fees collection, demand for water, willingness to pay for water, government policy, WRMA, WARUAs, NAWASCO, distance to watering points, nature of the site, location of low income settlements, arrangement of structures, high population densities, overcrowding and low income due to unemployment. These factors are conceptualized to influence or enhance access to water. Identifying and working on the problem that limits the extent of access to water services is apriority for enhanced water supply. This can be done through analyzing the socio-economic and institutional factors that might significantly influence water access and supply. Effectively implemented policies and regulations on water encourages proper practices in the supply of water and use of water thus promoting sustainable development and sustainable utilization of water and finally enhancing access to water services among the low income households of Kaptembwo location.

The conceptual framework makes explicit statements about crucial variables to understand water access in Kaptembwo.In addition, it provides an understanding of the underlying causes and structures that shape water supply and helpto put in place an action and decision oriented understanding of water access hence it's relevance in this study. The conceptual framework of the study is based on the assumption that access to water and supply of water are influenced by different socio-economic, geographical and institutional variables.

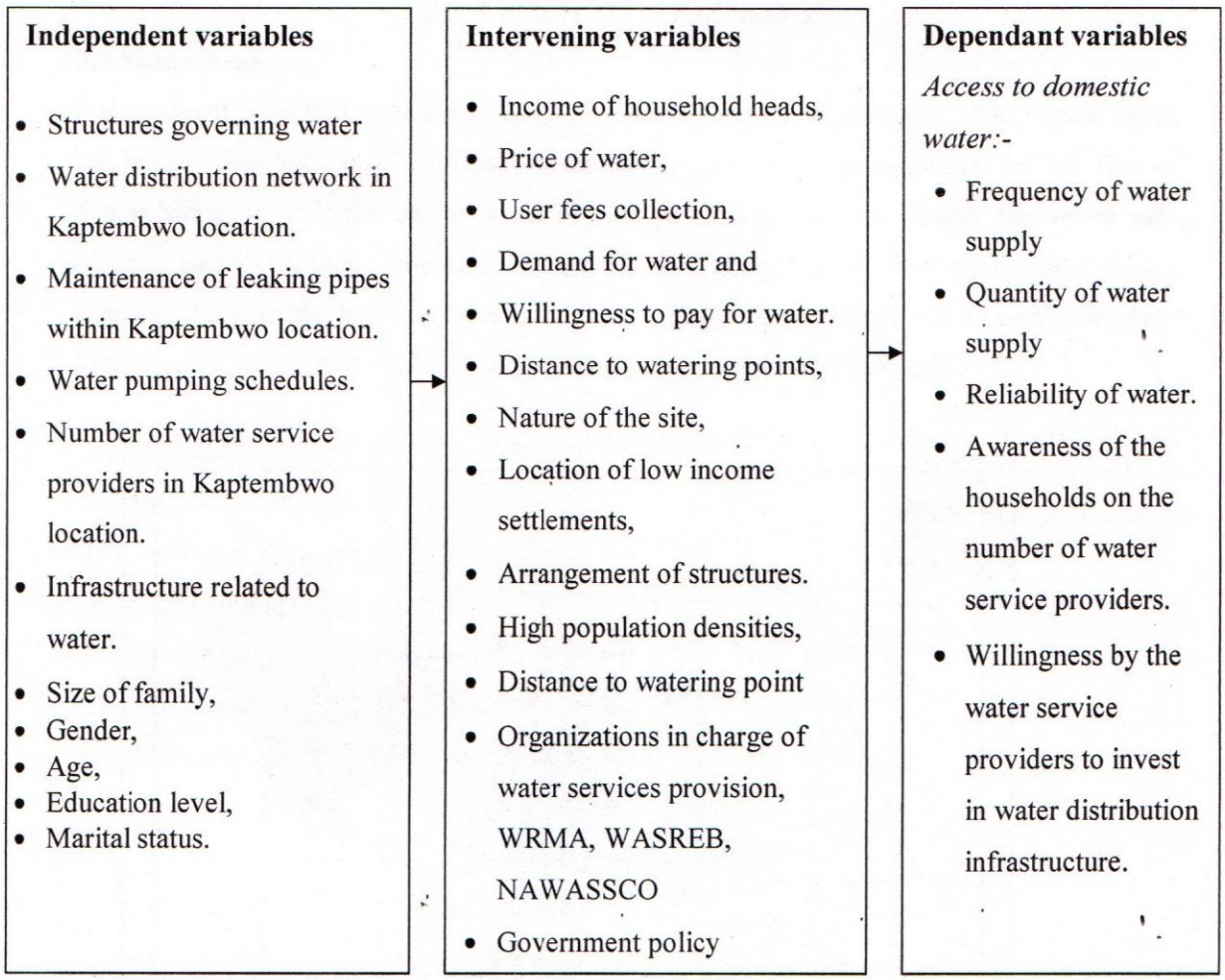


Figure 4: Conceptual Framework

Source: Derived from Literature Review

CHAPTER THREE

RESEARCH METHODOLOGY

3.1 Study Area

Nakuru town is located in Nakuru County, Kenya (Figure 5). It is located 1850 metres above sea level. It lies between $0^0 15'$ South of the Equator and between longitudes $36^0 04'$ East of Prime Meridian. It is the capital town of Nakuru County. Nakuru County has seven sub-counties namely; Rongai, Naivasha, Nakuru North, Nakuru Town, Molo, Njoro and Kuresoi. Nakuru Municipality has four locations, Baruti, Kaptembwo, Lanet and Central, five sub-location and 20,000 households (Kenya Demographic and Health Survey, 2010).

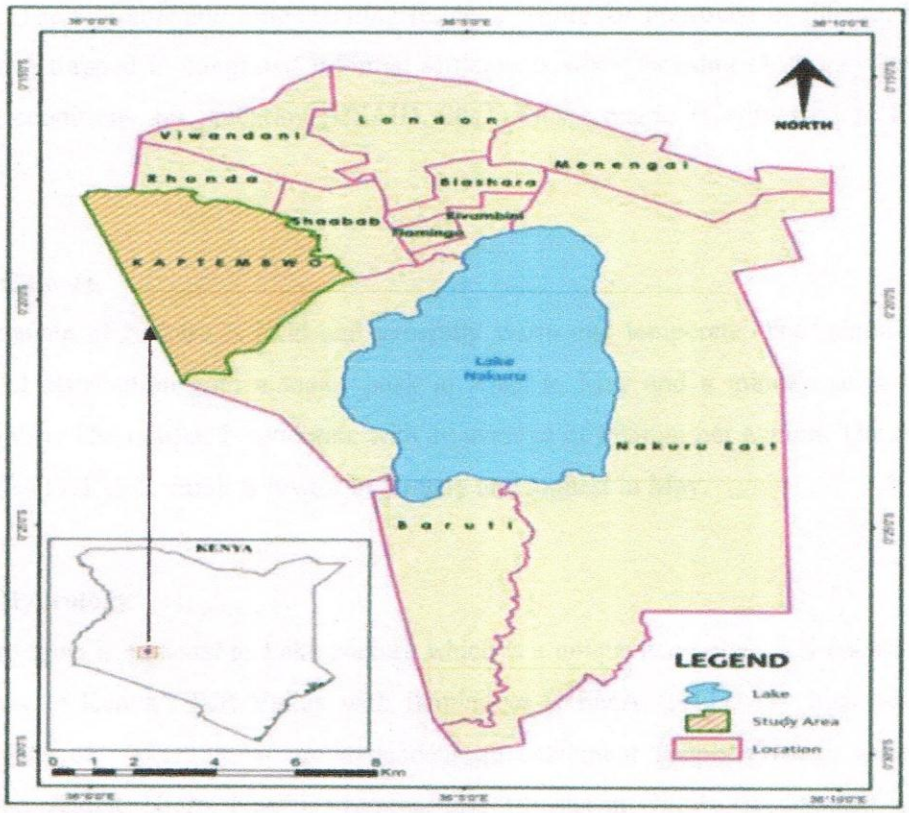


Figure 5: Location of the Study Area.

Source: Survey of Kenya, Topographical maps, scale 1: 50,000, using ILRI boundary Shapefiles: GIS ArcGIS 10.2.

3.1.1 Population

According to GoK (2010), Nakuru townhad a population of 500,000 people,with population density of 974 persons per square kilometre and the average household size of 5 persons (NDDP, 2010). With a total surface area of 270km^2 (of which 50km^2 made up of peri-urban areas);Nakuru townis one of the fastest growing towns in East Africa registering a growth rate of 4.5% per annum (KNBS, 2011). Almost half of the population resides in the 42 unplanned low income areas (NEMA, 2011). According to the National Census, Nakuru town population has been growing steadily from 150,000 people in 1987, to 310,000 people in 1999 and to 500,000 people in 2009 (KNBS, 2010). This trend reveals a pattern of urban demographic growth which most urban authorities are ill equipped to cope with (World Bank, 2010). The migrants and long-standing residents aspire for improved livelihood, but instead are often trapped in congested informal settlements where housing costs may be lower but living conditions are precarious(USAID, 2011).This scenario is witnessed in Kaptembwo location.

3.1.2 Climate

The climate of Nakuru is mild and generally warm and temperate. The rainfall exhibits a bimodal distribution with a major peak in April to May and a minor one in October to November. The rainfall is moderate with an average of 895mm per annum. The temperature averages 17.5^{0}C. Rainfall is lowest in January and highest in May.

3.1.3 Hydrology

Nakuru town is adjacent to Lake Nakuru which is a unique ecosystem it is one of the largest, salt lake in Kenya's Rift Valley with flamingoes (NEMA, 2011). The hydrological water conditions of Nakuru town are dependent on catchment supply through rivers such as Makalia, Endeit, Njoro, Naishi, Mereroni and Turasha in Gilgil. The forested areas of the catchment basic consist of the Eastern Mau, Eburru and Dondori forests (Ibid).The geology of Nakuru town lies in the Naivasha, Elementaita-Nakuru watersheds (Meijer, 2005). The geology is characterized by the following rocks; Alluvium, reworked water lain sediments, quaternarylucustrine deposits, rhyolites, comendite and obsidian (Ibid). The area is dominated by faults and voluminous fissural volcanic eruptions since lower Miocene (Meijer, 2005). The water catchment within the area is composed primarily of basic volcanic rocks. It experiences high fluoride level in its ground water which leads to major problems such as dental and skeletal fluorosis among the residents (NEMA, 2011).

Studies have shown that the area's geological and structural setup is responsible for the high fluoride levels. High fluoride levels are common in deeply drilled boreholes than surface water (Ibid). The available water sources in Nakuru town include piped water, boreholes, river and harvested rain water. Municipal water supply is treated while water sourced from other sources are usually untreated implying that most domestic water supplies may be contaminated (USAID, 2011).

3.1.4 Social Economic Activities

Nakuru town is a vibrant economic hub, with trade and tourism as the major activities. The area is a significant tourist destination earning foreign exchange especially from Lake Nakuru National Park. The boundaries of the lake region are known to host a wide variety of birds, hippopotamus, lions, rhinocerous, waterbuck, buffalo, giraffes, impalas and antelopes. Nakuru town has many thriving industries such as bakeries, sawmilling, food processing, and textile processing etc.

The commercial sector in Nakuru contributes about 19% of the economy of the town. Within the Central Business District (CBD), retail activity occupies 26%, wholesale has 10%, informal sector enterprises 18% of all commercial activity space. The most dominant forms of business in the Nakuru economy include retail in hardware and general wholesale. There is a significant network of financial institutions providing banking, insurance and credit services to the business economy.

3.2 Research Design

This study was based on cross-sectionalsurvey research design. In survey research, the researcher selectsa sample of respondents from a given population for detailed study. Survey research design is ideally suitable in describing the characteristics of large populations and is relatively cheap. This design, allows for large samples to be used. This is important because many questions can be asked about a given topic. In addition to the survey design, interviewing was used as a research tool to collect valuable data that was used to check the validity of responses obtained through use of questionnaires. Key informant interviews provide flexibility to explore new ideas and issues that had not been anticipated in planning the study but that are relevant to its purpose (O'Connor 2011&Kathuri and Pals, 1999).

3.3 Sampling frame and Sample size

The study was carried out in Nakuru town in the slum area of Kaptembwo location which has a total of 5600 households (KNBS, 2009).The target population was made up of household heads in Kaptembwo location. The study location was purposively selected to ensure that the study is carried out in an area with homogenous population characteristics of a low income area. Purposive sampling technique provided the researcher with the justification to make generalizations from the sample that was being studied. This variety of information in turn gave the researcher a better cross section of information as the study population shared the same characteristics. In addition purposive sampling enabled the researcher to focus on particular characteristics of the population, which in this case is, the low income residents of Kaptembwo location. This is justified by the fact that the researcher will gather information to answer the specific research questions. According to KNBS (2009),Kaptembwo location had a population of 5,600 households on the basis of which the sample of 280 households was obtained.

According to Mugenda and Mugenda (1999), if the target population is less than 10,000, the required sample size will be between 5% and 20%. Hence the final sample estimate (n_f) was got as follows;

$$n_f = \frac{5 \times 5{,}600}{100} = 280 \text{ households}$$

The total sample size was 280 household heads, who constitutes 5% of the total households in Kaptembwo location. A simple random sampling technique was used to obtain a sample of households from Kaptembwo location. Data was collected from randomly selected households by utilising structured face to face interviews.

3.4 Research Instruments

Two instruments were used to collect data, questionnaire and Key Informant Interview Schedule. The questionnaire was used to collect data from the sampled households on issues related to the factors influencing access to water while the interview schedule was used to collect in-depth information on the measures used to provide water in Kaptembwo location. Key informants who were interviewed included; a selected number of NAWASSCO officials , vendors and borehole owners. They were interviewed using key informant interview schedule (Appendix III). Interviews provided indepth data as well as an opportunity to clarify issues arising from the interview process.

3.4.1 Validity

Data collection instrument was developed as per the objectives of the study;it was then validated by carrying out a pilot study on respondents in Bondeni. Tenhousehold's heads were interviewed. The researcher also consulted with the supervisors and experts from the Faculty of Environment and Resource Development of Egerton University on the best methods to establish validity.

3.4.2 Reliability

The Cronbach alpha co-efficient was used to compute the reliability co-efficient of items on the questionnaire was 0.724. the coefficient was considered acceptable in line with recommended co-efficient for social sciences 0.7 (Fraenkel and Wallen, 2000).

3.5 Ethical Considerations

In order to conform to the ethical standards of a scientific investigation, the residents of Kaptembwo were given a thorough explanation on the purpose and objective of the study. Subsequently they were requested to participate in the study voluntarily without coercion. To ensure anonymity and confidentiality, numbers were used to identify the household heads instead of person names. No respondent was forced to answer questions they did not wish to answer. The researcher also sought permission from National Commission for Science, Technology and Innovation through graduate school of Egerton University to conduct this study.

3.6 Data collection

A questionnaire (Appendix I) and Key Informant Interview Schedule (Appendices II& III) were used for data collection. The questionnaire was used to collect data from household heads in the study area. This included data on factors influencing access to water and the situation regarding to water. The questionnaire was administered by the researcher to all the 280heads of households in the study area. In addition to the questionnaire, Key Informant Interview Schedules were used by the researcher to collect in-depth data on factors determining access to water, water access situation and measures used in provision of water. Secondary data was obtained from published books, relevant journals, records from NAWASSCO and periodicals, theses, policy research working papers, government sessional papers and other suitable publications.

3.7 Data Analysis

Data wasanalyzed using Statistical Package for Social Sciences (SPSS) software version 20.0. Study variableswere analyzed using Pearson correlation, chi-square test and descriptive statistics (percentages, frequency tables, pie charts). These statistics helped in identifying factors that influenced access to water, the water access situation and measures used in provision of water in the study location. Association and interactions among the study variables were tested using correlation and chi-square test respectively. Table 3 provides a summary of the study variables and analytical procedures employed.

Table 3: Summary of Data Analysis

Objective	Variable/Data	Analytical Procedure
1. To determine the factors influencing access to water amongst low income residents of Kaptembwo location.	- Access to water. - Demand for water. - Watet supply channels e.g piped, public taps, wells or boreholes, vendors e.tc.	• Use of correlation and descriptive statistics.
2. Toanalyze the water access situation in Kaptembwo location.	- Distance to watering points. - Availability of improved water sources. - Quantity of water. - Frequency of supply of water.	• Use of chi-square and descriptive statistics.
3.To establish the measures taken by water service providers to improve access to water in Kaptembwo location.	- No of water kiosks. - Water pumbing schedules. - No of water service providers.	• Use of descriptive statistics.

CHAPTER FOUR
RESULTS AND DISCUSSION

4.0 Introduction

This part of the thesis deals with the presentation, analysis and interpretation of data collected from the respondents through questionnaire and interviews. There were variation in the frequency of responses obtained for the various questions. This variation necessitated a summary of the descriptive statistics to show the expected mean standard error and the standard deviation that may be incurred during computation of results.

Table 4: Summary of Descriptive statistics to show the expected mean standard error and the standard deviation

	N	Mean	Std. Deviation
	Statistic	Std. Error	Statistic
Respondent's age	275	0.058	0.968
Gender	276	0.029	0.485
Respondent's Education level	276	0.045	0.742
Respondent's Occupation	272	0.255	4.199
Main source of drinking water	272	0.088	1.445
Water source location	276	0.028	0.467
Duration of water acquisition per day	270	0.020	0.322
Increase in water supply by NAWASSCO	273	0.078	1.286
Problems in getting water	232	0.068	1.029
Factors influencing water supply	253	0.085	1.356

4.1 Descriptive analysis of the Socio-economic characteristics of low income residents in Kaptembwo location

From the Table 5, it is observed that half of the respondents 50.9% were aged between 21 to 30 years. In addition, 32.1% were aged between 31 and 40 years. About 10.9% of the respondents were 41 to 50 years old. Only 2.2% and 3.3% of them ranged from 51 to 60 years or 60 years and above, respectively (Table 5 & Fig. 7).

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Table 5: Respondent's Age

Age Bracket		Frequency	Percent
21-30 years		140	50.9
31-40 years		90	32.1
41-50 years		30	10.9
51-60 years		6	2.2
61+ years		9	3.3
Total		275	100
N	Valid		275
	Missing		5
Std. Deviation			0.968

Source: Field data, 2015

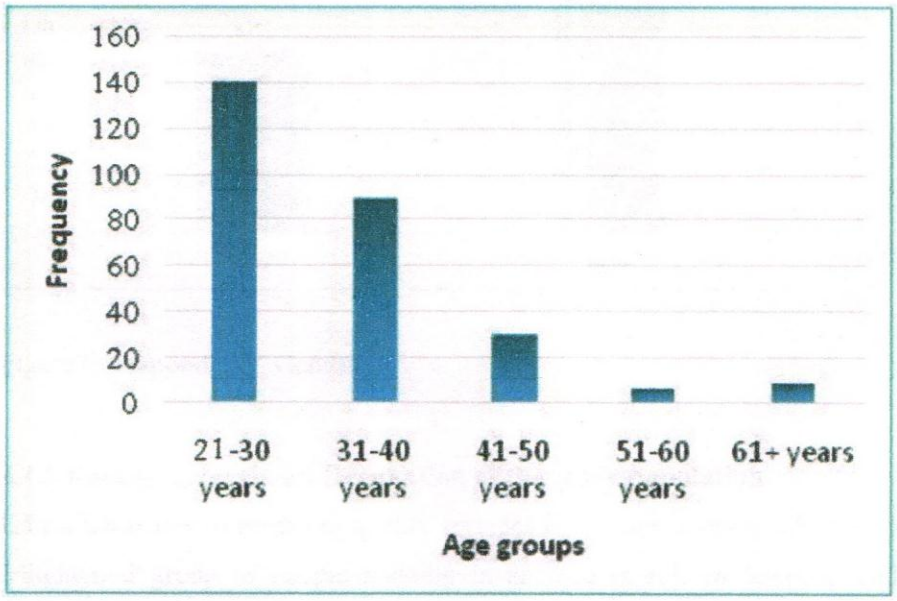


Figure6: Respondents' Age

4.1.1 Respondents' Gender in Kaptembwo location

The study involved both genders in providing their views about the access to water at Kaptembwo. It is clear from Table 6 that the male population formed the majority of the total respondents making up 62.5% against 37.5% female. Most respondents (70.2%) were married.

Table 6: Respondents Gender

Gender	Frequency	Percent
Female	105	37.5
Male	175	62.5
Total	280	100.0

Source: Field Data, 2015

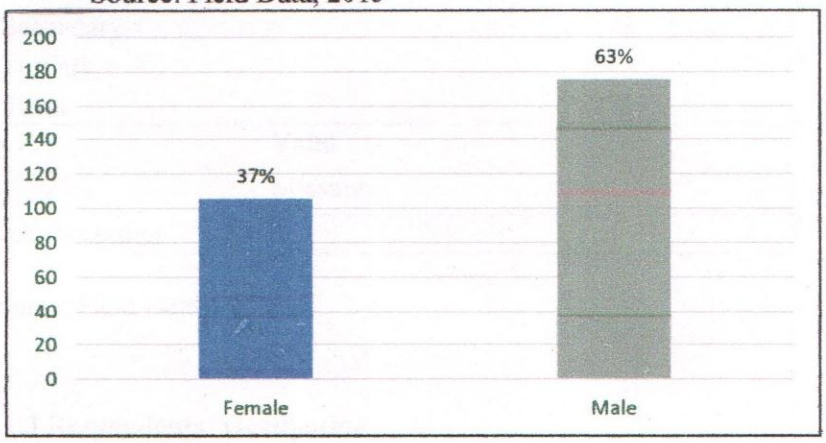


Figure7: Respondents' Gender

4.1.2 Education level and Occupation of the study population

Education is key to access to quality services like water in many urban settings in Kenya. An enlightened group of people residing in an area is able to team up and ensure safe and sufficient water for domestic purposes is easily available as opposed to a society whose members are ignorant about their rights and responsibilities. People wit higher level of education attainment are more likely to value access to water and sanitation (World Bank, 2009).

From Table 7, it is observed that people with secondary education were the majority forming 51.8% of the total respondents. This group was followed by those with primary education whose percentage was 26.8%.However,18.5% of the respondents had attained tertiary education level while only 2.9% lacked any formal type of education. The results are consistent with KNBS (2012) according to which majority of population in urban centres in Kenya were literate. The level of education among respondents is very high; this is expected to translate to high level of awareness with regard to issues concerning access to water in the study area.

Table 7: Respondents' Level ofEducation Achievement

Level of Education		**Frequency**	**Percent**
Informal		8	2.9
Primary		74	26.8
Secondary		143	51.8
Tertiary		51	18.5
Total		276	100.0
N	Valid		276
	Missing		4
Std. Deviation			0.742

Source: Field Data, 2015

4.1.3 Respondents' Occupation

Answers relating to the respondent's main occupation, (Table 8) show that 58.1% were business people undertaking various businesses within Kaptembwo and Industrial Area; 15.3% were engaged in *Jua Kali*, 5.2% in security, 2.4% in farming and 22.9% were engaged in various types of work to earn a livelihood. The research findings agree with a study done in Nakuru town by Owuor (2006) which indicates that most people in the slum areas of Nakuru town were self employed and engaged in their own micro-businesses.

Table 8: Respondents' Occupation

Occupation		Frequency	Percent
Business		151	58.1
Jua Kali		38	15.3
Farming		3	2.4
Security		7	5.2
Others		34	22.9
Total		272	100.0
N	Valid		272
	Missing		8
Std. Deviation			2.199

Source: Field Data, 2015

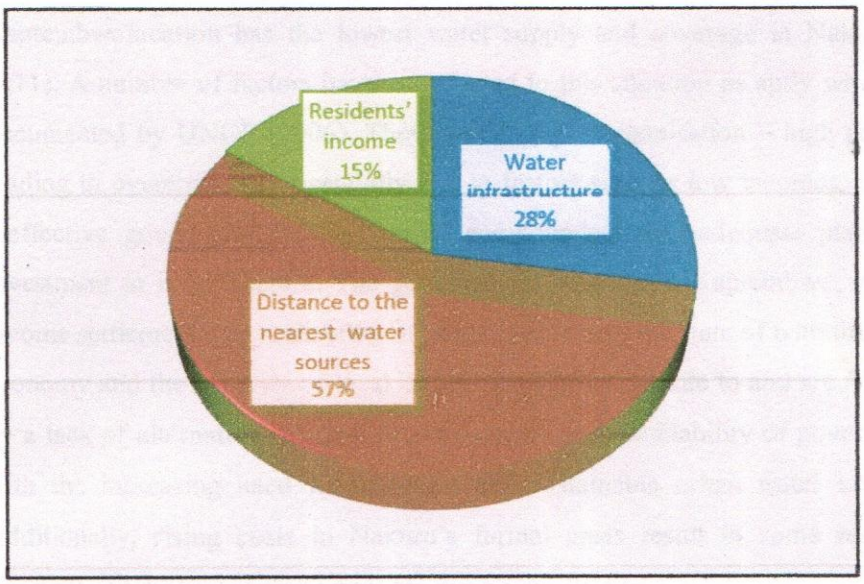
4.2 Perceived Factors influencing the access to water among residents in Kaptembwo location

The first objective of this study was to determine the factors which influence access to water amongst low income residents of Kaptembwo location. The major findings under this objective are described as follows. It is evident that 57% of the respondents identified distance to water points as the leading factor influencing access to water. The respondents 28% identified water infrastructure as a factor influencing access to water, while 15% of the respondents identified residents' income as a significant factor influencing access to water. The factors identified from the field study are summarized in Table 9and Figure 8 and discussed hereunder.

Table 9: Perceived Factors influencing access to water in Kaptembwo

Factor	Frequency	Percent
Distance to the nearest water sources	157	57
Water infrastructure	77	28
Resident's Income	42	15
Total	276	100.0

Source: Field Data, 2015



Source: Field Data, 2015

Figure 8: Factors influencing access to water in Kaptembwo

4.2.1 Water Distribution infrastructure

From the study findings, it is evident that water infrastructure in Kaptembwo location is a major factor inhibiting the availability of water for domestic use. For this reason usually people resort to fetching water from outside sources rather than depending on piped water.

It has been established that (Table 10), that only 6.2% of the household in Kaptembwo access water inside their houses, while majority of households 77.2% access water outside their houses. According to NAWASSCO, water supply to Kaptembwo is currently 2000 m^3 against the current water demand of 10,000m^3 a day. This indicates a high short fall which must be met from other sources. It is hardly surprising therefore that water vending is an important service and business in Kaptembwo. This reflects low level of water accessibility and low capital spending in the water sector compared to the increase in urban population.Efforts by NAWASSCO to supply water to Kaptembwo have not been felt as majority of the residents are not accessing enough water to satisfy family consumption.Access to water has been low and considerably below average in Kaptembwo. The major causes of this include; leakages in the system due to lack of maintenance and dilapidated infrastructure, water theft through illegal connections, water wastage as a result of unmeasured consumption coupled with fixed payment since 26% of the connections are inactive. There is also vandalism of the distribution network (NAWASSCO, 2007).

Kaptembwolocation has the lowest water supply and coverage in Nakuru town (NEMA, 2011). A number of factors have contributed to this situation as aptly which have been well documented by UNDP (2006). They include rapid urbanisation – high population densities leading to overcrowding essentially due to factors such as low incomes, unemployment and ineffective governance.This is further compounded by inadequate planning and lack of investment in infrastructure. The geographical location of Kaptembwo, and the site of low income settlements, unavailability of natural resources, the state of both the national and local economy and the capacity of local institutions also contribute to and are further compounded by a lack of alternatives for low income people and the inability of governments to keep up with the increasing need for adequate and sustainable urban water infrastructure (Ibid). Additionally, rising costs in Nakuru's formal areas result in some residents shifting to informal settlements to make ends meet(NEMA, 2011).

4.2.2 Distance to the nearest primary water source

A households' location in relation to the water access points determines the time taken to fetch water and the amount of water drawn per period of time. It is expected that the further the location of someone's residence is from a water point, the more the time spent in fetching water, and the lesser the amount of water fetched. A study conducted in Accra (Ghana) and Luanda (Angola) by World Bank (2009) on access to water among low income residents, indicated that distance to primary water source affects water consumption as well as socio-economic status of the households. This suggests that even if many households were connected to water system within their residential plot, they would still have no water for weeks continuously causing low water consumption.

In the case of Kaptembwo location, the greatest number of water sources 77.2% are located a way from the respondents' residential plot. This implies that water access points are shared, this leads to competition for water. Only 6.2% of the water sources are found in the respondents' house, while 16.7% of the water sources are located within the plot (Table 10).

Table 10: Water Sources in Kaptembwolocation

Location of water source		Frequency	Percent
In the house		17	6.2
Within the plot		46	16.7
Away from plot		213	77.2
Total		276	100.0
N	Valid		276
	Missing		4
Std. Deviation			0.467

Source: Field Data, 2015

A study carried out by Gulyani, Talukodar and Kariuki (2005), in Nairobi, Mombasa and Kakamega on access to water among the low income residents revealed that 71% of the sampled household in Nairobi had access to piped water (away from the plot). In Mombasa and Kakamega, these percentages dropped to 50% and 56%, respectively. This scenario is witnessed in Kaptembwo as majority of the households' access water away from their residential plot. The vast area of Kaptembwo therefore is not under distribution network.

Given the location of the water points relative to the location of residence, the study also covered the average duration taken for the residents of Kaptembwo location to fetch water daily (Table 11). The study revealed that1.1% spent 3 or more hours to fetch water, majority of the residents 88.9%, takes 1 to 2 hours for them to get water, while10% of the respondents spent 30 minutes fetching water. This may be explained by the outdated and poor water distribution network. Results similar to these were found in Kisumu where the low income Nyalenda Estate households received water for 1 to 2 hours a day (Kessides 2004).

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Table 11: Duration of Water Supply per day in Kaptembwo location

Duration		Frequency	Percent
30 minutes		27	10.0
1-2hours		240	88.9
More than 3 hours		3	1.1
Total		270	100.0
N	Valid		270
	Missing		10
Std. Deviation			0.322

Source: Field Data, 2015

4.2.3 Residents' Income

In order to gauge the relationship between household income and the household's access to water, correlation between residents income level and the amount of water acquired/ consumed per day by a given household was computed. As can be observed in Table 12, the correlation reported in the table is positive and also significantly different from 0 (p-value of 0.002 is less than 0.005) As we can see, a household's income is positively and significantly correlated with the amount of water the household acquires in a day, indicating that households with higher incomes tend to consume more water than the households with lower incomes. This implies that the higher the income earned, the more the households financial capacity which increases the probability of access more water.

Table 12: Correlation between Household income and water demand per day

		Household income	Amount of water
Pearson Correlation	Household income	1.000	.473
	Amount of water	.473	1.000
Sig. (1-tailed)	Household income	.	.002
	Amount of water	.002	.

As it can be observed from Table 13,a significant number of respondents 60% earn less than Ksh. 5,000 per month which according to the current living standards in Kenya,cannot comfortably meet the family's basic needs, including water. This income group is able to

access only up to 50 litres of water in a day. About 30% of the residents earn between Ksh. 5,000 and 10,000, and access between 20-100 litres of water a day depending on water availability (USAID, 2011).

Table 13: Income levels of Kaptembwo Residents

Income Bracket	Consumption per Day in litres
Less than 5,000	Upto50
5,000 – 10,000	20 to 100
10,000 – 15,000	100 +
More than 15,000	100 +

Source: Field Data, 2015

Although the piped water distribution system covered major parts of Kaptembwo, most poor households could not afford the costs for a connection or the landlord was not willing to pay. As a result, many low-income households had to rely on alternative sources, mainly private water vendors and water kiosks. Water vending by private individuals was quite common in Kaptembwo. However, many poor households could not afford the high prices charged by the private water vendors, which was 10 to 20 times higher (depending on the season) than the, NAWASSCO tariffs. The study revealed that recently constructed water kiosks were charging a price that was seven times higher than the public utility were a solution for the poor households.

4.2.4 Problems faced by Kaptembwo Residents in accessing water

Results from the study show that the residents of Kaptembwo location experience a number of problem in accessing water. The study revealed that 41.8% of the residents in Kaptembwo queued at water points. This may be attributed to low investment in water distribution network (WHO, 2005). The cost of water which determined its affordability proved a problem to some 27.2% of the residents. Fluctuation and insufficient supply of water registered the lowest frequency of 13.8% (Table 14).

Table 14: Problems in accessing safe water supply among residents of Kaptembwo

Problem	Frequency	Percent
Cost/ affordability	63	27.2
Long queues/ distance and fatigue	97	41.8
Fluctuation and inadequacy	32	13.8
Unsafe/ untreated water	40	17.2
Total	232	100.0

Source: Field Data, 2015

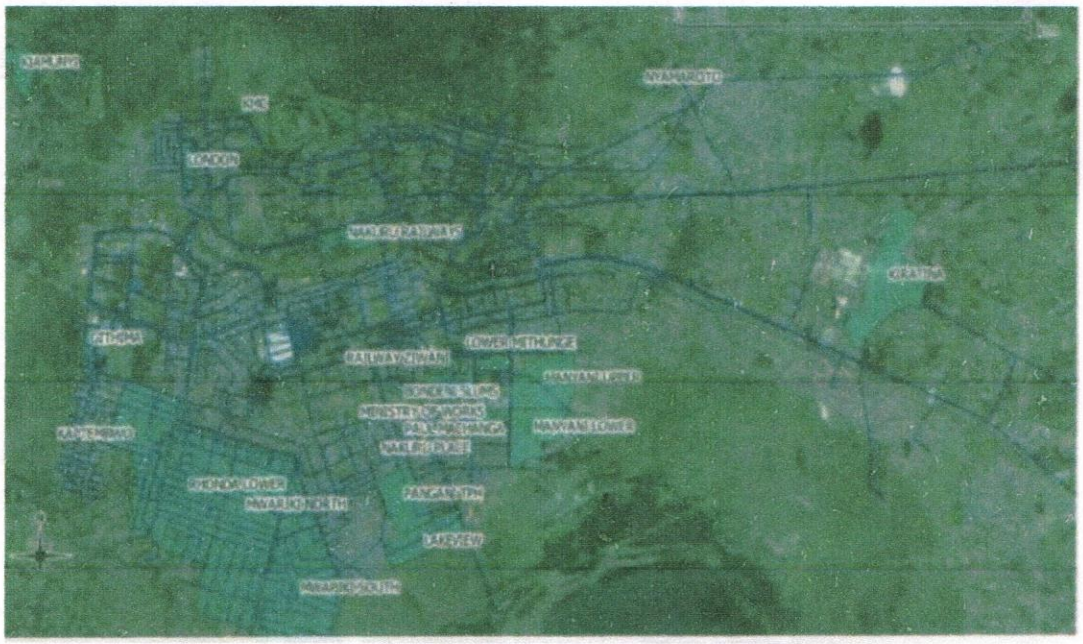


Plate1: Overview of water distribution network in Nakuru Town.

Source: NAWASSCO (2013)

Key: -

Blue Lines – Water coverage (main piping)

Areas shaded green – Location of Low Income Areas

The plate highlights the fact that Kaptembwo location is located at the far end of the distribution system. The vast area of Kaptembwo location therefore is not connected to the distribution network. In addition, most settlements in Kaptembwo are at the end of the pipe system and hence do not get enoughwater due to low pressure and low flow velocity.

4.3 Households' Access to Water in Kaptembwo location

The study's second objective was to analyse water access situation in Kaptembwo location.The quantity of water delivered and used for households in an important aspect of domestic water supplies, which influences hygiene and therefore public health (NEMA, 2011). The rate of domestic water consumption is frequently used as performance indicator of the water supply to meet the needs of the population.It is evident that the main sources of water in the study area is piped water 82%. This shows that most people rely on water supplied by NAWASSCO, Nakuru Public Health Department (2006). Fourteen percent of the residents depended on piped water either within their plots or outside. Others 3.3% relied on boreholes and 0.4% on rain water. The rest of the residents relied on other sources of water such as watervendors (Table 15).

Table 15: Main Source of Drinking Water for Kaptembwo residents

Sources		Frequency	Percent
Rainwater		1	0.4
Piped water		223	82.0
Borehole		9	3.3
Other		39	14.3
Total		272	100.0
N	Valid		272
	Missing		8
Std. Deviation			1.445

Source: Field Data, 2015

A number of factors considered to determine access to water were cross-tabulated to show their significance in determining the households' ability to acquire water for daily

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purposes.The resulting Chi-square statistic was hence interpreted to identify the relationship between the factors, as described herebelow.

4.3.1 The Influence of household size on water consumption per capita per day in Kaptembwo location

This study sought to find out the relationship between the size of the households in the study location and the amount of water consumed per capita per day. The size of a household usually determines the volume of water consumed by a particular family. Kaptembwo location is characterised by relatively larger household sizes given that 30.5% of the households were made of four people while about 20% were made up of three people. Smaller household sizes make it easier to meet its daily water requirements for washing, cleaning, cooking and drinking. On the other hand, a large household size is expected to have a higher demand for water. Large households are also likely to be under pressure to access, more water because of highfamily consumption. The results of the relationship between the two variables are tabulated below.

Table 16: Household water consumption per capita per day in Kaptembwo location

Household size category	Household size	Water consumption litres/capita/day	Daily water use in litres/household	Mean per capita daily water used in litres	% water consumption per capita per day
1	4.00	20	80.00	20.00	6.60
2-5	48.00	60	2880.00	16.70	80.00
>5	8.00	>100	800.00	21.70	13.40
Total	**60**		**3760**	**62.66**	**100**

Notes:(N=60)

Per capita water consumption per day is recognized internationally as a standard measure of access to water. This indicator thus allows not only measurement of residents' access to this important commodity, but also allows for comparisons to be made between one area and others. Necessary corrective strategies and actions, are facilitated on the basis of

such calculations. To arrive at an appropriate account of per capita water consumption in the study area, we took into consideration the structure and composition of households. Thus, households were categorized into three classes: (i) those with 1 resident, (ii) those with, between two to five residents and (iii) those with five and more residents (Table 16).

Second, the total number of residents in each household water consumption category per capita was examined against the three consumption sub-categories. The resulting water consumption per capita were derived as follows: Households with 1 resident and accessing 20 litres of water per day, consumed 20 litres per capita per day, while 48 households which access 60 litres of water each per day, had an average consumption per day is 16.70 litres per capita. On the other hand, 8 households which accessed 100 litres of water and more per day, had an average consumption of 21.70 litres per capita per day. From these calculations it is observed that the mean per capita water consumption for the three categories is 62.60 litres, thus giving a group mean of 20.86 litres per capita per day.

It will be noted that using the method employed in this part of the study allows us to observe significant differences in the per capita water consumption in Kaptembwo, with the main determinant being the number of people in each household. We consider these results to reflect more accurately the scenario in water consumption in Kaptembwo, given the expected variation in household size.

Overall, the per capita water consumption per day figure of 20.86 litres for the study area is far below international standards. According to World Bank (2009), the absolute daily minimum amount of water a person needs is 50 litres per day which include: 5 litres for drinking, 20 litres for sanitation and hygiene, 15 litres for bathing and 10 litres for preparing, food. However, in the study area, the average per capita is 20.86 litres per day. Based on the recommended basic water requirement of 50/l/c/d (World Bank, 2009), we can therefore observe that there is a mean daily water per capita shortfall of 33.3 litres in the study area. This implies that the basic water requirements of the residents of Kaptembwo are not adequately met. The low per capita daily water use in Kaptembwo location is indicator that accessibility to water, is low.

A study by UN Habitat (2010), in Kenya's three major towns, Nairobi, Mombasa and Kisumu observed that people only use about 5 to 11 litres of water per person per day.

Findings from this study are corroborated by results by Global Water Intelligence (2005) in their study in Kibera slums in Nairobi, according to which availability of utility water in urban areas is extremely low relative to subsistence benchmarks.This is attributed mainly to deficiencies in water treatment infrastructure. Another study by Owuor and Forken (2006) showed that the domestic water consumption in Kaptembwo was quite low compared to international standards. Further corroboration comes from studies conducted in Nakuru slums by Kimani Murage (2007) which found out that poor, inefficient and unreliable service delivery, low coverage of water supply and dilapidated water supply infrastructure were the main bottlenecks to access to water services by the residents.

4.3.2 Water supply and demandsituation in Kaptembwo Location

NAWASSCO is the major authority involved in provision and regulation of water supply in Nakuru town. Hence an analysis of Kaptembwo residents' perception of water supply and the extent to which it meets the demand was considered important to the study.

Table 17: Water Supply and Demand among the Residents of Kaptembwo.

			Basic water needs have not been met					Total
			Strongly disagree	Disagree	Unsure	Agree	Strongly agree	
Improved water supply by NAWASSCO	Strongly disagree	Responses	30	3	0	4	19	56
		%	53.6%	5.4%	0.0%	7.1%	33.9%	100.0%
	Disagree	Responses	5	5	0	0	2	12
		%	41.7%	41.7%	0.0%	0.0%	16.7%	100.0%
	Unsure	Responses	6	1	23	4	10	44
		%	13.6%	2.3%	52.3%	9.1%	22.7%	100.0%
	Agree	Responses	37	11	1	64	23	136
		%	27.2%	8.1%	0.7%	47.1%	16.9%	100.0%
	Strongly agree	Responses	15	2	0	0	5	22
		%	68.2%	9.1%	0.0%	0.0%	22.7%	100.0%
Total		Responses	93	22	24	72	59	270
		%	34.4%	8.1%	8.9%	26.7%	21.9%	100.0%

Source: Field Data, 2015

Table 18: Chi-Square Test

	Value	df	Asymp. Sig. (2-sided)
Chi-Square	200.111[a]	16	.001
Likelihood Ratio	166.928	16	.000
Linear-by-Linear Association	1.219	1	.270
N of Valid Cases	270		

The estimated Chi-square statistic is significant at 95% confidence level with 16 degrees freedom (because the p-value 0.001 < 0.05). Hence, we can deduce that the relationship between the supply of water by NAWASSCO and the amount of water accessed by residents is statistically significant. This indicates that there was very high interdependence between level of water supply and frequency of water availability in the network. The statistics further indicate that the role played by NAWASSCO in water provisioning has impacted negatively on the general availability and accessibility of water in low income households such as Kaptembwo.

The present water demand for Nakuru is estimated to be 100,000m^3/day (NAWASSCO 2007). NAWASSCO is currently supplying 40,000 cubic metres of water to the residents which is still short of the required supply. Figure 9 shows access to water supply by NAWASSCO since late 1990s to late 2000s.While NAWASSCO is the leading water provider within the entire Municipal boundaries, the reticulation has been confined to the built up areas. Research findings by Kimani-Murage and Ngindu (2007) in Nakuru revealed that the existing water network is an outdated distribution system which was done by Nakuru Municipal Council. Hence the vast area of Nakuru town is not under distribution network thereby affecting water accessibility in the low income areas. Access to safe water is believed to be essential for health security, livelihood, and quality of life, and is especially critical for women and children (WHO 2000). The minimum level acceptable standard for water supply service should be a household level water supply connection, that is, a direct piped connection for water supply within the household (World Bank, 2010).

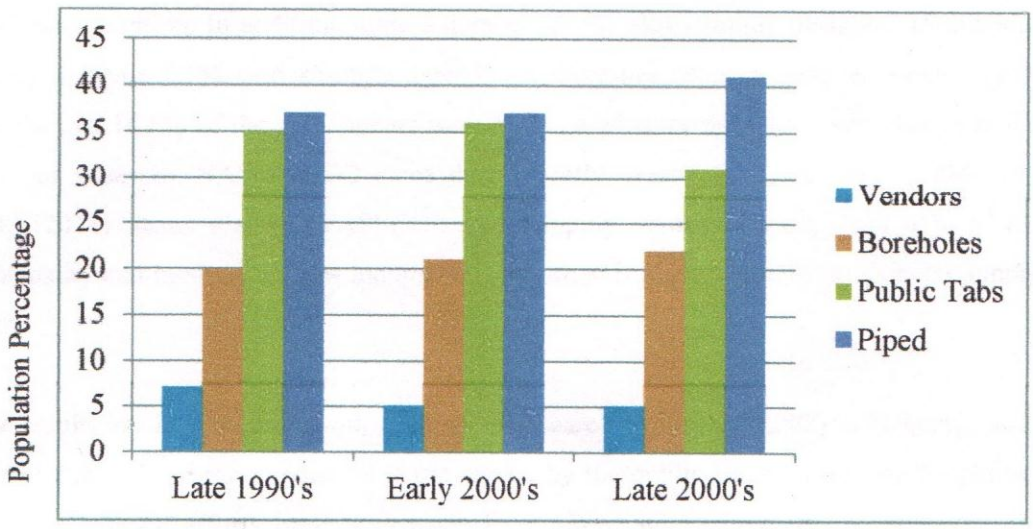


Figure 9: Access to Water Supply by NAWASSCO since Late 1990s to late 2000s

Source: Secondary Data, NAWASSCO, 2011.

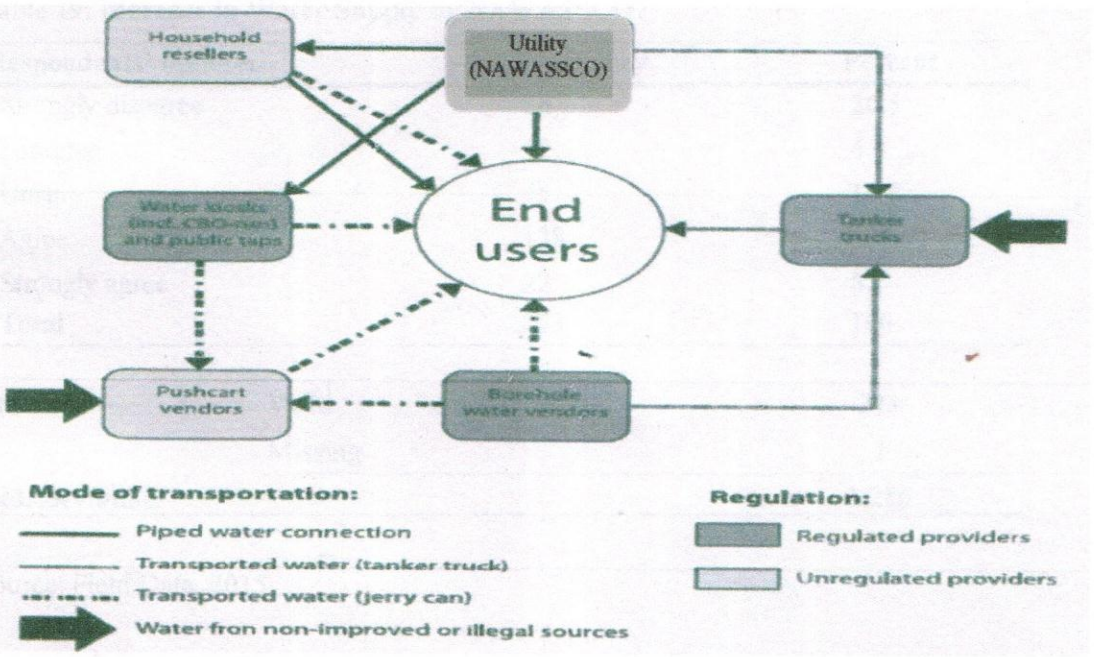


Figure 10: The water supply chain in Nakuru Town (Source: WASREB 2010)

4.3.3 Improvementof water supply by NAWASSCO

Table 19 shows feedback from respondents' level of perception as to whether or not there has been an increase in the supply of water by NAWASSCO. Their feedback indicates that about half of them 50.5% disagreed to the claim that NAWASSCO has increased the water supply

in the study location. In addition, quite a number 20.5% also strongly disagreed to this idea contrary to some 8.1% who strongly agreed that there has been increase in water supply. Nevertheless, 16.5% of the respondents were not sure whether there has been change in the supply of water by NAWASSCO since they recently moved to Kaptembwo (Table 19). KNBS (2011) shows that NAWASSCO's water supply network covers about 65% of the Municipality and most of the low income neighbourhoods are not connected to water supply system.

These results are in agreement with findings of research by Onjala (2002) in Nakuru, which revealed that 55% of the population is not served by the public water utility. Althoughfrom the study findings, efforts have been made by NAWASSCO to replace old pipelines and maintain pumping stations, the current water supply distribution system is inadequate and unreliable and has many deficiencies. Thus, the supply cannot cope with the increasing demand.

Table 19: Increase in Water Supply by NAWASSCO?

Respondents' opinion		Frequency	Percent
Strongly disagree		56	20.5
Disagree		12	4.4
Unsure		45.	16.5
Agree		138	50.5
Strongly agree		22	8.1
Total		273	100
N	Valid		273
	Missing		7
Std. Deviation			1.286

Source: Field Data, 2015

4.3.4 Current water supply situation in Kaptembwo location as compared to a period of five years back

Residents' comparison of the current water supply with a situation 5 years ago is depicted in Figure 11. It is observed that a significant number of residents 47% felt the supply of water had improved in addition to 38% who felt the supply has more or less remained the same. However, 15% felt the situation had worsened compared to the last 5 years ago (Fig. 11).

This implies more than half of the respondents in Kaptwembwo location are not satisfied with the water supply of the town. This finding is in agreement with a study by (UNDP 2006) according to which urban population growth out paces expansion of improved water supply sources.

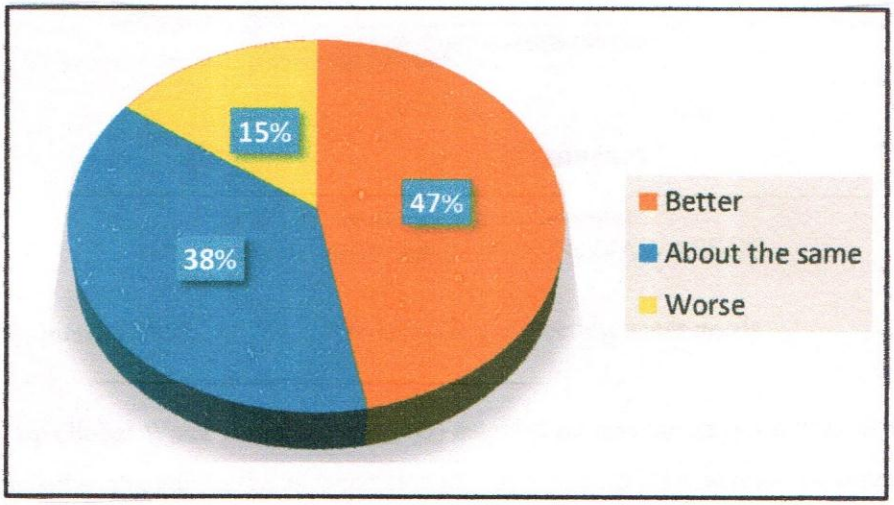


Figure 11: Current water supply compared to five years back in Kaptembwo location.

4.3.5 Meeting Residents'Water Needs

It is clear from Figure 12 that there are varied views concerning water needs by residents of Kaptembwo location. Most of the respondents differ with the view that their water needs have been met, while others strongly support it. A significant number agreed with the position that the water needs have been met as opposed to those who disagreed. The rest were not sure whether their water needs had been met or not (Figure 12). These views can be explained by household connection to the water supply and water service delivery variations. Approximately 6% percent of all low income area residents have a household connection, 66% use a yard tap connection, 16% a water kiosk, an estimated 2% receive water from a prepaid meter (yard tap) while an estimated 10% purchased their water from water kiosks operated by community groups, individual entrepreneurs or from pushcart vendors (NAWASSCO, 2013). These results corroborate a study by World Bank (2009) in urban centres in Central Africa Republic, in which it was observed that the average domestic water consumption was 6.5 litres per capita per day compared to 25 litres per capita per day recommended per person recommended by (World Bank, 2009).

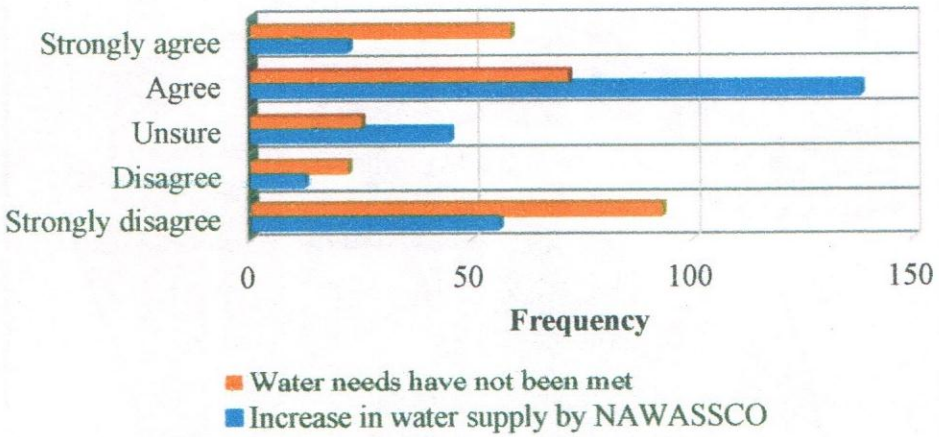


Figure12: Increase in supply by NAWASSCO and meeting water needs

A study by Global Water Intelligence (2005) established that the daily water consumption per capita in sub-Saharan Africa is exceptionally low due to deficiencies in water treatment infrastructure. These findings are consistant with the study findings (Table 16) which revealed that 2.6% of the households consume more than 100 litres of water per day as compared to 91.0% who consume between 20-100 litres per day. This implies that most households in Kaptembwo location were getting water below the minimum amount required for healthy living. According to KNBS (2010) low income areas in urban centres in Kenya with access to piped water supply is only 35%, and only 45% of the basic water requirements of the residents are met. Also only 25% of the households access the minimum recommended 50 litres consumption per capita per day (Ibid).Kakumu (2006) asserts that this is caused by low level of investment in water infrastructure.

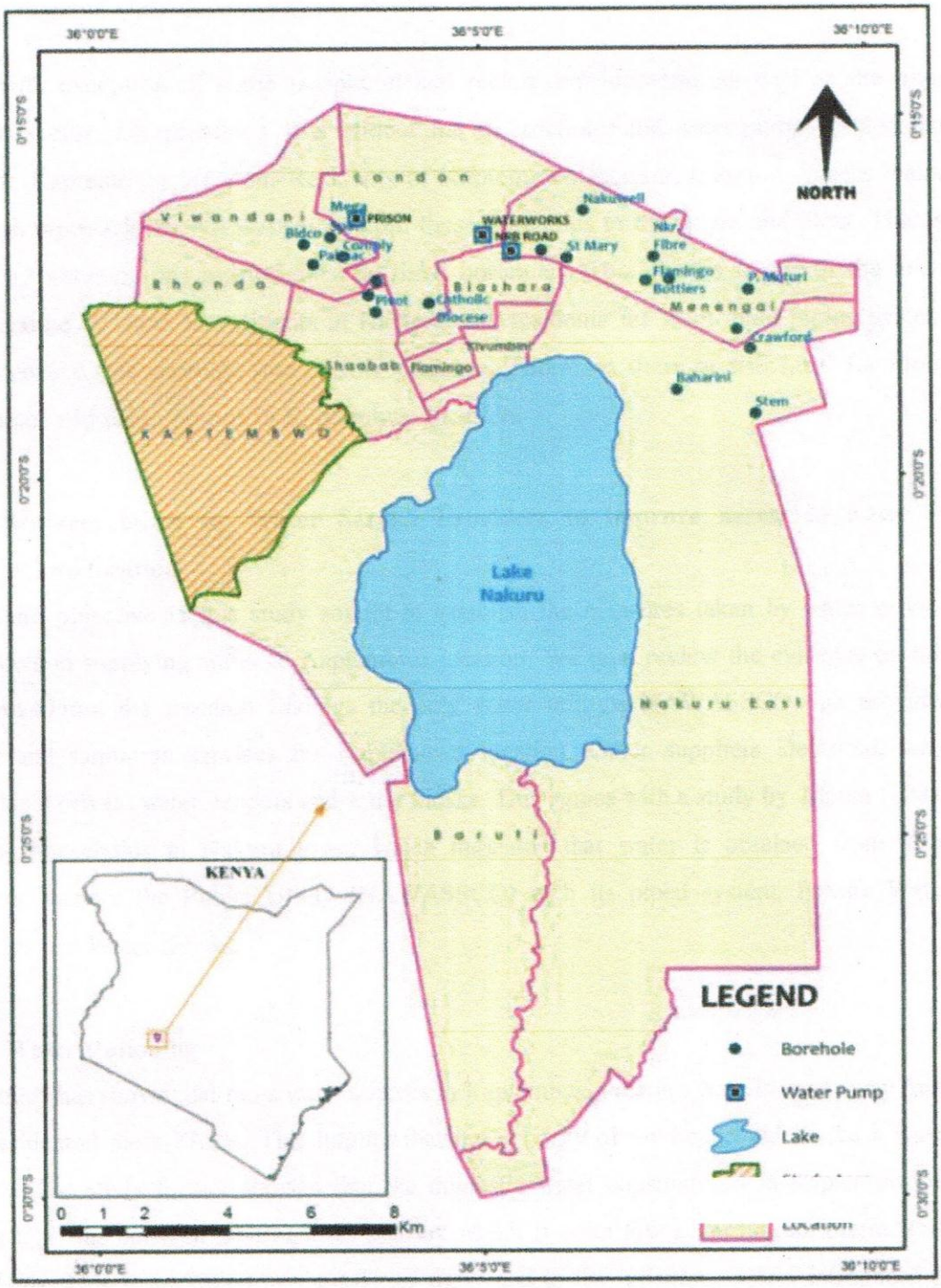


Figure13: Distribution of Boreholes and Water Pumps in Nakuru town. Source: National Bureau of Statistics 2011.

Figure 14 depicts the location and distribution of water pumps and boreholes in Nakuru Municipality. Water distribution network system is organised from the Eastern water treatment plants. Water is pumped to the distribution reservoirs and then channelled through the service connections. The distribution network covers the major part of Nakuru urban

area with exception of some peripheral and recent developments as well as the high density sector of Kaptembwo. It is evident that all boreholes and water pumps are located outside Kaptembwo location. Residents of Kaptembwo location therefore access water through pipes laid by NAWASSCO from these boreholes to the estate and plots. This is done by water pumps located close to these boreholes. Though this is one of the most vital source of water to residents in Kaptembwo, residents far from main piping system experience water shortage due to low pressure. Therefore there is still need for more boreholes and water pumps in Kaptembwo location.

4.4 Measures taken by Water Service Providers to improve access to water in Kaptembwo location

The third objective in this study sought to establish the measures taken by water service providers in supplying water to Kaptembwo location. We now review the evidence on this objective.From the research findings the only water utilityis NAWASSCO that provides water and sanitation services for Kaptembwo location. Other suppliers identified, were individual private water vendors and water kiosks. This agrees with a study by Meijer (2005) among households in Nakuru town, which indicated that water is obtained from three sources, namely the Public Utility (NAWASSCO) with its piped system, Private Water Vendors and Water Kiosks.

4.4.1 Water Rationing

The study has shown that most water sources in Kaptembwo location were located away from the residential plots 77.2%. This implies that the majority of the household shared a water source. The study further showed that the domestic water consumption in Kaptembwoper household was between 20-100 litres per day which is quite low according to international standards. This is attributed to shortage of water and to the rationing system introduced in 2000 in order to distribute water to the different sectors of the city by rotation. Data analysis shows that the level of satisfaction of household with the water supply services in Kaptembwo was only 47%. The main reasons for the high level of dissatisfaction were unfair and non-equitable distribution of water and poor management by NAWASSCO.

As a water managing and supplying body, NAWASSCO rations water supply to ensure equal distribution especially during the drier months. Piped water is made available only twice a

week to the residents. Kaptembwo area has been divided into zones with each allocated its own period of water supply. This rationing helps in regulating the amount of water supplied and also ensures that the little amount available is equitably distributed to all locations. However, this process of water rationing has not been efficient in ensuring water delivery and availability to all the residents. The two days per week of water supply is not regular and the water supply varies to the extent that some regions end up missing water during the week.

Studies by Owuor (2006) also indicated that water rationing system adopted by NAWASSCO as a means of sharing water was not equitable, as many areas especially the low income, are located at the far end of the pipe system were left unfairly without water due to low pressure and low velocity. In addition, the time of water supply is not uniform in the two days of the week. It may be either morning, afternoon or later during the day. Thisaffects water fetching since majority of the people are often away from their residential areas during the day. Hence many households are therefore deprived of water services most of the time.

Table 20: Water rationing schedules to Kaptembwo location

Days	Duration	Time
Tuesdays	4 hours	7-10 am
Fridays	4 hours	3-6 pm

Source: NAWASSCO, 2011

4.4.2 Construction of boreholes

Currently, there are about 17 boreholes in Nakuru Municipality located in Kabatini, Baharini and along Nairobi Road, which are owned and managed by NAWASSCO. The sinking and construction of these boreholes was mainly funded by African Development Bank. Table 21 provides a summary of the number of boreholes and amount of water made available. The boreholes have generally helped in improving accessibility to water since they are more reliable sources of water than piped water from NAWASSCO.

However, the boreholes have not been effective in supplying water to residents of low income areas such as Kaptembwo as none of the boreholeis located in the area. Water supply from the boreholes as indicated in Table 21 is below optimal, partly because the power interruptions that limit the amount to be pumped at a particular time. The nearby transformers are yet to have their power stepped-up hence affecting the amount of water currently pumped (USAID, 2012). In addition, some boreholes have a higher fluoride content (of up to 19mg/l)

compared to WHO recommended level of 1.5 to 3 mg/l (NEMA, 2011).Water from such boreholes is therefore not suitable for domestic consumption, unless treated.

Table 21: Boreholes and the amount of water production in Nakuru town.

Location	Number of boreholes	Amount of water in m^3
Kabatini	8	10,350
Baharini	5	6, 470
Nairobi Road	4	5,180
Total	17	22,000

Source: NAWASSCO, 2012

4.4.3 Supply of water from Vendors (Water Kiosks)

NAWASSCO has established water kiosks to boost water supply in Kaptembwo location. These kiosks are mainly operated by local vendors i.e. community based groups and entrepreneurs. There are about 4 water kiosks in Kaptembwo which operate for 6 days a week hence boosting water supply to the residents. These kiosks usually provide a price cheaper than other water suppliers. This is in line with decentralization policy of Kenyan government which is associated with better access to water in urban centres (KNBS, 2012).Although water kiosks mayhave helped a great deal in availing water to residents, they are still unreliable since most kiosks do not operate throughout the day (about 4 hours per a day) and majority do not operate on weekends due to water rationing. Therefore this source of water can be described as insufficient. In addition, the kiosks are also affected by the rationing of water hence they do not operate throughout the day and charge a price that is higher than NAWASSCO (USAID, 2012).

Table 22: Cost of water in Kaptembwo by Service Providers.

Water service providers	Price in Kshs	Unit in litres
NAWASSCO	5.00	1000
Water kiosks	5.00	20
Water vendors	20.00	20

Source: Field Data, 2015

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4.4.4 Water Provision by other Service Providers

In addition to the earlier discussed measures to avail water to the residents of Kaptembwo, other players include small scale water providers. These are mainly water vendors who operate animal drawn carts, bicycles or motorbikes. Though their prices are usually almost twice the cost of buying water from the kiosks or boreholes, these vendors contribute a great deal to improvingaccess to water in the studyarea. Residents who are located far from the water points usually depend on water vendors due to distance and lack of means of conveying the water to the residential plots.



Plate 2: Residents of Kaptembwo location drawing water from a private kiosk.

Plate 2 shows that most households in Kaptembwo location rely for their water on private kiosks. This shows that water kiosks are by far the most prevalent alternative to piped supplies. The prevalence of water kiosks and not house connection could be attributed to water culture where the water company still views the poor as unattractive investment and the residents prefer to meet daily water costs as opposed to monthly bills (Kakumu, 2006)

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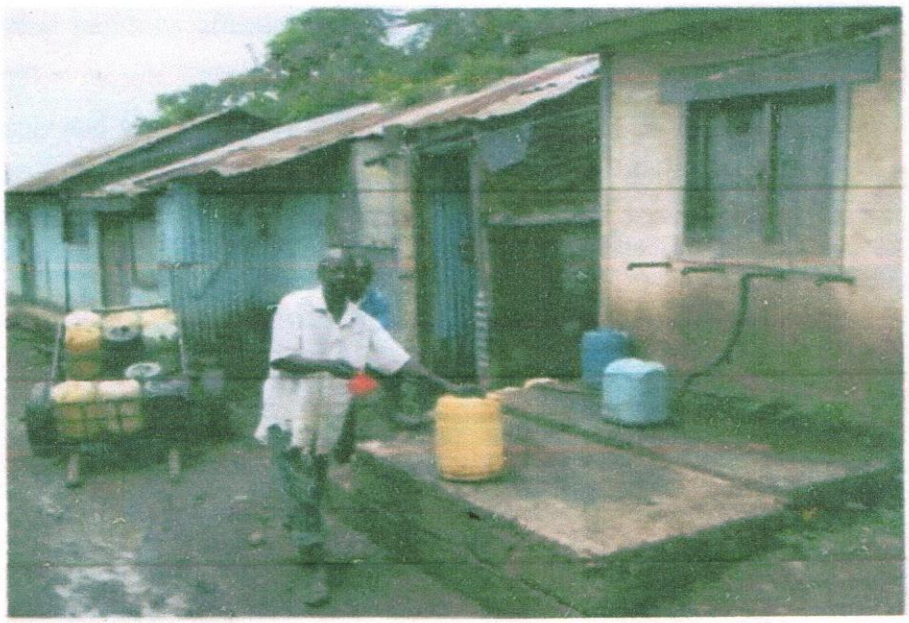


Plate 3: A water vendor draws water from a private water kiosk in Kaptembwo location.

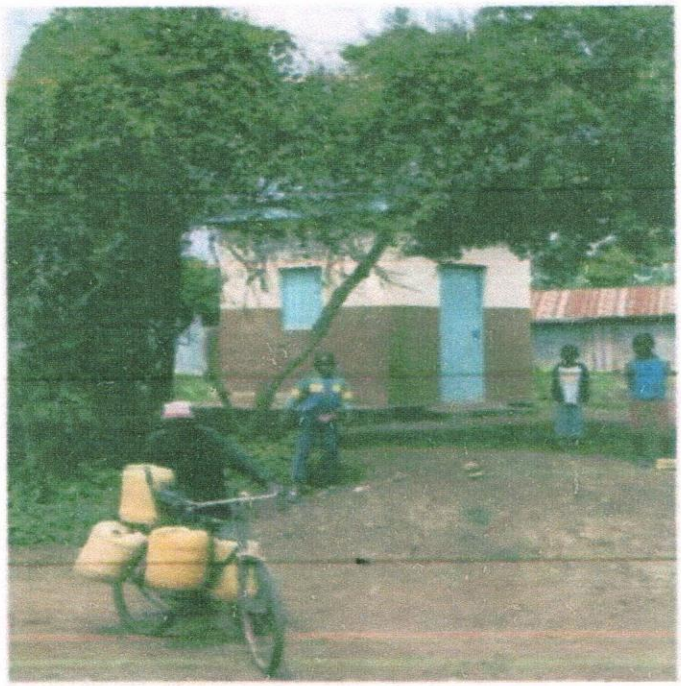


Plate 4: A vendor with a bicycle – load of water containers from a private water kiosk in Kaptembwo location

Plates 3 and 4 show that water vending is by far the most prevalent alternative to piped supplies in Kaptembwo location. This shows that NAWASSCO water supply is beset with

several problems affecting large proportions of Kaptembwo location. The water related problem include low service coverage by the water distribution network, intermittent mode of supply and long period of cut-offs. This implies that the current water supply distribution system is inadequate and unreliable and has many deficiencies to cope with increasing demand.

CHAPTER FIVE

SUMMARY, CONCLUSIONS AND RECOMMENDATIONS

5.1 Summary of the key findings

This research was carried out in Kaptembwo location in Nakuru town. From the survey, it was evident that there was a challenge of supplying adequate water to Kaptembwo due to many problems such as cost of water and fluctuation in the supply of water. The study focused on three main objectives namely: to determine factors influencing access to water amongst low income residents of Kaptembwo location, to analyze the water access situation in Kaptembwo location and to establish the measures taken by water service providers to improve access to water services in Kaptembwo location. The study used a descriptive survey design which targeted the low income households in Kaptembwo and involved a sample of 280 households. Data was captured through administration of structure interviews through questionnaires administered to the respondents. Data collected was analyzed using (SPSS) version 20.

On the basis of this study, the following findings are made: as one of the factors influencing access to water 57% of the sampled respondents identified distance to the nearest water source as the most notable followed by infrastructure 28% and income 15%.The study has revealed that the amount of water accessed by individual personsin Kaptembwowas below the international standard of 50 litres consumption per person per capita per day for drinking, washing and cooking per day. This was attributed to many compounding factors such as shared water points, insufficient production capacity by NAWASSCO and inefficiencies of service providers. The study has also identified supply measures employed by water service providers to improve access to water services in Kaptembwo location. These included water rationing by NAWASSCO, sinking of boreholes and establishment of water kiosks. These, however, have not meaningfully improved access to water in the study area as the water supply system is still beset with several problems affecting large proportion of the residents in Kaptembwo location. The water related problems include low service coverage by the water distribution network, intermittent mode of supply and long periods of cut-offs. These problems are related mainly to limited or scarce water sources, substantial water losses due to leakage, limited hydraulic capacity of the water distribution system and ineffective system of management.

5.2 Conclusion

It is clear from the results that the proportion of households with access to water in Kaptembwo location is quite low.

The residents' water needs in Kaptembwo location have not been fully met.This may be attributed to the current water distribution conditions in the study area. These conditions include low service coverage by the distribution system, intermittent mode of water supply, and long periods of cut-offs.

The measures employed by NAWASSCO such as water rationing and establishment of water kiosksare not effective to provide long-term permanent water service provisionsolution.

5.3 Recommendations

Based on the findings and conclusions of the study, the following recommendations were made: - (a) Policy recommendations

NAWASSCOshould ensure fair distribution of water sourceS. Public water points and pipes ought to be evenly distributed in order to address the problem of the people in Kaptembwo location. Moreover, installation of additional public water points could narrow down the gap between demand and supply by taking into consideration of the number of people, density and distance between water points.

The government should also subsidize the water supply to reduce the cost paid by poor community members. The rate paid to water vendors in Kaptembwo is ten times higher the rate declared by the WRU. In addition,WRMA and WASREB should look for grants from development partners to assist WSP in funding the water investment requirements (Infrastructure expansion) in Kaptembwo location.

Most of the water in nakuru town is sourced for boreholes. This water is inadequate to meet the needs of the resindents. WRMA and WASREB should look for alternative water sources.

(b) Suggestions for further research

There is need for further research to critically analyze other factors affecting access to water in Kaptembwo location. This will provide further insight to low access of water among the, low income residents.

The effectiveness of water distribution network by NAWASSCO, water vendors and water kiosks should be investigated further, to ascertain the adequacy, availability and quality of water supply in Kaptembwo location.

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APPENDIX I: QUESTIONNAIRE FOR HOUSEHOLDS

Dear Respondent,

My name is SamwelMokaya, a student of Egerton University, undertaking a master's degree in Geography. The programme in I am enrolled requires that I carry out a field-based research in my area of study. The topic of my research is Assessment of factors that determine access to water and related services amongst low income residents of Kaptembwo in Nakuru town. You are one among several respondents who have been randomly selected to provide information and insights on this study. In view of this, I wish to humbly request you to answer the questions listed below. Please be as sincere as possible. I wish to assure you that the information you give will be treated with utmost confidentiality, and will be used for academic and no other reason. Thank you for choosing to support this research through offering of your most valuable time.

SECTION A Respondents' Social –Economic Profile

No.....Location.....Date.....

Instructions: Please tick (√) the appropriate response.

1. Name of Respondent (optional) ----------

2. Respondents Age

18-30 ☐ 31-40 ☐ 41-50 ☐ 51-60 ☐ 61+ ☐

3. Respondent's Gender

Male ☐ Female ☐

4. Marital status (SM provide options)

1. Single ☐
2. Married ☐

5. Level of Education attained.

No formal education ☐

Primary ☐

Secondary ☐

Tertiary ☐

University ☐

6. Household size (tick number of people.

1 ☐ 2 ☐ 3 ☐ 4 ☐ 5 ☐ 6 Others (Specify) ☐

7. Occupation.

1. Business ☐ 2. Juakali ☐ 3.Farming ☐ 4. Security ☐

Others Specify.....

6. What is your average monthly income?

1. Less than Ksh 5,000 ☐

2. BetweenKsh 5,000-10,000 ☐

3. BetweenKsh 10,000- 15,000 ☐

4. More than 15,000 ☐

SECTION B: Households' access to water

1. What is the main source of drinking water for members of your household? (Tick as may be appropriate)

1. Rain Water ☐ 2. Piped Water ☐ Borehole ☐

4. Others. ☐

2 What is the main source of water used by your household for cooking and personal hygiene? (Tick as may be appropriate)

1. Rain Water ☐ 2. Piped Water ☐ 3. Borehole ☐

4. Others. ☐

3 Which water source do you prefer? Provide options

1. Rain Water ☐ 2. Piped Water ☐ 3. Borehole ☐

4. Others. ☐

4 From where exactly do you get your water?

1. Water is piped into the house ☐
2. water drawn from a water point at the plot ☐
3. water accessed from elsewhere ☐

5. How much water does your household need per day?

1. Up to 20 litres ☐ 2. Between 20 and 100 litres ☐

3. More than 100 litres ☐

6. Does the household's need vary with time (season)?

1. Yes ☐ 2.No ☐

7. If the answer to Q6 is Yes, what factors contribute to the variation in demand?

1. Rationing ☐ 2. Distance to the nearest water point ☐

3. Distribution network ☐ 4. Water pressure ☐

5. Burst Pipes ☐ 6. Others specify.....

8. How much water does your households get per day?

Up to 20 litres ☐ Between 20 and 100 litres ☐ More than 100 litres ☐

9. If the answer to Q8 is Yes, what factors contribute to the variation in supply?

1. Number of people ☐ 2. Variation in Income ☐

3. Variation in season ☐

10. How long does it take to get water in a day?

1. 30 minutes ☐ 2. 1 hour to 2 hours ☐ 3. Others Specify.....

11. During which months of the year is water shortage most experienced?

1. January to March ☐ 2. April to June ☐

3. July to September ☐ 4. October to December ☐

12. What measures does your household take to deal with water experienced in Q 11?

1. Rationing ☐ 2. Water Vendors ☐ 3. Use of river water ☐

4. Others specify.....

13. Compared to a period of 5 years ago, what is the current water supply situation today?

1. Better than 5 years ago ☐ 2. Situation has not changed ☐

3. Worse than 5 years ago ☐ 4. No idea ☐

14. In your opinion whose responsibility is it to supply water in your location?

_____

15. How efficiently has/have this/these organization (s) supplied water to your area?

1. Very efficient ☐ 2. Efficient ☐ 3. Not Efficient ☐

4. Poor 5. Don't know ☐

16. In your opinion would you agree that residents' basic water needs have been met?

1. Strongly disagree ☐ 2. Disagree ☐ 3.Agree 4. Strongly agree ☐

4. Unsure ☐

UNIVERSITY OF NAIROBI

17. Overall what problems do you face in trying to get water for use for your household?

_____

_____

_____

18. In your opinion what factors influence the access of water in your area of residence?

_____

_____

_____

Thank you, for providing this information.

APPENDIX II

QUESTIONNAIRE FOR NAWASSCO

Dear Respondent,

My name is SamwelMokaya, a student of Egerton University, undertaking a master's degree in Geography. The course requires that I carry out a research in my area of study. My research topic is Assessment of factors determining access to water services amongst low income residents in Nakuru town. You have been selected as one of the research respondents. Kindly answer the question below as sincerely as possible. The information you give will be highly appreciated and most importantly be treated with confidentiality.

I. Water Supply and Demand in Kaptembwo

No of Questionnaire **Date.of Questionnaire Administration.....**

1. Name of Respondent (optional) ----------

2. Department / Section. _____

3. Do you have a water ration plan for different residential estates in Nakuru town?

Yes ☐ No. ☐

3. What is the current water demand (in cubic metres) in Nakuru town?

_____

4. What is the current water consumption (in cubic metres) in Nakuru town?

_____

5. What is the current water demand (in cubic metres) in Kaptembwo?

_____

6. What is the current water supply (in cubic metres) to Kaptembwo?

_____

7. In your opinion, are the residents of Kaptembwo receiving adequate water supply to meet their needs?

1. Yes ☐ 2. No. ☐

8. If No to question no. 7 explain the reasons as to the inadequacy

_____

_____

_____

9. In view of the inadequate supply, what measures does your organization take to ensure satisfactory supply?

_____

_____

_____

10. In your opinion, what infrastructural facilities or changes need to be put in place to help improve the supply of water in low income areas such as Kaptembwo?

_____

_____

_____

11 What factors determine water supply to low income residential location such as Kaptembwo?

_____

_____

12. What are the challenges does NAWASSCO face in supplying water to low income residential areas such as Kaptembwo?

_____

_____

_____

13. Besides NAWASSCO who else is involved in water supply in Nakuru town?

_____

14. How does NAWASSCO relate to these other water service providers?

_____

_____

Thank you, for providing this information.

APPENDIX III

KEY INFORMANT INTERVIEW SCHEDULE

Dear Respondent,

My name is SamwelMokaya, a student of Egerton University, undertaking a master's degree in Geography. The programme requires that I carry out a research in my area of study. My research topic is 'Assessment of factors determining access to water services amongst low income residents in Nakuru town. You have been randomly identified as one of the respondents to provide information and insights that would assist to answer the research questions. Kindly answer the questions below as sincerely as possible. The information you give will be highly appreciated, and most importantly, will be treated with confidentiality.

Interview Questions

1. Name of service provider.....
2. Which of the following best describes who you are:

   1. Water vendor fixed kiosk ☐ (2) itinerary water vendor ☐

   3. Borehole owner/supply of water ☐ 4. Any other (specify). ☐

3. How long have you been operating as a water vendor? Provide options

   1. < 5 years ☐ 2.5-10 years ☐ 3. 10-15 years ☐

4. What factor(s) prompted you to supply water as a vendor?

   1. Opportunity to make money ☐ 2. Occupation 3. ☐ hers specify.....

5. What is the source of the water you supply?

   _____

6. Compared to a situation 5 years ago, how would you rate the current water supply situation in Kaptembwo?

   1. Improved significantly ☐ 2. Improved ☐ 3. Remained the same ☐

   4. Not improved ☐ 5. Don't know. ☐

7. If your answer to Q6 is option 4, what factors hinder effective supply of water to low income areas such as Kaptembwo?

   _____

   _____

   _____

8. How much water (in 20 litre jerry cans) do you sell in a day?

   1. < 20 ☐ 2.20-40 ☐ 3.40-60 ☐ 4. 60-80 ☐

   5. 80-100 ☐ 6. Others specify.....

9. What challenges do you face in supplying water to residents of Kaptembwo?

   _____

   _____

   _____

10. Indicate the infrastructural facilities or service (s) that Nakuru low income residents urgently require to improve access to water.

    _____

    _____

    _____

APPENDIX IV

RESEARCH PERMIT

CONDITIONS

1. You must report to the County Commissioner and the County Education Officer of the area before embarking on your research. Failure to do that may lead to the cancellation of your permit
2. Government Officers will not be interviewed without prior appointment.
3. No questionnaire will be used unless it has been approved.
4. Excavation, filming and collection of biological specimens are subject to further permission from the relevant Government Ministries.
5. You are required to submit at least two(2) hard copies and one(1) soft copy of your final report.
6. The Government of Kenya reserves the right to modify the conditions of this permit including its cancellation without notice.

REPUBLIC OF KENYA

National Commission for Science, Technology and Innovation

RESEARCH CLEARANCE PERMIT

Serial No. A 4071

CONDITIONS: see back page

THIS IS TO CERTIFY THAT:
MR. SAMWEL BOGONKO MOKAYA
of EGERTON UNIVERSITY, 1238-20100 nakuru,has been permitted to conduct research in *Nakuru County*

on the topic: "*ASSESSMENT OF FACTORS DETERMINING ACCESS TO WATER SERVICE AMONGEST LOW INCOME RESIDENTS OF NAKURU MUNICIPALITY, KENYA: A CASE STUDY OF KAPTEBWO LOCATION*

for the period ending:
31st March,2015

.....
Applicant's Signature

Permit No : NACOSTI/P/15/4252/4306
Date Of Issue : 26th January.2015
Fee Recieved :Ksh 1,000



.....
Secretary
National Commission for Science, Technology & Innovation

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APPENDIX II

RESEARCH AUTHORIZATION



NATIONAL COMMISSION FOR SCIENCE, TECHNOLOGY AND INNOVATION

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Email: secretary@nacosti.go.ke
Website: www.nacosti.go.ke
When replying please quote

9th Floor, Utalii House
Uhuru Highway
P.O. Box 30623-00100
NAIROBI-KENYA

Ref: No.

Date:

26th January, 2015

NACOSTI/P/15/4252/4306

Samwel Bogonko Mokaya
Egerton University
P.O. Box 536-20115
EGERTON.

RE: RESEARCH AUTHORIZATION

Following your application for authority to carry out research on ***"Assessment of factors determining access to water service amongst low income residents of Nakuru Municipality, Kenya: A case study of Kaptebwo Location"*** I am pleased to inform you that you have been authorized to undertake research in **Nakuru County** for a period ending **31st March, 2015.**

You are advised to report **the County Commissioner and the County Director of Education, Nakuru County** before embarking on the research project.

On completion of the research, you are required to submit **two hard copies and one soft copy in pdf** of the research report/thesis to our office.

DR. S. K. LANGAT, OGW
FOR: DIRECTOR-GENERAL/CEO

Copy to:

The County Commissioner
Nakuru County.

The County Director of Education
Nakuru County.

National Commission for Science, Technology and Innovation is ISO 9001: 2008 Certified