

**FACTORS AFFECTING WATER GOVERNANCE AND ACCESSIBILITY AMONG  
HOUSEHOLDS IN HURUMA INFORMAL SETTLEMENT, NAIROBI**

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A research paper submitted to the Department of Geography & Environmental Studies in the Faculty of Arts in partial fulfillment for the award of the degree of Master of Arts in Environmental Planning and Management of the University of Nairobi.

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## DECLARATION

I declare that this research project is my original work and to the best of my knowledge has not been presented for award of degree in any other University.

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This research project has been submitted for examination with our approval as the University of Nairobi supervisors.

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(Supervisor)

Signature.....Date.....

**Dr. Samuel Owuor**

(Supervisor)

## **DEDICATION**

For my late sister Irene A. Otieno. Thank you for your stewardship in my pursuit of academic excellence.

## ACKNOWLEDGEMENT

I am thankful to the Almighty God for His blessings, for a sound state of mind and impeccable health which has enabled me to achieve this important academic milestone. The successful completion of this research project has been made possible by the selfless and endless efforts of my mentors, friends and colleagues not only from the University of Nairobi fraternity, but also from beyond this great academic institution. I am particularly grateful to my two resourceful and supportive supervisors, Professor George Krhoda and Dr. Samuel Owuor. I thank them for articulating my ideas into what I can confidently term as a coherent piece of scholarly work. Their professional guidance and absolute devotion has made this research project a success.

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## **ABSTRACT**

The enactment of the Water Act of 2002 has been hailed as an important milestone in the reform and subsequent improvement of the water sector in Kenya. The Act established institutions that separated the three key functions of policy formulation, regulation and service provision. Though some challenges still exist, considerable progress has been made in the management of resources and provision of water services. However, the pace of reforms has not been able to contend with pressing development issues especially in informal settlements. The Water Services Trust Fund was created and mandated to provide financial support for improved access to water and sanitation in areas without adequate services. Almost a decade later, the challenges facing informal settlements continue to exist. The ultimate goal of the study was to assess water governance in informal settlements in Kenya's Nairobi County and evaluate the different factors that affect access to water for households. The objectives of the study were to identify the sources of water for households in Huruma and to identify the formal and informal actors involved in the provision of water in the area. The study also sought to highlight the challenges faced by both water actors and households in the provision and access to water respectively. The study adopted both quantitative and qualitative approaches in data collection and analysis. This involved administration of structured and open ended questionnaires. Key stakeholders were identified and simple random sampling method used to select households, water vendors, civil society groups, administrative authorities and water service providers, both legal and illegal. A sample size of 100 randomly selected households and 20 different water vendors operating in the study area were selected to supplement data and information collected through focus group discussions. The per capita daily water demand was barely within the limits of basic access of service level. The study also revealed challenges related to the poor quality of water supplied to households. In relation to cost of water, over ninety percent of household spent about one fifth of their monthly income on water. It emerged that households in informal settlements, with lower purchasing power parity, paid over 12 times more for water than households depending entirely on water supplied by Nairobi City Water and Sewerage Company. Leaking water pipes, illegal water connections, poor condition of access paths and harassment by administrative authorities were some of the challenges affecting water actors sampled in the study area. The study recommends that the water service provider together with other stakeholders first address the reported leakages of water to prevent further losses. This includes efforts to disconnect all illegal water connections, which according to the study, have led to the economic exploitation of

poor households in informal settlements. The study also recommends that the number of *water kiosks* in strategic areas be increased to reduce the distance travelled and time taken to access water. Eventually, the main aim should be geared towards individual water supply connections to ensure optimal water access. Finally, the study recommends the exploitation of alternative water sources such as rainwater harvesting, together with the commensurate infrastructure capacity for water capture and safe storage.

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## **LIST OF ACRONYMS**

CAACs: Catchment Area Advisory Committees  
CBO: Community Based Organization  
GWP: Global Water Partnership  
NCWSC: Nairobi City Water and Sewerage Company  
NGO: Non-Governmental Organization  
SHG: Self Help Group  
UNDP: United Nations Development Programme  
UN-HABITAT: United Nations Center for Human Settlements  
WAB: Water Appeal Board  
WARMA: Water Resources Management Authority  
WASREB: Water Services Regulatory Board  
WRUAs: Water Resource Users Associations  
WSBs: Water Services Boards  
WSP: Water Sanitation Provider  
WSTF: Water Services Trust Fund

## **DEFINITION OF KEY TERMS**

### **Standpipe**

A freestanding pipe fitted with a tap which is installed outdoors to act as a communal water supply point for neighbourhoods which lack individual housing water service.

### **Water cartel**

A group of individuals who illegally gain access to water from the utility's main supply network by disrupting normal supply through illegal connections in an effort to re-sell the water at a higher cost and manipulating prices.

### **Water kiosks**

These are booths for the sale of tap water. They mostly receive treated water from utilities through a piped distribution network and act as access points for water users in areas without individual housing water service

## **CHAPTER 1: INTRODUCTION**

### **1.1 Background of the study**

In many developing countries, governance of the water sector as a whole is in a state of confusion and dysfunction with little responsiveness or accountability to citizens (Tropp, 2005). Recent studies show a direct correlation between the countries most lacking in water services and those with poor governance (United Nations Development Programme (UNDP) 2004; United Nations 2005). As a result of these governance challenges, the disparity in access to water supply in developing countries like Kenya is stark, and majority of urban dwellers do not have a networked water-supply connection. (Bakker, 2010). The few who are lucky to have access do not rely entirely on the network for all their water supply needs. This increases their reliance on alternative sources of water such as from mobile water vendors and illegal water connections run by cartels which are often unsafe and unreliable.

The combined concept of market failure, state failure and governance failure as portrayed by Bakker, (2010) affects the provision of urban water supply and lead to exclusion of the urban poor in accessing public resources. This failure also plays a major role in perpetuating the contemporary urban water crisis. It is also critical to note that in many cities, especially in developing countries, water supply networks do not operate homogeneously over the urban landscape. Rather, they overlap with what policy experts would term as ‘alternative service delivery mechanisms’. It is therefore appropriate to identify these mechanisms as spatially separated but linked ‘islands’ of networked supply in the urban fabric. And the distribution of this network is highly correlated with household income. It is a common sight where large water mains run through a poor community yet the adjacent homes do not have outlets to access the water. This brings about critical concern for equity and the right to access basic resources in urban areas. The urban poor are particularly highly vulnerable since governments and local authorities are faced with financial and institutional challenges. This has led to their inability to extend public services to socio-economically marginal areas of the city. This research study seeks to assess water governance in informal settlements based on how households access water. It seeks to identify the sources of water, the actors involved in the provision of water and the



challenges faced by both actors and households. In the assessment, factors influencing access to water such as water quantity, quality, costs, distance, and time and to a less extent participation will be analysed against recommended limits of water service indicators.

## **1.2 Statement of research problem**

Social analysts such as (Kaufmann et al., 1999) have shown that there is a strong causal relationship between better governance and better development outcomes. Poor governance is a barrier to development and hurts the poor through both economic and non-economic channels, making them more vulnerable and unable to adapt to changes. The Water Act (2002) was aimed at improving both water and sanitation service provision through better governance and setting up of new sector institutions. The reforms have created a new institutional framework which has devolved water and sanitation services to water service boards. It is the transition from policy to practice that make these reforms ineffective in ensuring that poor households have access to safe, adequate, and affordable water as enshrined in the Constitution of Kenya. Documented evidence has shown an increase in the rate of urbanization in Kenya. This signifies that informal settlements will continue to grow at an unprecedented rate and thus increasing the demand for utility services like water. Amidst these trends, the inability of water service providers to provide adequate and affordable water has created ideal conditions for illegal water vendors to thrive. The resulting situation is that households have limited sources of water with limited quantities and generally unacceptable quality levels. Moreover, households pay significantly higher costs for water than other households in well-to-do areas. These are indicators of ineffective water governance and have a direct impact on how households access water. It is therefore important to understand the sources of water in informal settlements, the actors involved in the provision of water and the challenges faced by both households and actors. Through the assessment of these challenges, an effective water governance framework can be formulated and as a result, lead to improved development outcomes in other water-related sectors like health and education.

### **1.3 Research objectives**

The broad objective of this study is to examine and assess water governance in the context of accessibility to water in informal settlements.

The specific objectives of the study are -

1. To identify the sources of water for residents in Huruma.
2. To identify formal and informal actors involved in the provision of water in Huruma.
3. To highlight the challenges faced by water actors and residents in the provision and access to water respectively.

### **1.4 Research questions**

The study is focused on answering the following research questions -

1. What are the sources of water for residents in Huruma?
2. Who are the formal and informal actors involved in the provision of water in Huruma?
3. What are the challenges faced by water actors and residents in the provision and access to water respectively?

### **1.5 Justification for the study**

Previous studies carried out on water issues in informal settlements have been limited to analyzing individual components of accessibility to water such as water quality, affordability and proximity to piped supply networks. However, little research has been done in studying these components as units of analysis which influence access to water and by extension define the effectiveness or otherwise of water governance in an area. It is widely assumed that informal settlements lack effective management structures especially in relation to resource allocation and use. An initial survey of the water access situation in Huruma indicated that households relied heavily on *water kiosks* even though some have been reduced to idle structures due to lack of

water. This has resulted in the emergence of small scale water vendors in the area, who increase charges arbitrary depending on the availability, and convenience of their source of water irrespective of the quality. There are many incidences of illegal water connections in Huruma and most of these are connected using artisanal methods which result to huge water losses. The problem is so rampant that it was alleged by some residents during the reconnaissance visit, that an illegal connection exists on the water mains which supplies the Kenya Air force base nearby. However, these claims have not been independently verified by the researcher.

These characteristics make this a timely study, whose outcome is expected to generate valuable insight in access and management of water in informal settlements of urban areas and also evaluate the impact of the interventions by various stakeholders.

## **1.6 The study area**

The research study was based in Mathare valley and specifically in Huruma area. Huruma location is situated in Central Division of Nairobi North District. The total population in Huruma is estimated at 106,319 consisting of 54,787 males and 51,532 females according to the 2009 population census. Huruma as a whole occupies a total land area of 1.4 square kilometers with a population density of 77,656 persons per km<sup>2</sup> in about 34,017 households built on land originally belonging to the City Council of Nairobi. The study was focused in two sections of Huruma namely, Ngei 1 and Kiamaiko. The total population in the study sites Kiamaiko and Ngei 1 is 70,082 persons. In Kiamaiko, the total population stood at 33,824 persons by the year 2009. These areas occupy a total land area of 0.9km<sup>2</sup> with a population density of 50,620 persons per km<sup>2</sup>. There are about 21,615 households of which 10,217 of those enumerated in 2009 occupied a spatial area of 0.67 km<sup>2</sup> in Kiamaiko while 0.23 km<sup>2</sup> were in Ngei 1. These settlements have been in existence for over 30 years (GoK, 2010). The population is generally middle aged reflecting similar statistical characteristics of the County of Nairobi. The entire study area is delineated by the Mathare River which defines the northern boundary while Juja road defines the boundary to the south. The selection study area was influenced by the following factors;

- A previous reconnaissance study to the study area had revealed challenges in accessibility of water and this prompted the need for further research.

- Media reports on the high number of illegal connections and high number of car wash outlets that had resulted in water-related conflicts. A few residents and youths who owned the car wash outlets always had water even when the entire settlement experienced acute water shortage.

The national, regional and local contexts of the study area are represented graphically on Figure 1.6a, Figure 1.6b, and Figure 1.6c

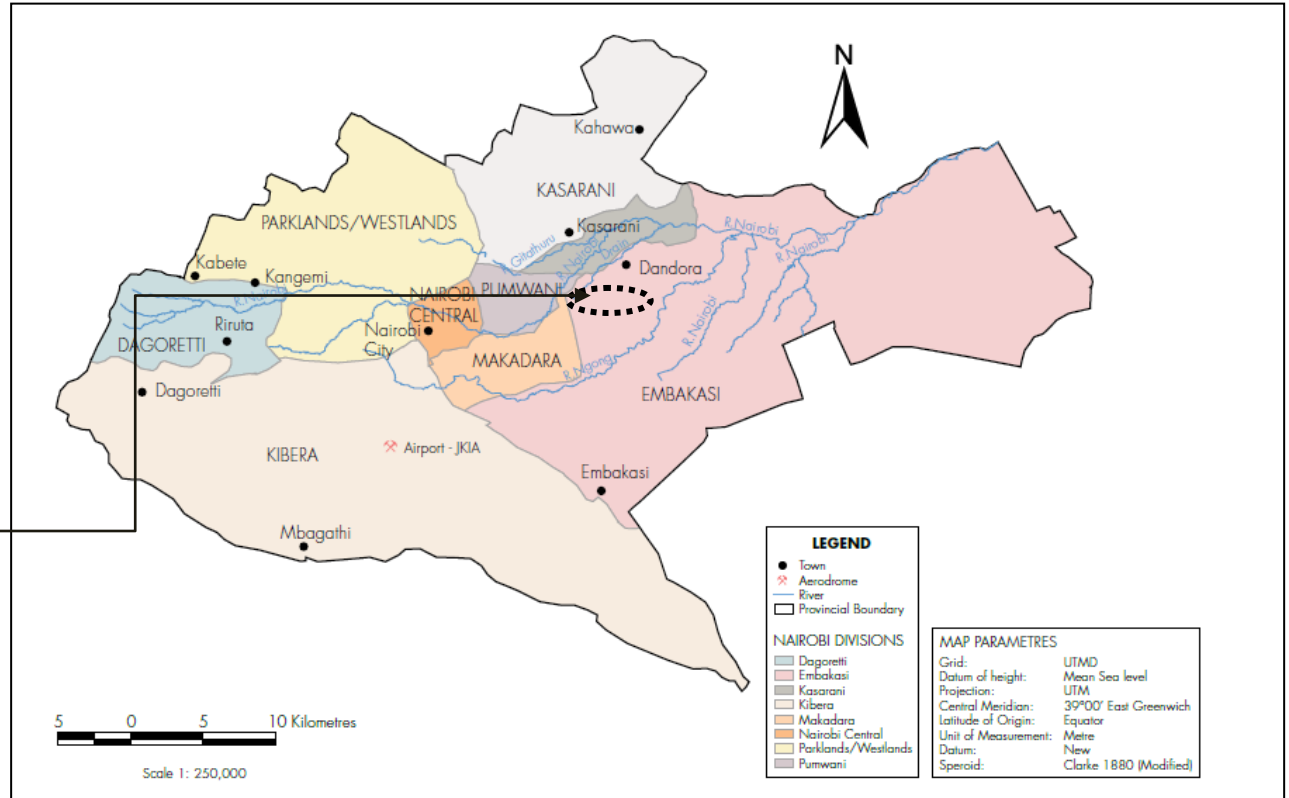
Figure 1.6a: Location Context

**NATIONAL CONTEXT**



Source: CRA, 2012

**REGIONAL CONTEXT**



Source: RCMRD, 2009



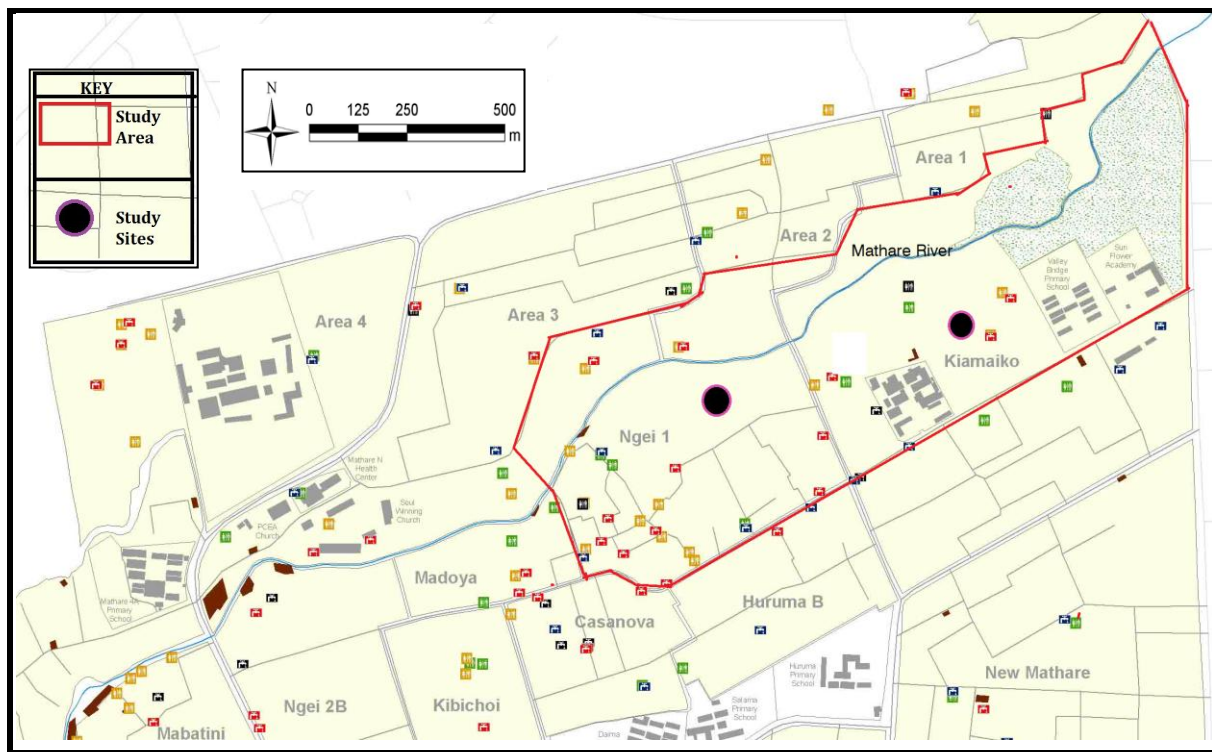
*Study area*

Figure 1.6b: Aerial view of Huruma settlement and its immediate environs



Source: Google Maps (with researcher's modification), 2012.

Figure 1.6c: Detailed map of study area



Source: [www.mapkibera.org](http://www.mapkibera.org) (with Researcher's modifications), 2012.

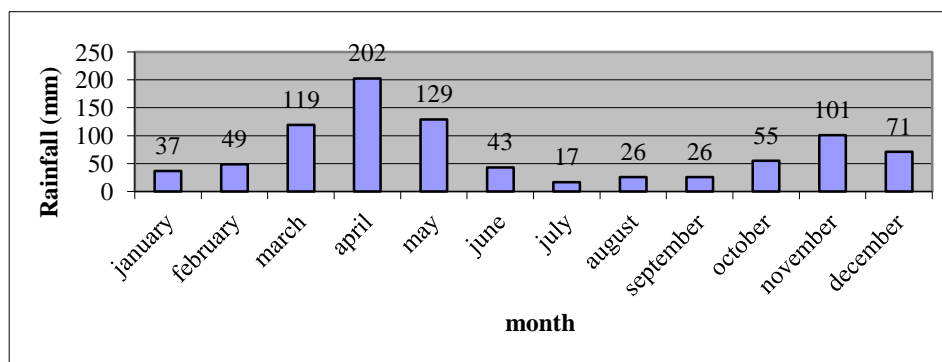
## 1.7: Physical Characteristics

### 1.7.1: Rainfall

The average annual rainfall for Nairobi is about 900mm, but the actual amount in any one year may vary from less than 500 mm to more than 1500 mm. For the purpose of this research project, the amount of rainfall for Nairobi will be taken to be encompassing that of Huruma. There are two rainy seasons, from mid-March to the end of May (the long rains), and from mid-October to mid-December (the short rains). The dates on which these rainy seasons start and end vary. In fact the beginning and end of a wet season are not well defined. These seasons approximately coincide with the time of changeover of the monsoon currents which affect Eastern Africa, the south-west monsoon becoming established in April, and north-east monsoon in November. The rains form a basic source of water for catchment areas thus informed knowledge of the rainfall pattern helps all stakeholders in the water sector to know when to experience water shortages and put in place mitigation efforts.

Heavy rains also cause havoc in the city and generally leads to floods in areas where drainage is poor. Informal settlements are mostly affected. Figure 1.7.1a shows the mean monthly rainfall in Nairobi.

Figure 1.7.1: Mean monthly rainfall in Nairobi



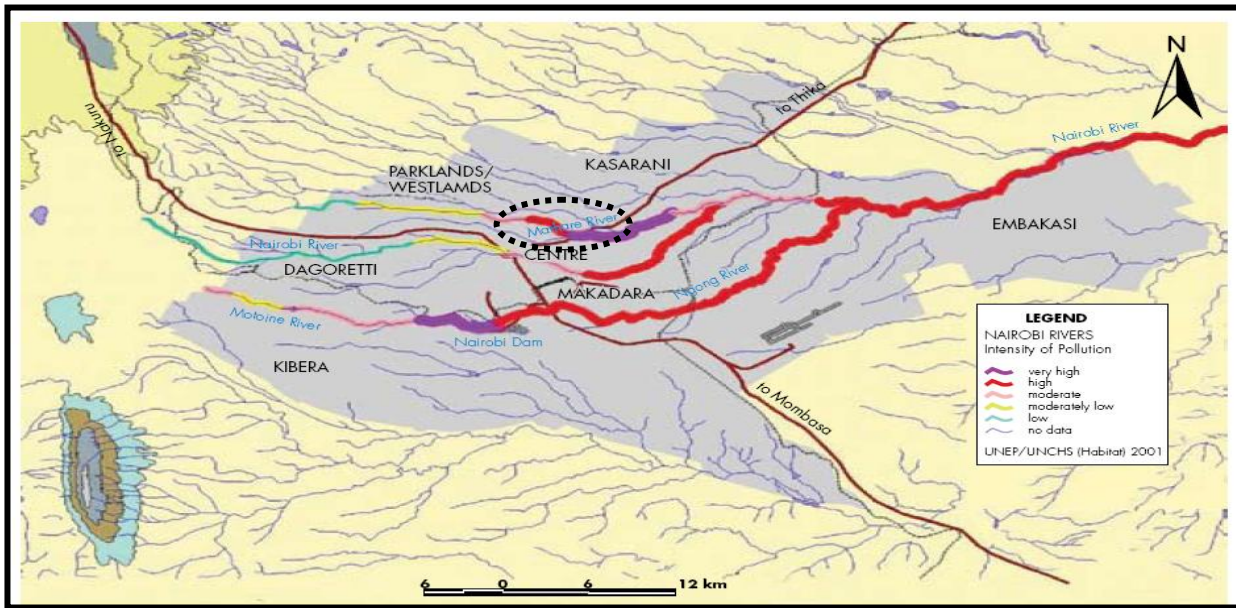
Source: Morgan, 1997


### 1.7.2: Hydrology

Huruma is transversed by the Mathare River which is part of the Nairobi River. Rivers are vital in the provision of water for irrigation, non-consumptive domestic use, and ecological biodiversity. However, the river water is highly polluted and poses severe health and environmental hazards for such activities.

The river is used for dumping of domestic, industrial, and human waste. A large number of urban farmers use the water to practice urban agriculture by cultivating crops. This poses a great health risk associated with the pathogenic content in the polluted water. Figure 1.7.1b below shows the levels of pollution in the river.

Figure 1.7.2: Levels of pollution of the Nairobi River at different stages.



 Section of Mathare River in Huruma

Source: Nairobi Environmental Outlook, 2007

### 1.8: Population structure and composition

53% of the population in Huruma is composed of females while the male population is 47%. The age-sex distributions in different cohorts show high domination of the working age. The total population in the study sites Kiamaiko and Ngei 1 is 70,082 persons. The population is generally middle aged reflecting similar statistical characteristics for Nairobi Province. In Kiamaiko sub-location the total population stood at 33,824 persons by the year 2009. This was composed of 17,053 males and 16,771 females. Total number of enumerated households was 10,217 on a spatial area of 0.9 km<sup>2</sup> (GoK, 2010). This was projected using the prevailing growth rate of 2.42% per annum for Nairobi. This was then



projected to the year 2030 so as to correspond with Kenya’s long term development strategy, Vision 2030.

**1.8.1: Population projection and growth trends**

In the last four decades, the population of the City of Nairobi has increased from 0.5 million people in 1969 to 1.3 million people in 1989 and 2.1 million in 1999. The enumerated population in 2009 was 3.1 million. According to Kenya National Bureau of Statistics, the City’s inter-censal population growth rate of 3.8 percent between 1999 and 2009 is relatively high compared to the overall national growth rate of 3.0 percent over the same period (KNBS, 2010). Population projections for Huruma have been done using the growth rate of 2.4%, which currently prevails in the country. The projection is vital in determining the land budget for the various land uses and the demand for services such as water. It also provides a basis for planning for infrastructure development and effective service provision.

The population projection for Huruma by use of the exploration formula:

$$P_1 = P_0 (1+r)^n$$

Where  $P_1$  is the projected population,  $P_0$  is the current population,  $r$  is the population growth rate at 2.4% and  $n$  is the number of years.

**Table 1.8.1: Population projection in Huruma location**

<b>Year</b>	<b>2009</b>	<b>2019</b>	<b>2030</b>
Male	32,939	41,754	54,200
Female	37,143	47,085	61,120
<b>TOTAL</b>	<b>70,082</b>	<b>88,839</b>	<b>115,320</b>

Source: Researcher, 2012

The population projections will be sustained provided that the prevailing mortality rates prevail and all other socio-economic and physical factors remain constant.

### 1.9: Housing

Housing refers to the number of habitable units in an area. In most urban areas housing is of low quality due to migration into the urban areas from the rural areas. This has led to increase in the urban population. This results in congestion thus forcing people to dwell in units that are not up to the recommended standards. The housing typologies in Huruma are categorized according to the building materials used, the surrounding development and the size of land they occupy.

Plate 1.9a and 1.9b: Low income housing in Huruma



Source: Researcher, 2011

The low income housing is characterized by congestion and their plot sizes are less than 36m<sup>2</sup>. The plot sizes are 40×80 ft (1/16 acre) or 0.03 Ha). Low income housing in most cases lacks access to basic facilities such as piped water, sewerage, roads, electricity and social services.

### 1.10: Access roads

Apart from the main road which is a tarmac road, urban services for example are non-existent and minimal. Secondary roads and pathways are made of earth and vehicles cannot access most households especially during the rainy season. Drainage is equally poor in the study area.

Plate 1.10a: Narrow access paths in Huruma



Plate 1.10b: Poor drainage channels in Huruma



Source: Researcher, 2011

### 1.11: Limitations of the study

The limitations of the study included the inability of residents to easily volunteer information especially on the rampant incidences of illegal water connections. Residents in Huruma, like their counterparts in other informal settlements have experienced research fatigue due to many research activities carried out in the settlements. This proved to be quite a challenge as most of them demand for payment in exchange for information. The researcher overcame this challenge by using research assistants who were well-known in the settlements and who were able to gather the relevant information within the shortest time possible. Financial constraints were also experienced given that the available budget was limited to field data collection and remuneration of field research assistants. The researcher had to secure alternative resources to carry out data entry, synthesis of findings and presentation of research findings at different stages.

Despite these limitations the author remained objective throughout the research process and ensured that the objectives of the research study were achieved within the outlined timeframe

## **CHAPTER 2: LITERATURE REVIEW**

### **2.1: Introduction**

This chapter reviews the empirical and theoretical literature relevant to the problem under investigation. It shows clearly the linkage between the literature review and the research questions. Similar studies carried out by other researchers are also highlighted in this chapter including the methodologies used.

In the assessment of effective water governance in Huruma, the research study seeks analyze the different variables that influence access to water by households in the study area. The variables identified to form a framework for analysis include the cost of water, quantity of water, distance to water source and participation in decision making. The conceptual framework is illustrated and discussed in detail to show what variable influences the other. Representative case studies have also been selected based on a combination of relevant literature review; extensive fieldwork and action research case studies undertaken by the author in various parts of the world during the research period.

A critique of the existing literature that is relevant to the study has been outlined in this chapter to bring out a clear comprehension of the issues affecting water governance that are unique to this particular study. A summary of the entire literature review is discussed and research gaps identified to strengthen the justification for the study.

### **2.2: Concept of water governance**

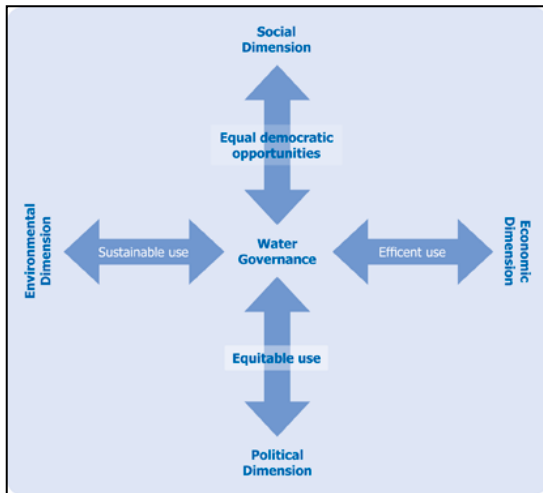
It is becoming increasingly recognized that the so-called 'water crisis' is essentially not as a result of absolute water scarcity but a crisis of governance (UNDP 2004). In water services, this manifests itself in the fragmented institutional structures, the lack of clarity of roles and responsibilities, questionable resource allocation, patchy financial management and the low capacity of implementing organizations. This crisis is also apparent in the pervasive leakage of sector resources, weak accountability of politicians, policy-makers and implementing agencies, unclear or non-existent regulatory environments, and unpredictability in the investment climate for private sector actors (UN 2006). Water governance is defined as the political, social, economic and administrative systems that are in place, and which directly or indirectly affect the use, development and management of water resources and the delivery of water service delivery at different levels of society (GWP, 2002).

Since the Dublin conference in 1992, significant international goals have been set that relate to water governance. At the 2000 World Water Forum in The Hague, the Global Water Partnership (GWP) Framework for Action stated that the water crisis is often a crisis of governance, and identified making water governance effective as one of the highest priorities for action (GWP, 2000). The Hague ministerial declaration in the year 2000 reinforced this view and called for governing water wisely to ensure good governance, so that the involvement of the public and the interests of all stakeholders are included in the management of water resources. In the year 2000, the United Nations Millennium Assembly emphasized on conservation and stewardship in protecting common environment and to stop the unsustainable exploitation of water resources. This was to be achieved by developing water management strategies at the regional, national and local levels, and promote both equitable access and adequate supplies. A year later at the Bonn Freshwater Conference, the ministers recommended that important actions are taken to address water governance. It was proposed that each country should have in place applicable arrangements for the governance of water affairs at all levels and, where appropriate, accelerate water sector reforms. This was endorsed at the World Summit on Sustainable Development in 2002 where heads of state agreed a specific target to prepare integrated water resource management plans and water efficiency plans by 2005. It was agreed that how societies choose to govern their water resources and services has profound impacts on people's livelihood opportunities and sustainable development of water resources.

### **2.3: Dimensions of water governance**

The Water Governance Facility has developed four inter-related and poverty-centered dimensions that point to the importance of addressing governance issues in the water sector. The four dimensions are categorized as social, economic, political and environmental. In assessing water governance in informal settlements, this research study co-opted these facets since they are important factors that influence access to water in different ways. Poor people's livelihood opportunities in particular depend directly upon sustained access to natural resources, including water – especially since they tend to live in marginalized areas that are prone to pollution, droughts and floods. Figure 2.3 shows these dimensions of water governance.

Figure.2.3 Dimensions of water governance



Source: Adopted from the Water Governance Facility, 2002

The social dimension of water governance seeks to address the equitable use of water resources. Apart from being unevenly distributed in time and space, water is also unevenly distributed among various socio-economic strata of society in both rural and urban settlements. How water resources and related services are allocated and distributed have direct impacts on people's health as well as their livelihood opportunities. The economic dimension draws attention to the efficient use of water resources and the role of water in overall economic growth. Aggressive poverty reduction and economic growth depend highly on water and other natural resources. Studies have shown that better governance can exert a powerful and positive effect on per capita incomes in many countries (Tropp, 2005).

The political empowerment dimension points at granting water stakeholders and citizens at large equal democratic opportunities to influence and monitor political processes and outcomes. At both the national and international levels, marginalized citizens, such as indigenous people, women, slum dwellers, etc., are rarely recognized as legitimate stakeholders in water-related decision making, and typically lack voices, institutions and capacities for promoting their water interests (WGF, 2002). The environmental sustainability dimension uniquely shows that improved governance allows for enhanced sustainable use of water resources and ecosystem integrity. The sufficient flow of water of appropriate quality is critical to maintaining ecosystem functions and services. Unfortunately, water quality appears to have declined worldwide in most regions with intensive agriculture and large urban and industrial areas as documented in the United Nations' State of the Cities report of 2010.

## **2.4: Water reforms synopsis in Kenya**

Kenya has made major reforms to its water sector especially after the passage of the Water Act of 2002. The Act was instrumental in decentralizing water provision services and creating the institutional framework that exists today. This framework provided avenues for the involvement of other stakeholders in the society (GOK, 2002). The Constitution of Kenya (COK, 2010) further safeguards adequate access to water for all citizens as a basic right (COK, 2010). While water resources remained vested in the state, the water reforms saw the introduction of the commercialization of water resources as part of the decentralization process and the participation of stakeholders in the management of national water resources. The separation of policy and regulatory responsibilities and the devolution of responsibilities for water resources management and water services provision to local level functions has been the principal mechanism for improving accountability and transparency in the water and sanitation sector.

The National Policy on Water Resources Management and Development Sessional Paper No. 1 of 1999 and the Water Act of 2002 spearheaded these water sector reforms. One of the main objectives of the National Water Policy of 1999 was preservation, conservation and protection of available water resources and allocation in a sustainable, rational and economical way. It also sought to enhance the supply of good quality water in sufficient quantities to meet various needs and alleviate poverty while ensuring safe disposal of waste water and environment protection. The Policy was also meant to establish an efficient and effective institutional framework to guide development and management of the water sector as well as develop sustainable financing system for effective water resources management, water supply and sanitation development. The policy advocated for decentralization of operational activities from the central Government to other actors, including local authorities, the private sector and increased involvement of communities in order to improve efficiency and sustainability in service delivery. The Sessional paper further addressed water supply and sanitation development, the institutional framework and financing of the water sector thereby proposing the amendment of the Water Act Cap 372 to enable it to be consistent with the provisions. It was clear that with the passing of the Water Act (2002) and consequent water sector reforms, the Government committed itself to adopting a human rights based approach in the water sector. Table 2.4 shows a summary of the key milestones in the water sector reform.



Table 2.4: Key dates in the reform of the water sector in Kenya

Year	Event
1952	Water Act Cap372
1957	Establishment of Mombasa Pipeline Board, first 'commercial' supplier
1988	Establishment of NWPC
1990s	Corporatization and commercialization of municipal providers (Nyeri, Eldoret, and Kericho)
1995	First management contract, Malindi
1999	Water Policy
2002	Water Act 2002
2003/04	Establishment of WSIs
2005	Transfer plan published
2006	Launch of SWAp and first Annual Sector Conference
2009	Sector Investment Plan
2010	The Constitution of Kenya 2010

Note: WSI's means Water Sector Institutions

Source: Water and Sanitation Program, 2011

## 2.5: Institutional framework for water governance in Kenya.

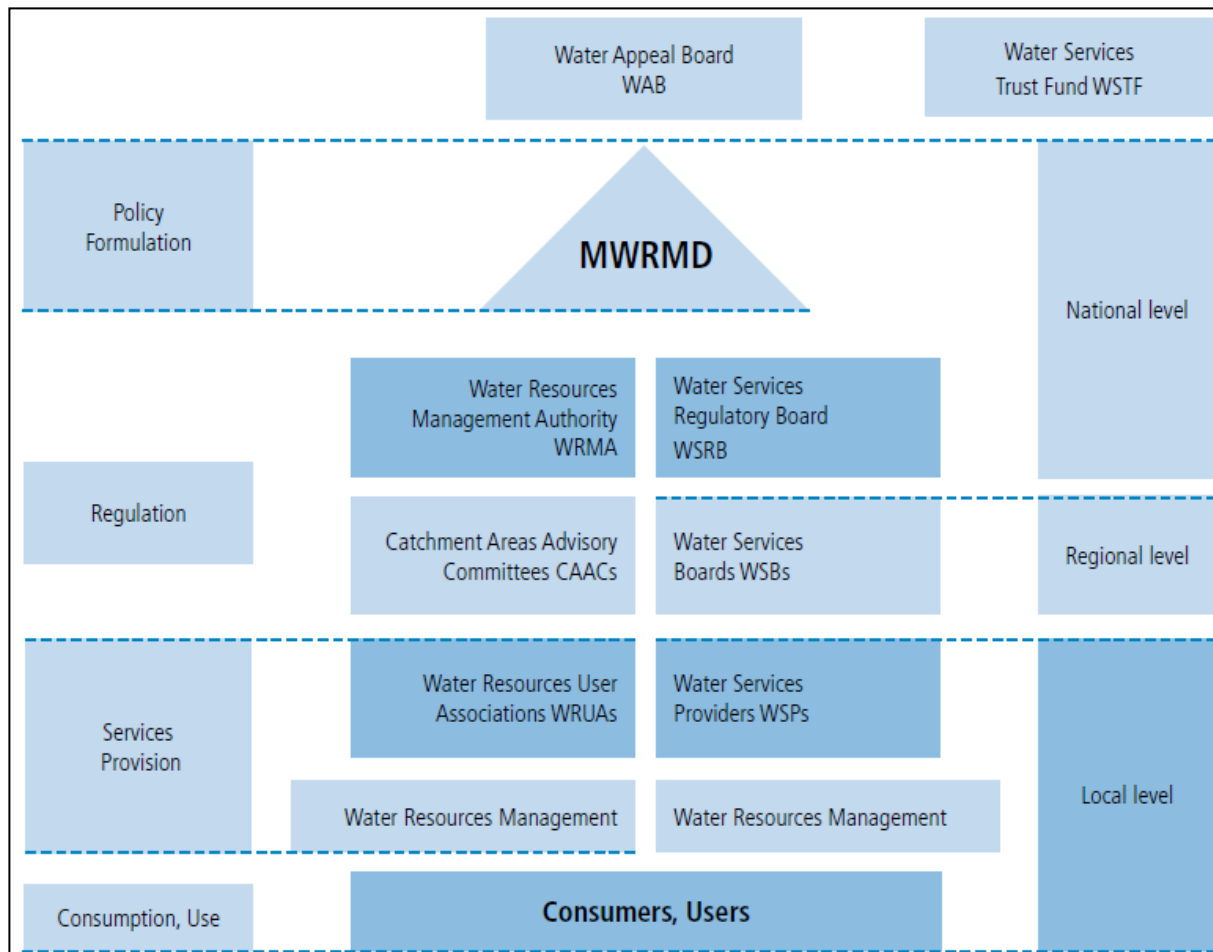
The Water Act of 2002 gave legal force to the National Water Policy objectives. The key provisions of the Act allowed for the necessary reforms for management of water resources, strengthening the institutional framework of the water sector while eliminating the role of government in direct service provision and providing mechanisms for financing water resources and services. The Ministry of Water and Irrigation (MWI) was vested with the responsibility for overall sector oversight including policy formulation, coordination and resource mobilization.

Under the Water Act, 2002, water and sewerage services are separated from water resources management to minimize conflicts of interests between allocation and service provision. The Act also established standards for the provision of water and sewerage services. The Water Services Regulatory Authority, Water Services Boards and Water Services Providers are three tiers of institutions established for water and sewerage.

Under Water Resources Management, new institutions were established to give greater attention to the management of water resources. The objective is to improve the management and protection of water resources for equitable allocation for the various uses including domestic, industry, agriculture, energy, livestock and others.

The institutional framework for water resources consists of institutions established to carry out specific mandates. The Water Services Regulatory Board (WASREB) was created to set standards and regulate the sub-sector while the Water Appeal Board (WAB) was mandated to adjudicate on arising disputes. Seven Water Services Boards (WSBs) were also created to be responsible for the efficient and economical provision of water services. Other institutions created are the Water Services Trust Fund (WSTF) whose mandate is to finance pro-poor investments, while Water Services Providers (WSPs) were delegated to be agents in the provision of water and sewerage services. The Water Resources Management Authority (WRMA) was given the vital role of managing and protecting Kenya's resources with the Catchment Area Advisory Committees (CAACs) formed to support the Water Resources Management Authority at the regional level. Finally, Water Resource Users Associations (WRUA's) were established as a medium for cooperative management of water resources and conflict resolution at sub catchment level (GOK, 2006). These institutions and their respective mandates have been summarized in figures 2.5a and 2.5b.

Figure 2.5a: Kenya's institutional framework for water governance



Source: Adopted from Public Expenditure Review - Water Sector Analysis, 2011, KNBS

Figure 2.5b: Summary of institutions in water governance in Kenya

<table border="1"> <tr> <td><b>Ministry of Water and Irrigation</b></td> <td> <ul style="list-style-type: none"> <li>• Development of legislation, policy and strategy formulation, sector coordination and guidance, and Monitoring and Evaluation (M&amp;E)</li> <li>• Overall sector investments planning and resource mobilisation</li> </ul> </td> </tr> </table>		<b>Ministry of Water and Irrigation</b>	<ul style="list-style-type: none"> <li>• Development of legislation, policy and strategy formulation, sector coordination and guidance, and Monitoring and Evaluation (M&amp;E)</li> <li>• Overall sector investments planning and resource mobilisation</li> </ul>																		
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<p>Source: Developed based on Water Act, 2005  Notes: SAGA means Semi-Autonomous Government Agency.  * Tana, Athi, Tanathi, Lake Victoria South, Lake Victoria North, Rift Valley, Coast and Northern Water Services Boards</p>																					

Source: Adopted from Public expenditure review - Water sector analysis, 2011, KNBS

## 2.6: The Water Bill 2013

The proposed Water Bill 2013 is expected to further transform the management and conservation of water resources in the country. The bill proposes to provide a platform for revamping the troubled Water Services Boards across the country. The new bill proposes that Water Resources Management Authority (WARMA) be replaced by the Water Regulatory Authority. This is expected to improve on the deficiencies of the Water Act 2002 that established WARMA and the Water Service Boards. The bill also seeks to establish autonomous bodies like the National Water Storage Authority to replace National

Water Pipeline Board. Perhaps the most crucial and anticipated aspect of the bill will be the establishment of Water Services Boards at every county. Under the new bill, WARMA will be in charge of formulation of water regulations and the management given to another organization yet to establish. However, it is still premature to conclude that the new bill will be successful in resolving the problem of water provision, regulation, storage and management.

## **2.7: Emerging challenges of water reforms in Kenya**

Owuor and Foeken (2009) looked at the institutional set up, impacts and emerging challenges in water reforms and interventions in urban Kenya. The working paper was based on a research study carried out in five urban towns that assessed their state of affairs in water service provision. This was vital in the analysis of the emerging impacts of the reforms in the five towns studied.

The study also analysed the involvement of private sector in the urban water sector. Given that full privatisation as a way to reform the water sector is seen by many as undesirable and unnecessary (Hukka & Katko 2003); Owuor and Foeken clearly illustrated the need for public-private partnerships model as well as highlighting some community based water supply projects.

Some of the emerging impacts from the study showed that there was minimal network extension with efforts towards rehabilitation and *water kiosks* especially in informal settlements. There was also a significant reduction in unaccounted-for-water from utilities. It is documented that the water utilities which had inherited high unaccounted-for-water above 70 percent, had reduced to an average of 49 percent. Given the myriad of challenges facing the utilities, this was an indication of an improvement in revenue collection as well as saving water resources. Owuor and Foeken also noted the continued provision of *water kiosks* and standpipes in low-income settlements. However, despite these efforts, residents still relied on other highly priced and poor quality sources of water such as water vendors, springs and wells. Other challenges included limited resources and high operation and maintenance costs, local political interference, lack of autonomy to do major investments, persistent illegal connections among others (Owuor and Foeken, 2009).

Overall, the authors agreed that poor access to water services in sub-Saharan Africa is the inefficiencies of water utilities, especially those that serve urban areas. In their assessment, they concur with previous studies (see World Bank, 2004) that many water systems are characterized by high water losses,

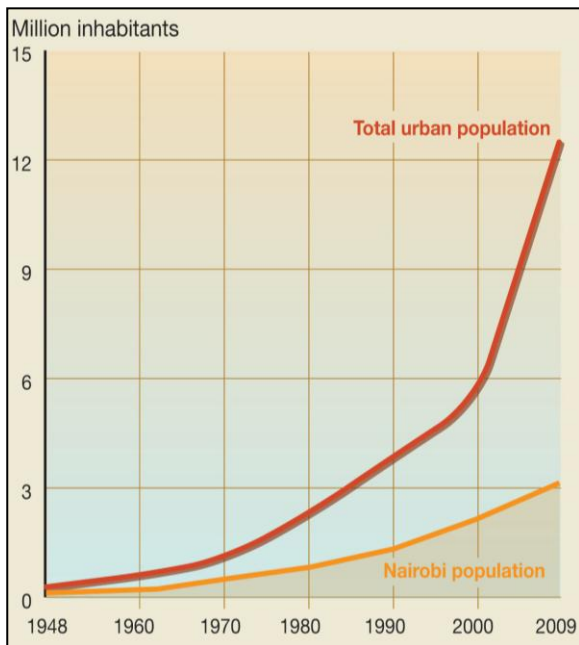
insufficient revenues to cover operation costs, dilapidated and poor functioning infrastructure, low coverage especially for the urban poor, corruption and other factors. These in essence, represent fundamental aspects of governance that affect access to water even in circumstances where the resource is in abundance.

### 2.8: Water demand and supply in Nairobi

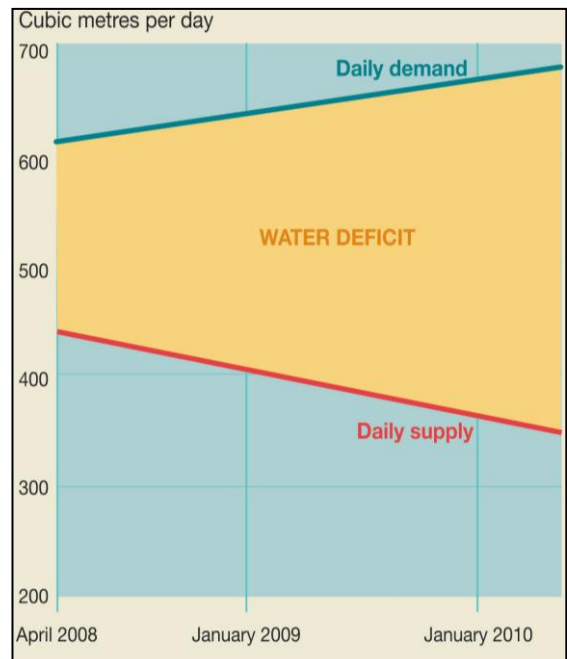
The total urban population rose from 6 million people in the year 2000 to 12.4 million in the year 2009 (KNBS, 2010). This increase is attributed to the unbridled rural-urban migration as people seek employment and improved livelihoods in urban areas. In Nairobi, the population increased from 2.6 million people in 2000 to 3.1 million people in 2009. This is highlighted in figure 3.1. 60% of these people live in the informal settlements which are unplanned for provision of basic infrastructure and essential services (UNHABITAT, 2010). These new influxes of people into the urban population require water which has not increased in supply and therefore must contend to share the meagre resources available regardless of the quality.

Figure 2.8a: Urban population trends-Kenya and Nairobi.

Figure 2.8b: Water demand and supply in Nairobi



Source: Adopted from NCWSC, 2011



Source: Adopted from NCWSC, 2011

According to Nairobi City Water and Sewerage Company (NCWSC), the daily demand for water in the City has increased from 600 cubic meters per day in April 2008 to approximately 700 cubic meters per day by January 2010. This has been projected to increase to over 1000 cubic meters per day by 2013 (NCWSC, 2011). On the other hand, daily water supply has declined from 450 cubic meters per day in April 2008 to 350 cubic meters per day by 2010. This has been attributed to the effects of drought and reduced rainfall in the catchment areas, frequent breakdown of pumping machinery from the treatment works to the distribution stations and massive leakages in the aging water pipe infrastructure. This then creates a huge water deficit that is unable to bridge the huge gap between daily water demand and supply as shown on figure 2.8b.

## 2.9: Sources of water for the County of Nairobi

According to the report from the 2009 population census and demographic indicators, 38% of urban dwellers receive water from a networked pipe, with 14% having water piped into their dwellings. The figures are significantly higher in towns with better infrastructure like Nairobi. The report also indicates that 24% source their water from springs, boreholes and wells. This is usually the case in urban areas located in arid and semi-arid areas. Water vendors account for 13% water supply to urban households. Rainwater harvesting is still underexploited both in urban and rural areas in the country. Figure 2.9a shows the main sources of water for both urban and rural households in Kenya.

Figure 2.9a: Main sources of water for households in Kenya

<i>Percentage households by main source of water</i>		
	<b>RURAL</b>	<b>URBAN</b>
Pond/Dam	5.9	1.1
Lake	1.5	0.5
Stream	30.4	7.6
Spring /Well / Borehole	42.6	24.2
Piped into dwelling	2.2	14.2
Piped	13.4	38.4
Jabia /Rain/Harvested	1.3	0.7
Water Vendor	2.3	13.2
Other	0.4	0.1

Source: KNBS, 2010

Nairobi obtains its water from the satellite regions that border it. The city does not have its own source of water. The sources of water are –

### **2.9.1: Kikuyu springs**

Kikuyu springs are located along Magana flows in Kikuyu about 15 kilometers from Nairobi. There are three springs in what makes up the entire water springs. It has a daily yield of 4,000 cubic meters of water per day. Construction to harness water from the springs was completed in 1913, making it the oldest source of water for the city. A 10 kilometre-long pipeline serves Nairobi from the springs.

### **2.9.2: Sasumua Dam**

Sasumua Dam is located in Njambini in Nyandarua, approximately 65 kilometers from Nairobi. The dam is on Sasumua River but receives most of its water from Kaburu River and Chania River which originates from the Aberdare mountain complex. It has a storage capacity of 15.9 million cubic meters and a daily yield of 52,800 cubic meters against its initial design yield of 59,000 cubic meters. The first phase in the construction of the dam was completed in 1955 while the second phase was completed in 1968. The water that drains into the dam from these rivers has drastically reduced and has been attributed to increased human activity and climatic changes in the atmosphere.

### **2.9.3: Ruiru Dam**

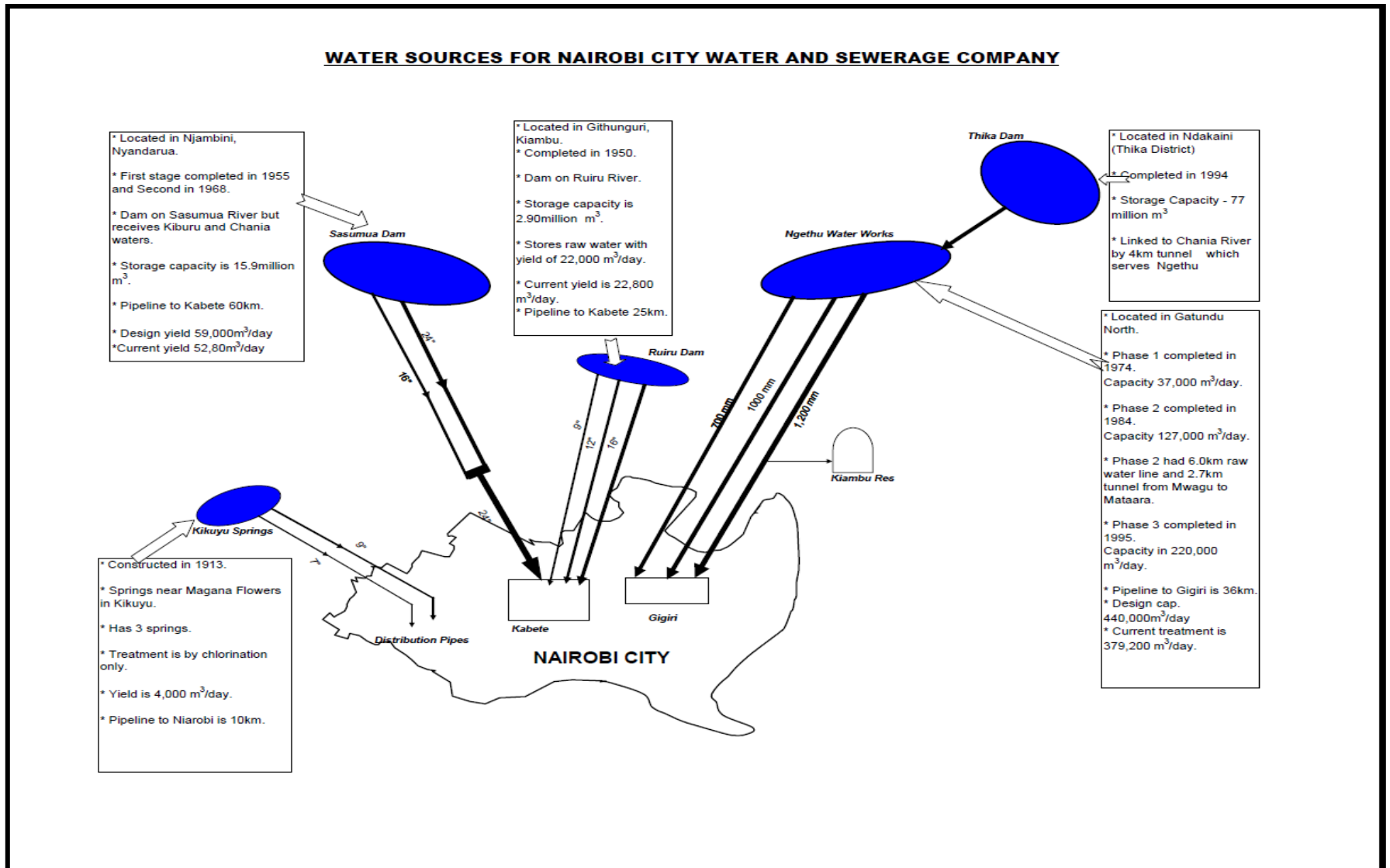
Ruiru Dam is located in Githunguri, Kiambu which is approximately 20 kilometers from the city. It receives its water from Ruiru River and was completed in 1950. The dam has a storage capacity of 2.9 million cubic meters and stores raw water with a yield of 22,000 cubic meters per day. It has a 25kilometer pipeline to Kabete close to the city.

### **2.9.4: Thika Dam**

Thika Dam is located in Ndakaini, which was formerly Thika district. The dam has a storage capacity of 77 million cubic meters and was completed in 1994. It is linked to Chania River by a 4 km tunnel which serves Ngethu Treatment Plant. The spatial location of these sources of water is represented by figure 2.9b



Figure 2.9b: Water Sources for Nairobi City Water and Sewerage Company



Source: NCWSC, 2011

## **2.10: Factors influencing access to water**

Documented research findings have observed that several factors inform the sources of water used by households for domestic chores in informal settlements. In this analysis it is vital to define what constitute domestic water supply. The World Health Organization (WHO) defines domestic water as *‘water being used for all usual domestic purposes including consumption, bathing and food preparation’* (WHO, 1993; 2002). Guidelines on the quantity of domestic water required to promote good health, which is an indicator of well-being, have not been provided as yet. The basic need for water includes water used for personal hygiene, but defining a minimum has limited significance as the volume of water used by households depends on accessibility as determined primarily by distance and time, but also including reliability and potential cost (Howard and Bartram, 2003).

Sub-dividing the uses of domestic water may be useful in understanding minimum quantities of water needed to inform decision making and water management options. White et al (1972) suggested three types of use that could be defined in relation to normal domestic supply. These are consumption, hygiene and amenity. Based on these categories, Howard and Bartram (2003) derived a standard table which describes four broad functioning water service levels depending on distance, time, quantity of water and levels of health concern. The extracted table 2.10a is highlighted.

Table 2.10a: Service level descriptors of water in relation to hygiene

<b>Service level description</b>	<b>Distance/time measure</b>	<b>Likely quantities collected</b>	<b>Level of health concern</b>
No access	More than 1000m or 30 minutes total collection time.	Very low (often less than 5 l/c/d).	Very high as hygiene not assured and consumption needs may be at risk. Quality difficult to assure; emphasis on effective use and water handling hygiene.
Basic access	Between 100 and 1000m (5 to 30 minutes total collection time).	Low. Average is unlikely to exceed 20 l/c/d; laundry and/or bathing may occur at water source with additional volumes of water.	Medium. Not all requirements may be met. Quality difficult to assure.
Intermediate access	On-plot, (e.g. single tap in house or yard).	Medium, likely to be around 50 l/c/d, higher volumes unlikely as energy/time requirements still significant.	Low. Most basic hygiene and consumption needs met. Bathing and laundry possible on-site, which may increase frequency of laundering. Issues of effective use still important. Quality more readily assured.
Optimal access	Water is piped into the home through multiple taps.	Varies significantly but likely above 100 l/c/d and may be up to 300l/c/d.	Very low. All uses can be met, quality readily assured..

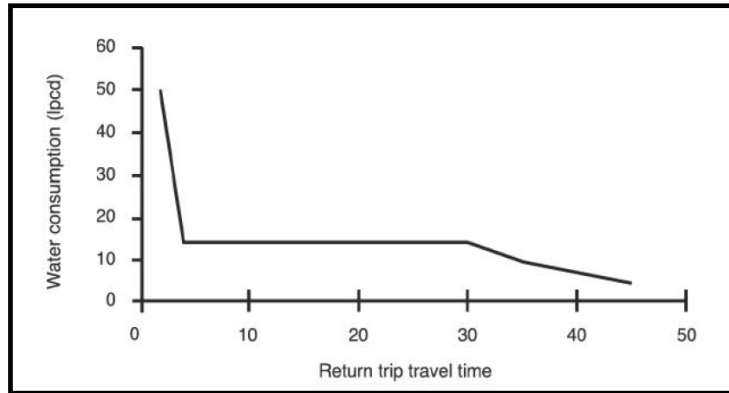
*Note: l/c/d implies litres per capita per day.*

Source: Howard and Bartram, 2003

Howard and Bartram (2003) asserts that a minimum for basic health protection corresponds to basic access and experience shows that this is equivalent to a water collection of less than 20 liters per capita per day, of which 7.5 litres is required for consumption as recommended by the World Health Organization. These levels of access can also be interpreted in terms of household water security.

In the review of several studies on water use and collection behavior, Cairncross (1987) suggests that there is a clearly defined general response of water volumes used by households to accessibility in relation to time taken to reach water sources.

Figure 2.10a: Travel time (in minutes) versus water consumption (in litres per capita per day)



Note: l/c/d implies litres per capita per day and travel time is in minutes (not indicated on the graph).

Source: WELL, 1998

The graph shows that when time taken to collect water from the source exceeds a few minutes (typically 5 minutes or 100 meters from the house), the quantities of water collected decrease significantly. The graph highlights a clear plateau of consumption between 5 to 30 minutes, or 100 meters to 1000 meters. This suggests that there is little change in quantity of water collected within these boundaries (Cairncross and Feachem, 1993). Beyond a distance of one kilometer or 30 minutes of collection time, the graph indicates that quantities of water are expected to decline significantly.

The mode of water delivery also has an influence on the quantity of water used. Findings from a study in Jinja, Uganda, revealed that average consumption of water when it is piped into the home is relatively high (155 l/c/d), but decreases to 50 l/c/d when water is supplied to a yard level (WELL, 1998).

Table 2.10b: Average water consumption by type of supply in Jinja, Uganda

Type of supply	Average consumption (l/c/d)	Service level
Traditional sources, springs or handpumps	15.8	Communal
Standpost	15.5	Communal
Yard tap	50	In compound
House connection	155	Within house (multiple)

Source: WELL, 1998

There appears to be relatively little variation in quantities used when water is supplied through a yard level service, probably because this level of service does not permit easy use of water-hungry devices and efforts expended to obtain water remain significantly high to limit overall quantities used. There is however, a high variation in the volume of water used when supplied into a household. There are more water-hungry and time-saving devices which are deployed and as such the physical effort to obtain water is largely obviated (Howard and Bartram, 2003).

Studies have shown that where water is purchased, the cost may also be a limiting factor on the volumes of water used. In urban areas, water supplies may be close but total collection times will remain high. Even when greater volumes of water are collected, there will be a significant impact on overall household poverty (Aiga and Umenai, 2002).

### **2.11: Theoretical framework for the study**

In undertaking this study, the author defined theory as an explanation of phenomena or an abstract generalization that systematically explains the relationship among given phenomena, for purposes of explaining, predicting and controlling such phenomena (Abdellah, 1986). This is important in developing the conceptual framework for the study. The researcher proposes that there are factors which have a direct or indirect impact on the access to water in the study area and the assessment of water governance is the underlying pillar which makes the research findings meaningful and generalizable. The theoretical framework will help to stimulate research as well as extend knowledge by providing both direction and impetus thus establishing orderly connections between observations and facts.

The study relied on the following key theories in the assessment of water governance in Huruma.

#### **2.11.1: Neo-institutionalism**

New institutionalism focuses on developing a sociological view of institutions. Fundamentally, this theory analyses the way institutions interact with one another and how this interaction eventually affects society. It provides a way of viewing institutions outside of the traditional views of economics by explaining why and how institutions emerge in a certain way within a given context (DiMaggio et al, 1983).

This theory holds that institutions operate in an environment that includes other institutions and thus creating an institutional environment. Every institution is further influenced by the broader environment. In this environment, the main goal of organizations is to survive. In order to do so, they need to do more than succeed economically; they need to establish legitimacy within the world of institutions.

Social scientists have argued that it is not accurate to lay much focus on economics when dealing with neo-institutionalism since institutions are by themselves products of political processes. They are the substance of which politics is constructed and the vehicle through which the practice of politics is transmitted.

### **2.11.2: Actor-centered institutionalism**

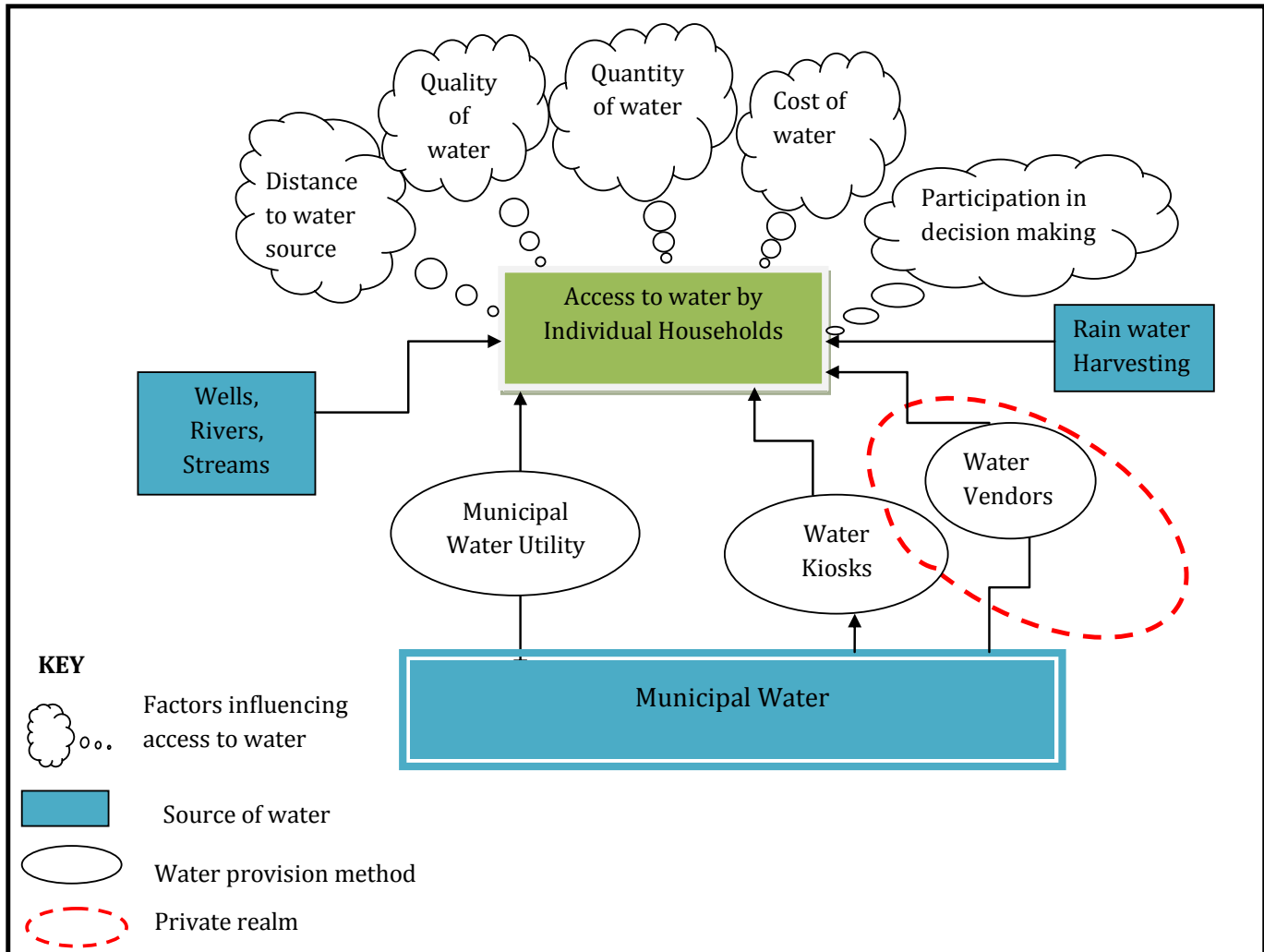
This theory asserts that actors and their interactive choices, rather than institutions, are the proximate causes of policy responses, whereas institutional conditions, to the extent that they are able to influence actor choices, are conceptualized as remote causes (Scharpf, 2000). Actor-centered institutionalism emphasizes on the autonomy of political institutions from society in which they exist. Most scholars classify this theory as a sub-component of neo-institutionalism. It assumes a greater influence on human behaviour coming from the socio-political environment surrounding people and organizations than from within individual or group based interactions (Howlett & Ramesh, 2009).

This theory's main insight is to establish an analytical separation between actors' interaction dynamics and institutional factors when explaining policy development processes. Institutions are therefore broadly viewed as formal rules and social norms.

New approaches to governance have advocated for increased citizen participation while enhancing the problem-solving capacity of politics. The challenge of how equity can be secured when informal networks of actors flourish is also critical especially in water sector governance. (Putman, 2000)

## 2.12: Conceptual framework

Figure 2.12: Conceptual diagram: Factors influencing modes of water provision in urban informal settlements



Source: Adopted (with modifications) from Bakker 2003

The broad objective of this research study is to assess water governance in informal settlements. It seeks to achieve this by analysing the modes of water provision available to households on one hand, and factors that influence access to water on the other hand. This interaction constitutes a significant relationship and its analysis will be able to achieve this particular objective of the study.

Access to water for individual households is the ultimate goal in assessing the effectiveness of water governance. However, this is influenced by other spatial, socio-economic and temporal factors. The study will analyse the cost of water, the quality of the water, the quantity of water available at a given

time, and distance to be covered when accessing the water in relation to households in informal settlements. The participation of water users in decision making processes is also an important determinant of effective water governance

The sources of water for households in informal settlements are limited. In her analysis of governance failure and reframing the urban water supply crisis; Bakker (2010) questioned the persistent fragmentation of urban water supply networks in cities in developing countries. She argues that the provision of public services such as water, electricity and telephone services when compared against the ideal of universal networks, are indeed fragmented. In this case, most informal settlements rely on the municipal water supply. Documented studies have shown that informal settlements are generally marginalized and rarely serviced by a piped network. There are small parcels in the periphery that are serviced. Most households generally rely on stand pipes, *water kiosks* or mobile vendors as highlighted in the conceptual diagram. Other water sources available are streams and rivers, though these are highly polluted and are not used for consumptive purposes. Rainwater harvesting has also not been explored since informal settlements generally lack the capacity required in terms of adequate water capture infrastructure and water storage facilities. The houses are poorly designed to capture significant amount of rain water and even when they do, most lack the prerequisite water storage facilities.

The definition of what constitutes public versus private is also vital when looking at water provision. Different scholars have attempted to distinguish between the two but their characteristics and mode of operation makes it vague and barely comprehensible. The definition of 'private' provision for instance is blurred even when the informal, often unregulated, small-scale water supply businesses that meet the majority of peoples water supply needs in many cities are considered (Bakker, 2010). They often work alongside community organizations which are both non-governmental and not-for-profit. Bakker asserts that both often operate with community goals in mind, with a self-identified culture of public service.

Public on the other hand is not restricted to government but also includes civil society. The unions representing water workers, whether within government or a privately run company, often assert that they defend 'public' water in the interests of civil society (Keil, 2006). The distinction between public and private is usually unclear especially in slums and informal settlements. In the complete absence or limited presence of the government in the provision of public services, many alternative strategies of service provision emerge. Private individuals which are mostly businesses fill the substantial gap. Bakker explains that when such unregulated private alternatives spring up, they operate on a small scale



and use artisanal technologies. These are classified as water vendors in the conceptual diagram on Figure 2.12. Sometimes communities come together to provide themselves with services in the form of cooperative water supply systems and sewerage networks. These are classified as ‘private’ strategies for providing services for and by members of the ‘public’. This explains why there is a slight interface of *water kiosks* under the private realm in the conceptual diagram on Figure 2.12.

## **CHAPTER 3: RESEARCH METHODOLOGY**

### **3.1: Introduction**

This research is an investigative study aimed at assessing water governance in the informal settlement of Huruma and how this is linked to access to water in the area. The study seeks to analyse the parameters in relation to access to water. These are cost of water, distance and time taken to the water source, quantity and quality of water available as well as the opportunity to participate in decision making processes. The study further aims to look at the different roles played by various actors in the provision of water and link that to the apparent crisis of governance in the water sector.

This research study adopted both quantitative and qualitative approaches in data collection and analysis. It involved generation of data in quantitative form which was subjected to rigorous quantitative analysis. Inferential quantitative approach, in particular, was used. In this approach, a database was created from which characteristics or relationships of the population were inferred. A sample of the population was studied (questioned and observed) to determine the specific parameters of access to water. The qualitative approach to research was concerned with subjective assessment of attitudes, opinions and experiences on challenges affecting water provision.

The sampling approach used was probability sampling. Key stakeholders were also identified and simple random sampling method used. Sampling units included households, water vendors, civil society groups, administrative authorities and water management institutions such as the Nairobi Water and Sewerage Company. The sample size was determined by the level of statistical precision required, the variability of the population under study; and the time and financial resources available for the study. A sample size of 100 randomly selected households was selected to supplement data and information collected through focus group discussions. Similarly, a representative sample of 20 different water vendors operating in the study area was selected.

For effective collection of data the following procedure was followed. Questionnaires were administered to the randomly selected households in the study area, and interview schedules conducted with key informants identified during the reconnaissance of the area and during community meetings. A differently structured questionnaire was administered to the key officers of the Nairobi Water and

Sewerage Company as key stakeholders in water governance and similarly for civil society organizations who were mobilizing residents in the area. The local administration was also interviewed. Observations were made simultaneously, resulting into an inventory through photography, notes taking and sketching of the study area and other qualitative issues.

Data analysis included the evaluation of frequencies, cross tabulation of key variables and extensive evaluation of statements from key informants. Participatory methodologies such as transects, community mapping and ranking of issues were used especially during the focused group discussions with the community members and civil society organizations.

### **3.2: Data types and needs**

a) **Secondary data** – This is data sourced from already published materials such as books, journals, working papers and the internet and to appreciate the and the surrounding neighbourhoods in terms of their historical development, the nature of interventions by the government and non-governmental organizations in the area, past studies on water governance and their findings as well as the gaps not addressed by past researchers. This data was collected through literature review.

b) **Primary data** – This form of data was collected directly from the area of study through;

*Observations* – Mainly aimed to identify the sources of water for residents in the study area, the type of water infrastructure in the area, physical characteristics of the area and the like. The findings here were then compared with those from written questionnaires and oral interviews for output.

*Oral Interviews* – Aimed to understand the challenges faced by various actors in water service provision and management as well as the consumers.

*Written Questionnaires* – These were presented to respondents at major water points as well as to households in the informal settlement. Water managers in-charge of Nairobi Water and Sewerage Company were also administered with written questionnaires. The Data collected through both primary and secondary sources fell in one of the four categories; physical, economic, social, institutional or legal data.

### **3.3: Data collection**

#### **3.3.1: Methods of survey**

The various aspects of water governance that the research sought to investigate required the adoption of different forms of data collection techniques. These techniques include-

##### **a) Literature review**

The existing physical, economic, social and legal data was collected from published material and the internet. The main aim was to comprehend the concept of water governance in its wider context as well as previous studies undertaken that are relevant to the research subject.

##### **b) Observation and site analysis**

The researcher was able to undertake a detailed profiling of the study site and identify not only water access and governance challenges but also other pertinent issues that affected the respondents' livelihoods. Such issues included insecurity, poor roads and drainage facilities.

##### **c) Administration of questionnaires**

Written questionnaires were administered at various water collection points and also at the household level. This ensured that the views of both water consumers as well as other actors in the water sector were captured. With the help of research assistants, the questionnaires were administered over a period of 2 weeks. A total of 100 household questionnaires were administered in Huruma while 20 questionnaires were administered to water vendors in the area.

#### **3.3.2: Sample size**

With the total population of the study area identified from the 2009 census records, a sample size was calculated using the statistical formula on Figure 3.3.2.

Figure 3.3.2 Sample size statistical formula

<p><b>Sample Size - Infinite Population</b> (where the population is greater than 50,000)</p> $SS = \frac{Z^2 \times (p) \times (1 - p)}{C^2}$ <p>SS = Sample Size                      Z = Z-value<sup>A</sup> (e.g., 1.96 for a 95 percent confidence level)                      P = Percentage of population picking a choice, expressed as decimal<sup>B</sup>                      C = Confidence interval, expressed as decimal (e.g., .04 = +/- 4 percentage points)</p>	
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Source: Adopted from Bill Godden, 2004

For the purposes of this research, the sample size was calculated as:

$$\frac{1.96^2 \times (0.5) \times (1-0.5)}{0.09^2} = 118.$$

Where:

- Confidence level (Z) was 95%
- Expected frequency of the factor under study (p) was 0.5
- Confidence interval (C) was 0.09

*Note: The calculated sample size of 118 was rounded off to 120 to increase the population to be captured in the study and further distributed into 100 households and 20 water vendors.*

### 3.3.3: Sample frame

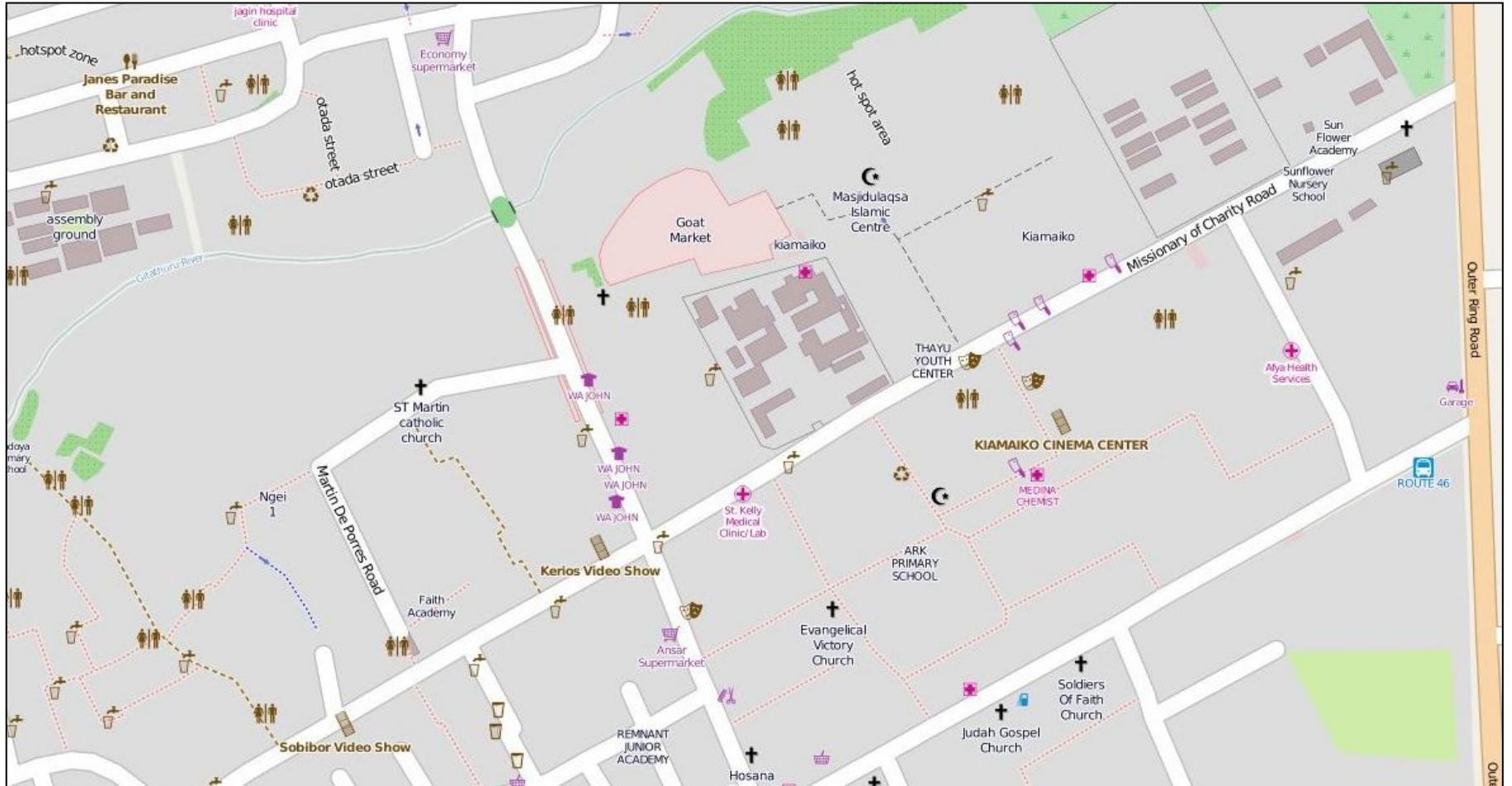
In drawing the sample frame for the survey, the total population of the study area was identified from the 2009 Kenya population census. Kiamaiko and Ngei 1 areas of Huruma have a population of 33,834 and 36,248 persons respectively. A sample frame was drawn from the population as indicated in table 3.3.3

**Table 3.3.3 Sample frame**

Area	Population as of 2009	Household Sample Size	Water Vendors' Sample Size
Kiamaiko	33,834	50	10
Ngei 1	36,248	50	10
<b>Total</b>	<b>70,082</b>	<b>100</b>	<b>20</b>

Source: Researcher, 2011

Figure3.3.3: A detailed map of the study area showing water points (Not to scale)



Source: www.mapkibera.org, 2011

### **3.3.4: Oral interviews**

These were conducted in form of informal conversations with residents, water vendors and local administration personnel in Huruma. Water practitioners including utility staff and academic scholars also gave their views on water governance challenges in Huruma and in informal settlements as a whole.

### **3.3.5: Focused group discussions**

Data for this study was also gained through participatory community forums in which members of the Huruma community were facilitated to discuss water governance and adaptation strategies towards water shortages. This data was supplemented with information from discussions with community leaders and civil society organizations.

## **3.4: Data processing and analysis**

Subsequent to collection, data was edited and coded. After this both qualitative and quantitative data collected from the field was input into the Statistical Product and Service Solutions (SPSS) software for analysis. Processing of data was then undertaken with analysis taking the form of descriptive statistics such as frequencies, mean, correlation analysis and projections. Microsoft Excel software was also used to process raw data into meaningful outputs.

## **3.5: Output and presentation**

Findings were presented in the inform of a written report, maps, charts, tables and graphs depending on the type of research questions to be addressed. A data needs matrix is presented in Table 3.5 to summarize the relationship between research objectives, data parameters and the expected output.

Table 3.5: Data needs matrix

Objectives	Type of data	Sources of data	Methods of data collection	Methods of data analysis	Method of presentation	Expected output
1. To identify the sources of water for residents in Huruma	Physical survey Types, distribution and operations of water facilities in the area	Documents from the Nairobi Water Company Household survey	Literature review Observation Written questionnaires Photography Mapping	ArcGIS Frequency analysis Historical analysis Deductions	Maps	Maps showing the location of the water points in the area
2. To identify formal and informal actors involved in the provision of water in Huruma	Water providers in the area. Organisations involved in the provision of water.	Literature or journals by the providers  Household survey	Literature review Interview schedule Written questionnaires photographs	SPSS	Sketches Graphs charts	Water providers i.e NGO's or community organisations, water vendors, the Nairobi Water & Sewerage Company.
3. To identify the challenges faced by water actors and residents in the provision and access to water respectively.	Socio-economic surveys.  Role of the actors in the water sector.	Census  Household survey	Written questionnaires Interview schedules Oral interviews Literature reviews Focus group discussions	Tables Graphs	Pie charts Graphs	If the actors are performing their roles and challenges they face in the process. Adequacy of distribution of water points

Source: Researcher, 2011



## CHAPTER 4: RESEARCH FINDINGS AND DISCUSSION

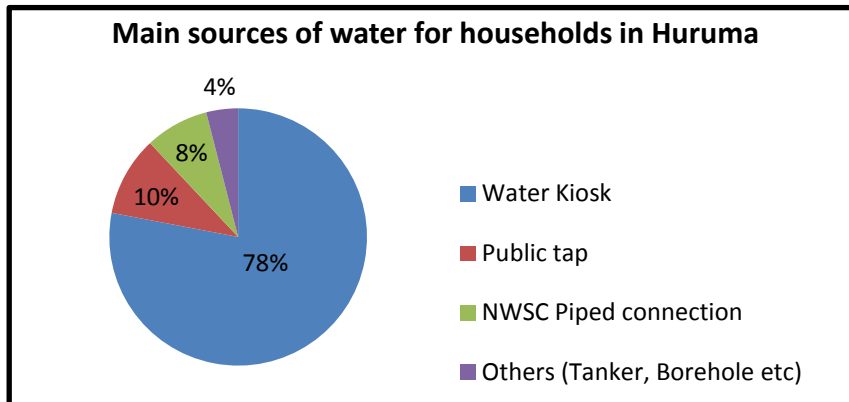
### 4.1: Introduction

The research findings are based on the objectives of the study. The analysis of these findings led to the compilation of an informed and up to date situation of water governance situation in Huruma. This chapter further interprets the findings and their socio-economic and spatial implications with relevance to the strategies available for integration in policy and development approaches.

### 4.2: Main sources of water in Huruma

The research sought to identify the main sources of water for residents in Huruma. Research findings revealed that 78% of the respondents obtained their water from *water kiosks*. The findings further revealed that *Water kiosks* were a preferred source since the water quality was acceptable and the cost of water relatively affordable to most households. 10% of households obtained water from public taps. These were taps set up by the Nairobi Water and Sewerage Company (NCWSC) at strategic points from the main water network connection. The dependency on this source was low since most of the time such taps are vandalized as well as frequently diverted to illegal connections. 8% of households relied on piped water directly into their households from the Nairobi City Water and Sewerage Company (NCWSC). This source was only available to areas around the periphery and close to the main transport corridors where it was relatively difficult to divert water. Further research revealed that this source was highly unreliable and experienced rampant water shortages. A meager 4% of households accessed their water from other sources such as tankers and boreholes. Boreholes were least preferred since there was a general impression among residents that the ground water in the area was highly polluted. This claim however, was not independently verified by water tests during the research study. Water tankers on the other hand, could not access most parts of the informal settlement due to the poor state of access paths and uneven terrain, which is characteristic of informal settlements.

Figure 4.2.1: Main sources of water in for households in Huruma



Source: Researcher, 2011

Plate 4.2.2: A woman fetching water from a *water kiosk*



Source: Researcher, 2011

### 4.3 Average household size

Findings from the research study revealed that an average household was made up of 5 persons. This was computed by taking the total number of persons identified by respondents as residing in a particular household then divided by the number of households sampled in the study which was 100 households.

Table 4.3: Average household size in Huruma

Number of persons residing in a household	Average score	Frequency	Total (persons)
1-3	2	29	58
4-6	5	43	215
7-9	8	25	200
10-12	11	3	33
			<b>506</b>

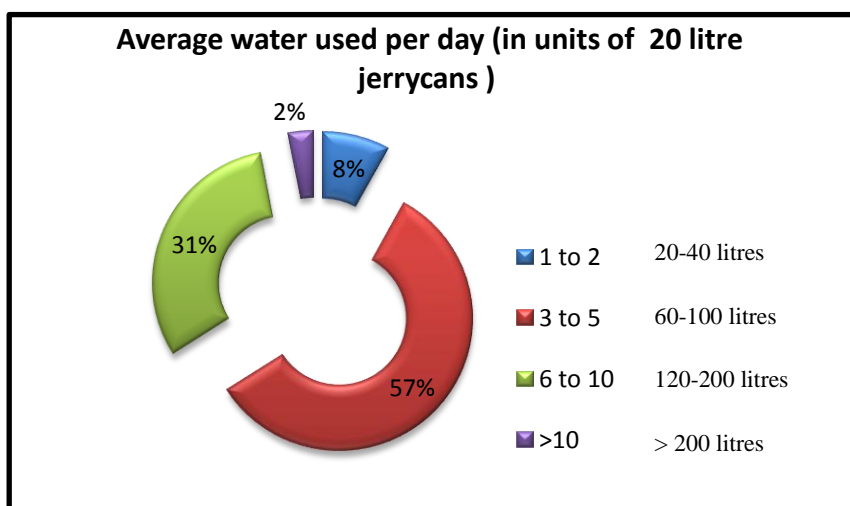
**506** persons  
**100** households  
 = 5.06 rounded off to  
 5 persons per household

Source: Researcher, 2013

#### 4.4: Daily water demand

Demand for water in households located in informal settlement is relatively high. Research findings showed that a majority of the respondents used between 60 and 200 litres of water daily for their domestic uses. Also worth noting is that the residents diversified their sources of water depending on the different uses. For example water intended for laundry could be obtained from the vendors, while water for cooking and drinking was individually obtained from the *water kiosks* and this was treated first before use. Figure 5.5 shows the average amount of water used per day by the residents.

Figure 4.4: Average amount of water used per day per household



Note: 2 households representing 2 percent of the respondents did not respond to this question.

Source: Researcher, 2011

From the statistics on average water use, it was also possible to compute the average water used in litres per capita per day in Huruma. This was then compared to the average minimum for basic health protection of less than 20 liters per capita per day, of which 7.5 litres is required for consumption as recommended by the World Health Organization. These levels of access can also be interpreted in terms of household water security as stated by Howard and Bartram, (2003).

Table 4.4: Per capita daily water use in Huruma

Number of 20 litres jerry cans used per household per day	Daily average of water used (in litres)	Frequency (households)	Total (litres)
1-2 (20-40 litres)	30	8	240
3-5 (60-100 litres)	80	57	4,560
6-10 (120-200 litres)	160	31	4,960
>10 (200 litres)	200	2	400
		<b>98</b>	<b>10,160</b>

**10,160** litres  
**490** persons (5 persons per household)  
 = 20.73 litres  
 Average daily water used is 20.7 litres per capita per day

*Note: 2 households representing 2 percent of the respondents did not respond to this question.*

Source: Researcher, 2011

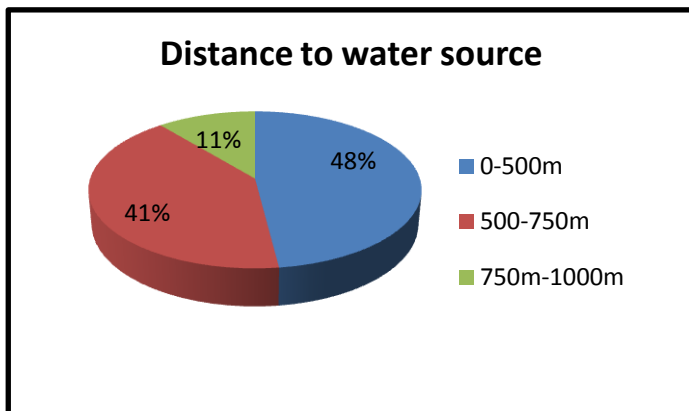
The average water use of 20.7 litres per capita per day in Huruma barely meets the service level description of basic access. The collected water quantity is classified as low where other domestic chores such as laundry and bathing may occur at water sources with additional volumes of water. Similarly, the quality of water in this category cannot be assured. It is also important to note that these figures are indicative and do not consider the age, gender or occupation of persons in a household. Different categories of persons have varying water demands.

#### 4.5: Distance to water source

The study findings revealed that about 48% of the respondents accessed water within a distance of 500 meters while 41% of them had to cover between 500 to 750 meters to their nearest source of water, while 11% covered between 750 meters to 1 kilometer to access water. This signifies that over half of the households had to access their water beyond a radius of 500 meters. This was significantly long distance when other factors such as insecurity and time constraints are considered. This is also quite a

considerable distance in an informal settlement that covers an approximate area of 0.9km<sup>2</sup>. The service level description as defined by Howard and Bartram, (2003), categorizes the distance between 100 meters and 1000 meters distance as a zone of basic access to water. In this service level, not all water requirements may be met.

Figure 4.5: Distance to the nearest water source



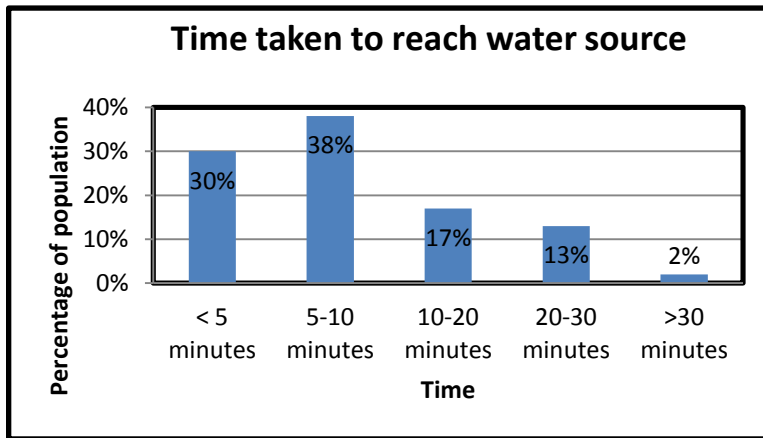
Source: Researcher, 2011

#### 4.6: Time taken to access water

The time taken to reach the nearest water source is highly significant in informal settlements as this may not always be dependent on the distance. There are other factors that determine the time taken to reach the water source. These include the accessibility of the paths, since most of them are usually narrow, and also the volume of people queuing for water at a given source. The time of the day is also significant since most residents draw water during early morning hours and late in the evenings. Security of the residents is also a determinant factor since some routes may be shorter in distance but riskier especially to women and girls. Research findings revealed that 30% of the respondents took less than 5 minutes to reach the water source. Most of these respondents however, had individual piped connections – legal or illegal or lived close to the water points. 38% percent took between 5 to 10 minutes to reach the water source, 17% took 10 to 20 minutes while about 13% took between 20-30 minutes. A mere 2% took more than 30 minutes and these were found to be negligible incidences. From the analysis of service level description, this range between 0 to 5 minutes is considered acceptable, but this also leads to an increase in the quantity of water consumed as portrayed by Cairncross and Feachem, (1993). The same research has shown that there is no significant change in the quantity of water collected from sources

between 5 minutes and 30 minutes of travel time. However, beyond 30 minutes, the quantity of water collected reduces drastically (Cairncross and Feachem, 1993).

Figure 4.6: Time taken to reach water source



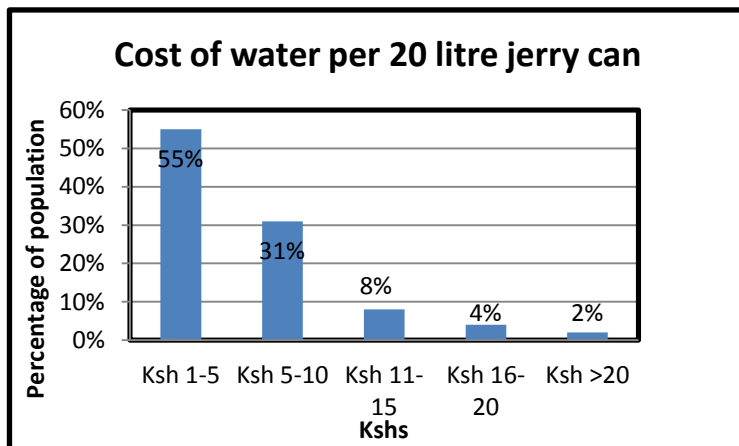
Source: Researcher, 2011

#### 4.7: Cost of water

The cost of water is a major factor in the determination domestic activities to be undertaken. This might also take up a significant proportion of the household income. Since this is a daily expense and not a monthly expenditure, it constantly triggers the residents' consciousness on the limit of how much to spend in a given day. Research findings revealed that 55% of the residents paid between 1 and 5 shillings per unit of a 20-litre jerry can. This was the average range charged per unit. 31% paid between 5 and 10 shillings per unit while a further 8% paid between 11 and 15 shillings per unit. 4% paid between 16 and 20 shillings and 2% paid more than 20 shillings per unit. Further insight showed that the cost of water depended on the source of water and the prevailing weather season. Borehole water was relatively cheaper costing about 2 shillings per 20 litre unit than treated water from the *water kiosks*. Water supplied by vendors to households was also charged at a higher cost (between 10 to 20 shillings) than water individually fetched by households from the same *water kiosk* (normally between 3 to 5 shillings). Figure 4.7 shows the relative prices paid per unit jerry can of water. Further inquiry also revealed that some water kiosks only sold water to vendors who would in turn sell the water to households at an exorbitant fee. These are mainly what households referred to as *cartels*. In the event of

water scarcity, or dry weather periods, water prices escalated arbitrarily and water vendors and *cartels* cashed in on the households' misery.

Figure 4.7: Cost of water per 20 litre unit jerry can



Source: Researcher, 2011

#### 4.8: Household income and cost of water

Majority of households in Huruma spent relatively high proportions of their monthly income on water. Based on the World Bank's 2005 purchasing power parity of 1.25 US dollars per day, a 25 day working month and an exchange rate of 80 shillings to the US dollar, the average household monthly income was computed and found to be 4,300 shillings per month. The minimum purchasing power parity used was 2,500 shillings computed as  $(1.25 \times 25 \times 80 = 2,500)$ . The statistics clearly show that a majority of the households (34%) lie below the poverty line.

Table 4.8a: Average monthly income in Huruma

Monthly income in (Kes)	Average score	Frequency	Total (Kes)
<2,500	2,500	34	85,000
2,500 – 5,000	3,750	27	101,250
5,000 – 7,500	6,250	29	181,250
7,500 – 10,000	8,750	6	52,500
>10,000	10,000	1	10,000
		<b>97</b>	<b>430,000</b>

**430,000** shillings  
**97** households

= 4,433 shillings

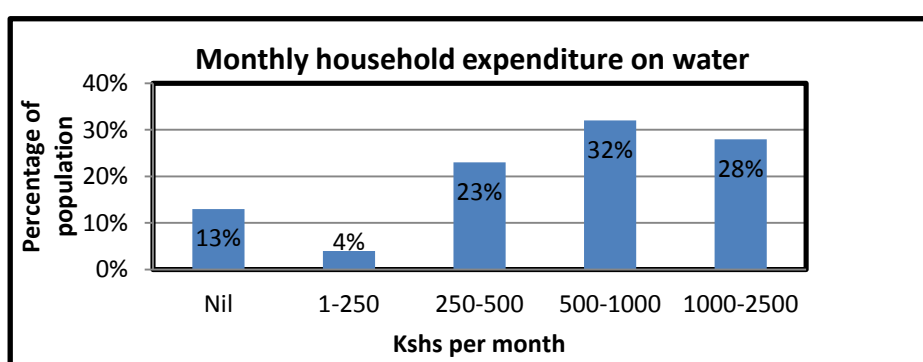
Average monthly income in Huruma

Note: 3 households representing 3 percent of the respondents did not respond to this question

Source: Researcher, 2013

On the amount spent on water, research findings revealed that 32% of the respondents spent between 500 and 1000 shillings of their total monthly budget on water. Another 28% spent between 1000 and 2500 shillings, 23% spent between 250 and 500 shillings of their monthly income on water. It is also critical to note that 13% of the respondents did not pay for their water. A further analysis to this group shows that they obtained their water directly from illegal connections diverted from the Nairobi City Water and Sewerage Company's network and connected to their premises. Figure 4.8 shows the average monthly expenditure on water.

Figure 4.8: Monthly household expenditure on water



Source: Researcher, 2011

Households connected to the Nairobi City Water and Sewerage Company's water mains pay an average of 20 shillings per 1000 litres inclusive of meter fees. This represents about 13 times less than what households in Huruma pay for the same quantity of water, despite their relatively low income.

Table 4.8b: Water tariff structure for the year 1<sup>st</sup> June 2009 to 31<sup>st</sup> May 2010

Customer Category	Consumption Block (m <sup>3</sup> )	Current Approved Tariff (Kshs/m <sup>3</sup> )
Domestic/Residential	0-10	18.71
Commercial/Industrial	11-30	28.07
Government Institutions and Schools	31-60	42.89
	≥ 60	53.80
Water Kiosks	0-10	15.00
	11-30	
	31 - ≥ 60	
Bulk sale to WSP's for resale	0-10	26.57
	11-30	
	31- ≥60	

Source: AWSB, 2009

Note: WSP's means Water Service Providers



Table 4.8b shows the water tariff structure by Athi Water Services Board which is in charge of water regulations in Nairobi.

A cross tabulation of the relative monthly income and the proportion of income spent on water reveals that 44% of households with a monthly income of less than 2,500 shillings spent between 250 to 500 shillings representing about one fifth of their total income. Similarly, 48% of households with a monthly income of between 2,500 and 5,000 shillings spent between 500 and 1000 shillings on water. This also represents one fifth of their total monthly income.

Table 4.8c: Cross tabulation of total monthly income and amount spent on water

			What is your monthly income?					Total	
			<2500	2500-5000	5000-7500	7500-10000	>10,000		No response
How much do you spend on water?	1-250	Count	0	1	1	0	0	2	4
		% within What is your monthly income?	0.0%	3.7%	3.4%	0.0%	0.0%	66.7%	4.0%
	250-500	Count	15	4	4	0	0	0	23
		% within What is your monthly income?	44.1%	14.8%	13.8%	0.0%	0.0%	0.0%	23.0%
	500-1000	Count	8	13	8	2	0	1	32
		% within What is your monthly income?	23.5%	48.1%	27.6%	33.3%	0.0%	33.3%	32.0%
	1000-2500	Count	6	7	12	3	0	0	28
		% within What is your monthly income?	17.6%	25.9%	41.4%	50.0%	0.0%	0.0%	28.0%
	No response	Count	5	2	3	0	1	0	11
		% within What is your monthly income?	14.7%	7.4%	10.3%	0.0%	100.0%	0.0%	11.0%
	Not applicable	Count	0	0	1	1	0	0	2
		% within What is your monthly income?	0.0%	0.0%	3.4%	16.7%	0.0%	0.0%	2.0%
Total	Count	34	27	29	6	1	3	100	
	% within What is your monthly income?	100.0%	100.0%	100.0%	100.0%	100.0%	100.0%	100.0%	

*Note: 3 households representing 3 percent of the respondents did not respond to this question*

Source: Researcher, 2013

#### 4.9: Water actors in Huruma

The study set out to identify the different actors involved in the provision of water in Huruma. Research findings revealed that there were several water actors involved both formal and informal actors. Formal actors were those licensed and therefore legally recognized to operate in the area. Informal actors involved those who were not licensed but carried out the business of selling water to households in the area. Table 4.9 shows the various actors involved in the provision of water in Huruma and their main characteristic as identified in the study.

Table 4.9: Water actors involved in the provision of water in Huruma

Water Actor	Type of Actor	Number Sampled	Characteristics
1. NCWSC	Formal	Single Provider	<ul style="list-style-type: none"> <li>Water is provided through piped network</li> <li>Has minimal spatial coverage</li> <li>Experiences frequent interruption of water supply</li> <li>Quality is acceptable but further treatment is required due to contamination from illegal connections</li> </ul>
2. <i>Water Kiosks</i>	Informal	5	<ul style="list-style-type: none"> <li>Water is provided through NCWSC piped network to a common point.</li> <li>Resell water to households and vendors at relatively affordable costs.</li> <li>Has water meter and pays water bills to NCWSC</li> <li>Water quality is acceptable but not fit for consumption without further treatment</li> </ul>
3. Cartels	Informal	3	<ul style="list-style-type: none"> <li>Masquerade as water kiosks but are unlicensed</li> <li>Obtain their water by making illegal connections from main water supply network</li> <li>Have no standard water charges (usually fluctuates with demand and supply)</li> </ul>
4. Water vendors	Informal	10	<ul style="list-style-type: none"> <li>Obtain water from water kiosks and cartels</li> <li>Use hand carts and wheelbarrows to deliver water to households</li> <li>Quality is not acceptable due to containers used for water delivery.</li> </ul>
3. CBO's and NGO's	Formal	2	<ul style="list-style-type: none"> <li>Provides water to all households in the area</li> <li>Have huge capacities for water storage</li> <li>Incorporate other income generating activities alongside water provision e.g. youth projects, sanitation blocks etc</li> </ul>
4. SHG's	Formal	1	<ul style="list-style-type: none"> <li>Provides water to member households</li> <li>Have limited capacities for water storage</li> <li>Incorporate other income generating activities alongside water provision e.g. youth projects, sanitation blocks etc</li> </ul>

Source: Researcher, 2011

Plate 4.9: One of the water points run by a Non-Government Organization in Huruma



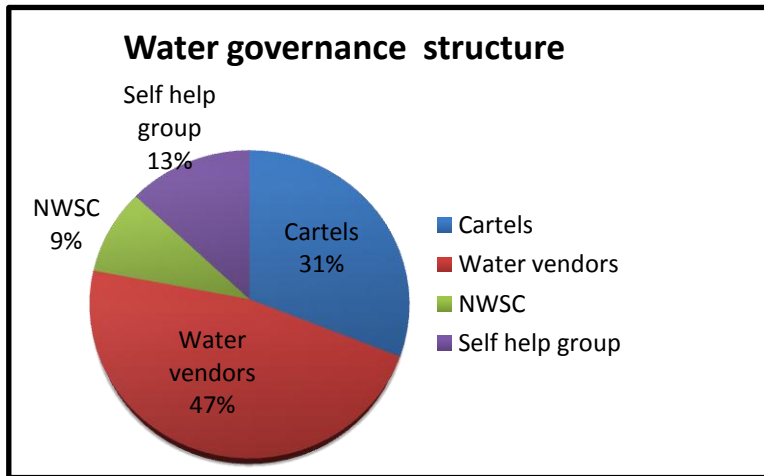
Source: Researcher, 2011

#### 4.10: Water governance in Huruma

The management of water sources in informal settlements is critical as this reveals the inherent challenges of governance such as the level of service provision, nature and level of participation in decision making, and other factors like marginalization of specific gender especially women.

The study sought to identify the individuals and institutions that were responsible for the management of various water sources in Huruma. Research findings showed that 47% of the water points were managed by water vendors, while *cartels* were identified to be in control of 31% of the water points in Huruma. Figure 4.10 shows the prevailing water governance structure in Huruma. In essence, about 78% of respondents attributed the ownership of 'public' water to be in 'private' hands. The water vendors and the cartels owned the *water kiosks* while 13% of the water points were under the management of self-help groups. The Nairobi City Water and Sewerage Company control a mere 9% of the water outlets in the informal settlement. This is in contrast to the ideal role of the water company since it is legally tasked to provide adequate water to all citizens within the city.

Figure 4.10: Water governance structure in Huruma



Source: Researcher, 2011

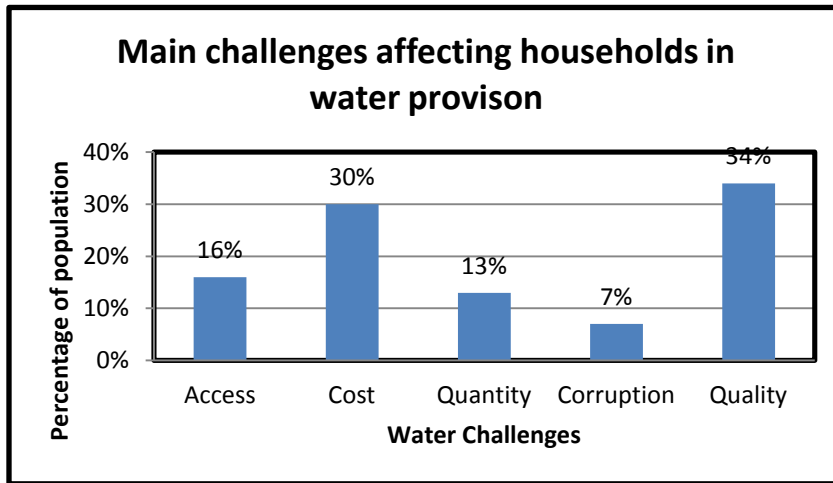
On further inquiry, the study sought to identify the most preferred water actors by households. Research findings showed that 50% of the respondents preferred Community Based Organizations (CBO's) to control the water points in the area while 42% preferred Non-Governmental Organizations (NGO's). A paltry 8% of the residents preferred Self Help Groups (SHG's). Several reasons were given for the different preferences. Most residents attested that CBO's and NGO's were best placed to understand the water needs of households in addition to being non-partisan in provision of water. Self Help Groups were faulted for being discriminatory and only advocating for the interests of their members at the expense of non members. The respondents did not want to be associated with the NCWSC as they do not find the company's efforts capable of addressing their water woes after years of neglect and seclusion.

#### 4.11: Main challenges affecting households in water provision

One of the objectives of the study was to identify the main challenges affecting households in Huruma pertaining to water provision. Research findings revealed that 34% of the respondents were concerned that the water was of poor quality while 30% of them perceived the high cost of water as the main challenge they faced. Inadequate access to the water sources was also identified as a major challenge affecting 16% of the respondents while 13% of the respondents identified low water quantity as the

major challenge. Only 7% of the respondents identified corruption as a major challenge affecting water provision in Huruma.

Figure 4.11: Main challenges affecting households in water provision.



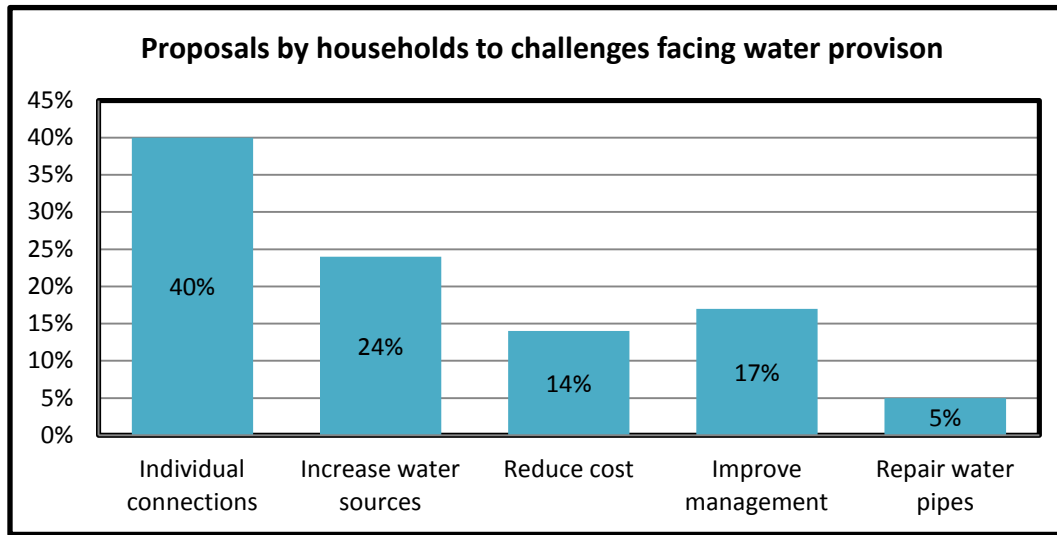
*Note: (Access in the bar graph has been used to represent distance and time taken to get water)*

Source: Researcher, 2011

#### 4.12: Proposals by households to challenges they face in water provision

The study also identified proposals from households to the challenges faced by residents in water provision. An average of 40% of the residents preferred to have individual piped connections to their premises. They however do not trust the NCWSC to supply and manage the water yet it has the legal mandate and the infrastructure to provide piped water to the premises. Those further interviewed on the matter accused the company of keeping poor records and issuing incorrect water bills to those who were already metered hence their resistance. 25% of households recommended an increase in the sources of water to cope with the challenges while 17% of the respondents pointed out that a reduction in the cost of water was the most effective way of dealing with the water problems. A fraction of the respondents, 17%, outlined that improving the management of the water points would alleviate the present water crisis while 5% proposed the repair of the water pipes as a preferred solution to water challenges. Figure 4.12 graphically represents the key proposals to challenges facing water provision as prioritized by the respondents.

Figure 4.12: Proposals by households to challenges affecting water provision

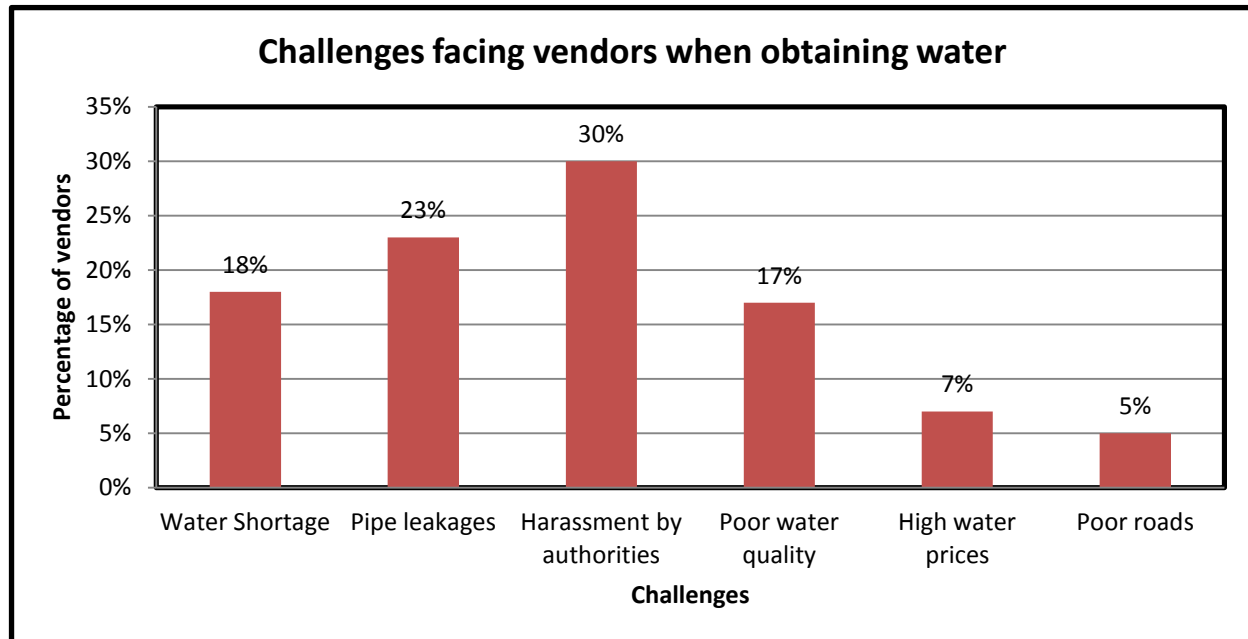


Source: Researcher, 2011

#### 4.13: Challenges facing vendors when obtaining water

A number of challenges faced by water vendors were identified in the course of the research study. These were varied depending on whether they were experienced when obtaining water or when selling water. 30% of the vendors observed that harassment by authorities was the greatest challenge when obtaining water. The authorities involved included officials from the water company, the officers from the County Council of Nairobi and the local administration police. A further 23% attributed leakages from pipes to be a major challenge while water shortage was a major problem for 18% of the vendors interviewed. 17% of the vendors lamented the poor quality of water and 7% attributed high water prices as the biggest challenge they faced. Cumulatively, over 80% of these challenges are not attributed to water shortage but rather to the lack of a proper water governance structure and failure of the relevant institutions to carry out their respective mandates. Figure 4.13 shows the challenges faced by vendors when obtaining water.

Figure 4.13: Challenges facing vendors when obtaining water



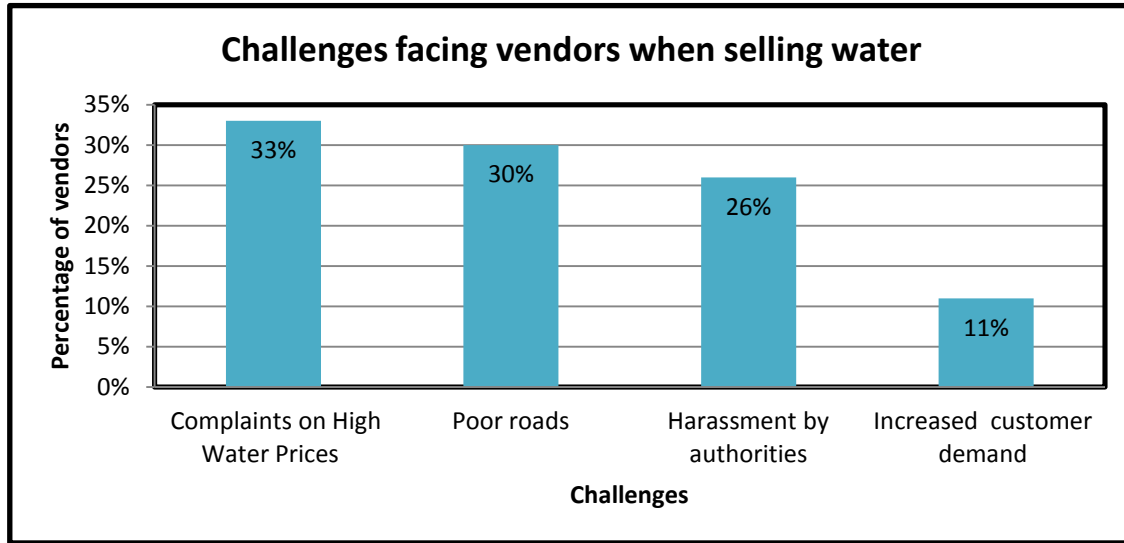
Source: Researcher, 2011

#### 4.14: Challenges facing vendors when selling water

On the other hand, vendors were also faced with challenges in the process of water delivery to their customers. The study revealed that about 33% of the vendors received complaints of high water prices as the major challenge and 30% attributed poor roads as a major impediment in their quest to sell water. Harassment by authorities was also a major problem identified with 26% of the vendors experiencing this even when selling the water. 11% of the vendors observed that they experienced a major challenge when dealing with the increased customer demand. These challenges observed by vendors still point out a crucial link to the fact that the water crisis is not entirely about the shortage of water but the governance structure and failures of various institutions within and beyond the water sector. Figure 4.14 shows the challenges faced by vendors when selling water.



Figure 4.14: Challenges facing vendors when selling water

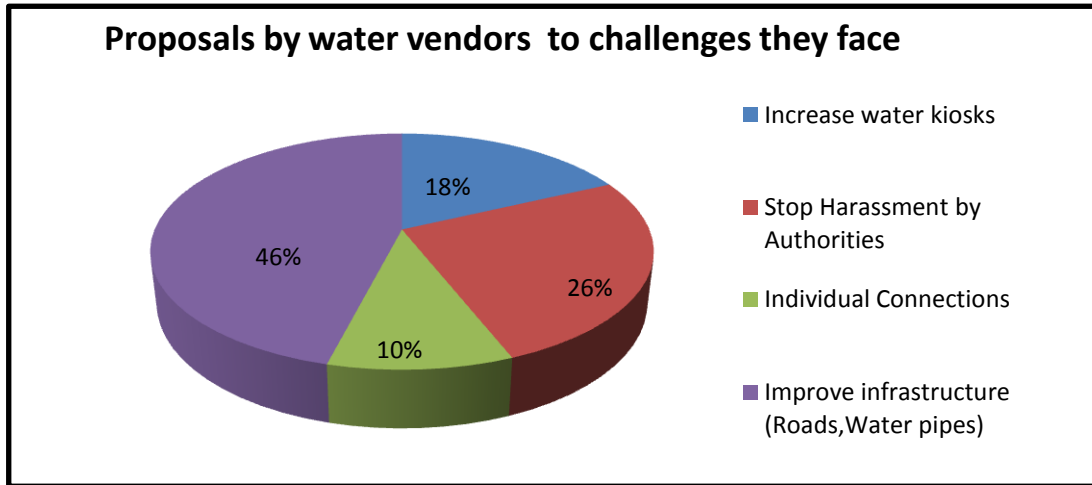


Source: Researcher, 2011

#### 4.15: Proposals by water vendors to the challenges they face.

Despite the challenges faced by water vendors in obtaining and selling water, there were several proposals they advanced to improve the situation. Research findings observed that 46% of the vendors recommended for improved infrastructure including paving of the roads and repair of leaking pipes. This is however a challenge given that there is hardly adequate space to enhance accessibility and movement in the informal settlement. 26% of the vendors proposed an end to the constant harassment by the various authorities while 18% proposed the increment of *water kiosks* to increase the number of water outlets. A meager 10% of the water vendors recommended individual connections for the residents. This can be attributed to the fact that implementation of such a proposal would render the water vendors out of business. Figure 4.15 shows recommendations to challenges faced by water vendors.

Figure 4.15: Proposals by water vendors to challenges they face

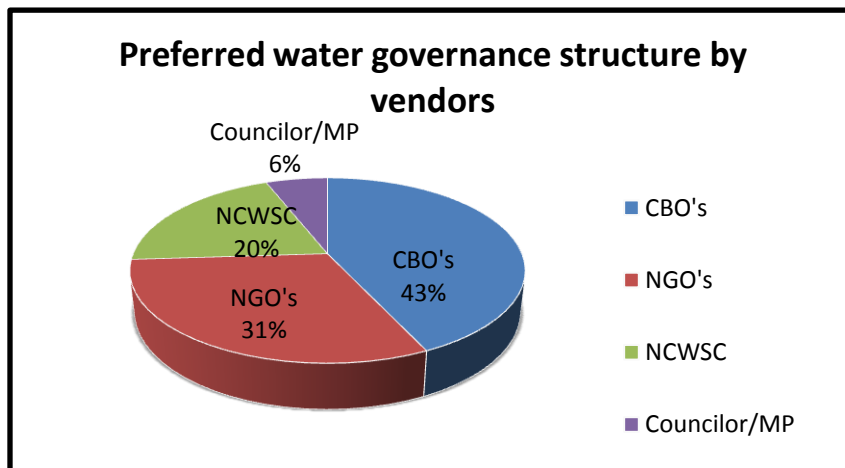


Source: Researcher, 2011

#### 4.16: Preferred water governance structure by vendors

The research study also sought to inquire from the water vendors what their most preferred water governance structure was. About 43% preferred CBO's to manage the water points, 31% opted for NGO's and 20% preferred the Nairobi City Water and Sewerage Company. 6% of the vendors preferred their local councilor or Member of Parliament to manage the water outlets. This corroborates earlier findings that CBO's and NGO's are most preferred by both households and vendors.

Figure 4.16: Preferred water governance structure by vendors



Source: Researcher, 2011

#### **4.17: Challenges facing Nairobi City Water and Sewerage Company (NCWSC)**

It has been documented that Nairobi City Water and Sewerage Company obtains its water from the surrounding peri-urban areas like Thika and Kikuyu. The adequacy of water in these areas dictates how much water is available for the city residents. Evidence has emerged of dwindling rainfall in the Aberdare water tower and increased abstraction rates resulting to less water available to cope with the city's high demand. (NCWSC, 2011)

The quest to quench the city's water demand by exploring alternative sources of water such as underground water and rainwater harvesting has not been fully exploited. There is very little empirical evidence of this, if any. Nairobi's underground water is not fossil, but renewable. However, the rate of extraction is quickly exceeding the rate of recharge with new evidence emerging of dried up boreholes in areas such as Parklands due to exhaustion of the aquifer. The capital and maintenance costs associated with drilling boreholes are huge. In developing its 20 year master plan, the water service provider has identified rainwater harvesting as a viable option that will ease the demand of water services for non-consumptive uses. It is advocating for the implementation of city by-laws that will compel new buildings to harness rainwater.

The uneven topography of the city also hinders the efficient flow of water to all parts of the city. The company has few pumping and distributing stations compared to the high demand in the city, which continues to grow both spatially and demographically. To alleviate this, the water company is implementing the Nairobi Water and Sewerage Emergency Physical Investments Programme with funding from the French government and other donors. The main objectives are to improve the living conditions of the inhabitants of the city of Nairobi through large investments in water and sanitation infrastructures; and simultaneously to complement the implementation of reforms within the water sector at the local level. It is expected to increase the city's water production capacity by 25% once the laying of a fourth water main transmission pipeline between Kwa Maiko in Githunguri and Gigiri is completed. (NCWSC, 2011)

Rising energy costs are a major impediment to the company's quest to supply water. The water company's machinery runs on diesel powered generators and electricity from the national grid. Oil prices which are dictated by global prices have been on a steady increase in the recent past thereby

significantly increasing the operational and maintenance costs of the company. These costs have not been levied on consumers and with no subsidy from the government, the company foresees passing the burden to the end users if these steady rise continues. Despite the water company making over 4.2 billion shillings (\$52.5million) in 2010/11 fiscal year, the apparent struggle by the company to cover its operations and maintenance (O&M) costs are impacting negatively on water sector gains achieved to date. An ineffective revenue collection mechanism results in less than half of the consumers connected to the grid system paying their bills, according to a recent water survey. The company has embraced Information and Communication Technology (ICT) where customers can check their outstanding bills via text message and pay using mobile money services. (NCWSC, 2011)

Leakages and burst pipes and blocked sewers remain a major problem. The aging and frail water infrastructure in the city can no longer adequately serve the city. Most pipes in the network have failed from over-use and lack of maintenance over the years. The water company has also been battling with illegal connections since its inception. This is a very common and highly prevalent practice especially in informal settlements like Huruma where many cases of vandalism go unchecked and unpunished. Water cartels sell illegally diverted water from NCWSC's piped network to poor urban dwellers at exorbitant prices. The water company has tried to address this issue by involving the affected settlements in constructing more *water kiosks* and providing more storage tanks in areas without the piped network. Figure 4.17a highlights some of the illegal water connections in Huruma.

Plate 4.17a: Illegal water connections in Huruma, Nairobi



Source: Researcher, 2012

Households are being encouraged to report incidences of vandalism, but this is hampered by a weak legal framework and an inadequate capacity to enforce the law. The company conducts civic education programmes dubbed ‘customer clinics’ in various parts of the city. These clinics target both domestic and industrial users. They provide a platform for interacting with the communities and advocating for water conservation tips. Some of residents are re-using water for non- consumptive uses like car washing among others. The company also uses these clinics to explain the rationale for their water rationing programmes and also get feedback from households on how to improve water services. Figure 4.17b shows some of the initiatives undertaken by the relevant water service board.

Plate 4.17b: Water tank donated to a youth group by Athi Water Services Board in Huruma, Nairobi



Source: Researcher, 2012

## CHAPTER 5: CONCLUSION AND RECOMMENDATIONS

### 5.1: Introduction

This research study set out to assess water governance in informal settlements by looking at factors that influence access to water situation in Huruma. In the assessment, the study identified parameters like cost of water, distance to water source, quality and quantity of water accessed and to a little extent, participation in decision making on water matters. These were the determinants that informed the choice of households and water vendors on which sources to obtain water from.

### 5.2: Summary of findings

The study identified the main sources of water for households in Huruma. These were found to be piped water connection from NCWSC as well as a relatively low number of households who obtained their water from tankers and boreholes.

The different actors involved in the provision of water services were also investigated and categorized as formal and informal actors. Formal actors were licensed and legally mandated to provide water services to households. These included *water kiosks*, Water cartels, the Nairobi City Water and Sewerage Company (NCWSC), and a handful of NGO's, CBO's and SHG's that had stepped in to improve access to water for households in the study area.

Variables that are related to and affect access to water were also investigated. These variables include cost of water, quantity of water, quality of water, distance to water sources, as well as the time taken to reach water sources. Findings revealed that a relatively high number of households spent a significantly high amount of their monthly income to pay for water. This was computed to about one fifth of their monthly income and more than twelve times what other households pay for piped water in well serviced areas. The per capita daily water demand was barely within the recommended service level to guarantee basic water access. The distance to water sources was also within the minimum limit of 1000 meters to guarantee basic access. However, it was found that the further the distance increased the lower the quantity of water collected.

The time taken to reach water source was also found to be significantly high even when this was not related to the distance covered. Other factors such as the inaccessibility of access paths and preference towards a specific water source were found to have contributed to this. The quality of the water was found to be a major challenge especially to households in the area. This may be attributed to the many incidences of illegal water connections which expose water pipes to contamination. This could also be as a result of the poor hygienic conditions by unlicensed water vendors and the containers used for storage and delivery of water to households.

Finally, the challenges affecting water vendors while obtaining and selling water to households were investigated. Research findings revealed that factors such as water shortages, leaking water pipes, harassment by authorities and poor water quality were among the most pressing issues. Others included poor access paths and complaints of high water prices.

### **5.3: Conclusion**

From the analysis, it has emerged that water governance in Huruma's informal settlements is not effective. There are many challenges relating to the limited sources of water, poor quality of water, low quantity of water and relatively high cost of water. The parameters used to determine effective water governance barely reach the recommended minimum limits. These challenges border the 'no access' service indicators in terms of water provision. This assessment of water governance in Huruma has also revealed the inability of the water service provider and its agencies to deal with the many incidents of illegal water connections and the thriving business of water cartels. This is a major deterrent to the quest of the water service provider to provide water to marginalized segments of the society.

### **5.4: Recommendations**

In an attempt to address the governance challenges related to water accessibility, the study came up with several recommendations for both policy action and future research activities.

#### **5.4.1: Policy recommendations**

The huge disparities especially in relation to the cost of water charged by the Nairobi City Water and Sewerage Company and those charged by other water actors needs to be addressed. The persistent

leakages of water resources need also to be fixed. This not only leads to loss of water, but also contributes to loss of revenue for the water service provider. The illegal connections should be identified and disconnected since these are the major contributors to the culture of exploitation in informal settlements. The water service provider may consider carrying out a mapping exercise to trace its entire water infrastructure as well as replacing the aging pipes.

Households should be involved at the local level of decision making especially in terms reviewing water costs in the area. Youth members in informal settlements can also be trained with technical skills to perform minor repairs and fix leakages before the water utility engineers replace defective parts. There should also be concerted efforts to increase the number of *water kiosks* or communal taps to increase the water outlets and broaden the choices of households in terms of access to water.

#### **5.4.1: Recommendations for further research**

Future research activities should explore the feasibility of alternative water sources in the city. Deliberate efforts should be made by researchers in informing water service providers, the county government and other stakeholders to enhance the capacity of households in informal settlements to capture and safely store rainwater.



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## **Appendices**

- i. Questionnaires

**UNIVERSITY OF NAIROBI**  
**DEPARTMENT OF GEOGRAPHY AND ENVIRONMENTAL STUDIES**  
**M.A (ENVIRONMENTAL PLANNING & MANAGEMENT)**  
**WATER PROVISION IN HURUMA**  
**HOUSEHOLD QUESTIONNAIRE**

*Declaration: this information is confidential and will be used purely for academic purposes only*

**Respondent information**

1. Name of respondent (optional) .....
2. 1) Male                      2 ) Female
3. How long have you been living here?  
     1) 0-1years    2) 1-3 years                      3) 3-5years    4) over 5years
4. How many people reside in this household? .....

**Economic information**

5. What is your monthly income in ksh?  
     1) <2500      2) 2500 - 5000      3) 5000 - 7500      4) 7500 -10,000      5) > 10,000
6. How much do you spend on the following?

Item	1 - 150	150 - 300	300 – 1000	1000 - 5000	>5000
a) Rent					
b) Water					
c) Energy:					
Gas					
Charcoal					
Fuel wood					
Paraffin					
d) Food					
e) Clothing					

**Water Supply and Consumption**

7. What are the main water sources and the distance to the source?

Water Source	Drinking	Cooking	Other Domestic Uses	Distance to source 1) 0 - 500mts 2) 500mt -750mts 3) 750mts - 1Km 4) 1Km - 1.5Km 5) >1.5Km	Time (mins) 1) < 5 Mins 2) 5 -10 Mins 3) 10 – 20 Mins 4) 20 -30 Mins 5) > 30 Mins
Nairobi Water Connection					
Public tap					



Bore Hole					
Shallow well					
Water Kiosk					
Carriers/Handcarts					
Tankers					
Others (Specify)					

8. How much water do you use and at what cost per 20ltr jerry can? (Refer to previous answer)

Source of Water	Quantity (No. of 20ltr jerry cans per day) 1) 1 to 2 2) 3 to 5 3) 6 to 10 4) >10	Cost per 20ltr Jerry can 1) Ksh. 1 - 3 2) Ksh. 3 - 5 3) Ksh. 5 - 10 4) Ksh. 10 - 20 5) Ksh. > 20
Nairobi Water Connection		
Public tap		
Bore Hole		
Shallow well		
Water Kiosk		
Carriers/Handcarts		
Tankers		
Others (Specify)		

9. How often do you?

- 1) Not available at all
- 2) Available all the time
- 3) Periodically (specify) (.....)

10. Do you think the water you are using is clean and safe for drinking?

- 1) Yes
- 2) No
- 3) I don't know

11. If no, how do you treat the water to make it safe to drink:

- 1) Boiling
- 2) Filtering
- 3) Water Guard / Chlorine
- 4) Settling
- 5) Others (specify) (.....)

12. What problems do you encounter with your current water supply

- 1) Unreliable supply
- 2) Interrupted supply
- 3) Poor water quality
- 4) High prices
- 5) Billing and revenue collection is inappropriate
- 6) Water Source is too far
- 7) Others (specify) .....

#### For respondents served by piped water

13. Do you have a meter? 1) Yes 2) No

If yes, is it functioning? 1) Yes 2) No

14. If you are connected, how often do you get your bills? .....

15. Do you sell water to your neighbors? 1) Yes 2) No

If yes, how much per 20ltr jerry can? .....

**For respondents served by standpipes & water kiosks**

16. Are you comfortable with the location of the water point from your premises?

- 1) Yes
- 2) No

If no, How far/ near would you like it to be located from your premises?

- 1) 0 - 500mts
- 2) 500mts - 750mts
- 3) 750mts - 1Km
- 4) 1Km - 1.5Km
- 5) >1.5Km

17. Who is currently responsible for managing the water point?

.....  
.....

18. Are you comfortable with the management of the water point?

- 1) Yes
- 2) No

If No, in your opinion who can be relied on for effective management?

- 1) Community Association
- 2) Self help groups
- 3) Private Operator
- 4) Community Based Organization
- 5) Non- Governmental Organization

**For respondents served by mobile water vendors**

19. How are you supplied with water?

- 1) Hand carts
- 2) Individuals
- 3) Others (specify) (.....)

20. In case of improvement of water supply services are you willing to be connected to water supply?

- 1) Yes
- 2) No

21. If yes, what option would you prefer?

- 1) Standpipe
- 2) Water Kiosk
- 3) Individual connection

22. In case of a kiosk selling water from a pipe connection what are you prepared to pay per bucket/jerry can (20 liters)? Kshs.....

23. In your opinion who can be relied on for effective water supply and management?

- 1) Nairobi Water & Sewerage Company
- 2) Community Association
- 3) Self help groups
- 4) Private Operator
- 5) Community Based Organization

6) Non- Governmental Organization

7) Other (Specify).....

**Open discussion**

24. What do you consider to be the biggest problem with Water Provision in Huruma? (Please rank)  
a) Access ( ) b) Price ( ) c) Quantity ( ) (d) Quality ( ) (e) Corruption (f) Others (Specify)

25. What other problems do you encounter as a result of the water problem in this neighborhood?  
.....  
.....What do you think should be done to improve the Water Supply situation Huruma?  
.....  
.....  
.....

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**FOCUS GROUP DISCUSSIONS WITH COMMUNITY GROUPS.**

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1. Who are the main water suppliers in Huruma?  
.....  
.....  
.....  
.....
2. What is the current water situation in Huruma in terms of?
  - a) Availability.....
  - b) Quality.....
  - c) Quantity.....
  - d) Reliability.....
3. What are the key factors responsible for the current water situation?
  - a) .....
  - b) .....
  - c) .....
  - d) .....
4. How can the situation be improved?
  - a) .....
  - b) .....
  - c) .....
5. How would the improvement impact on your daily activities?
  - a) .....
  - b) .....
  - c) .....
6. Who do you think should be responsible for the improvement and why?
  - a) .....  
.....
  - b) .....  
.....
  - c) .....  
.....
7. Do you think the residents would be willing to play cost sharing role in the water supply improvement efforts during:
  - a) Implementation (contributing to investment cost): Yes / No )
  
  - b) Operation and maintenance stage (pay for user fee): Yes / No )
8. If there is any improvement to be done on provision of water, which agencies would you like to manage the resources / process?

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**QUESTIONNAIRE FOR NCWSC**

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1. Under the current contract, is NCWSC mandated to cover informal settlements?  
1) Yes            2) No
2. If yes, how much water is supplied to Huruma? .....
3. If no, who are the water providers in Huruma?  
.....
4. a) What is the number of licensed water vendors (if any) in Huruma? .....
- b) In which sections of Huruma do these vendors supply water?  
.....  
.....
5. What are the challenges faced by NCWSC in the supply of water to residents in Huruma?  
.....  
.....
6. How are you currently addressing the water problem in Huruma?  
.....  
.....
7. Are there any planned or ongoing water projects in Huruma?  
  
1) Yes            2) No
9. If yes, who are the actors involved and what roles do they play?
  - a. ....
  - b. ....
  - c. ....
  - d. ....
10. Is there a plan to completely cover the area with piped water?  
1) Yes            2) No
11. If yes, what is the time scale? .....
12. What advise would you give to other water operators in order for them to operate efficiently?  
.....  
.....
13. Given the situation in Huruma, what (in your view) is the best mode of water supply in the area?  
.....  
.....  
.....

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**QUESTIONNAIRE FOR WATER OPERATORS**

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1. Name of respondent.....
2. Age .....
3. Sex of respondent.            1) Male                            2) Female
4. How long have you been supplying water in this area?  
1) 0-1years                    2) 1-3 years                    3) 3-5years                    4) over 5years
5. Where do you obtain the water to sell?  
1) City Council Water                    2) Boreholes                    3) Wells/Springs  
5) Others (Specify) .....
6. For how much do you buy the water and at how much do you sell?  
Buying .....                    Selling .....
7. What mode do you use to supply water?  
1) Handcart                    3) Stand pipe  
2) Water kiosk                    4) others (Specify) .....
8. What problems do you encounter in obtaining water from the source?  
.....  
.....  
.....
9. What problems do you encounter in water delivery in this area?  
.....  
.....  
.....
10. In your opinion, how can the water situation be improved?  
.....  
.....
11. How would the improvement impact on your operation in this area?  
.....  
.....
12. Who do you think should be responsible for the improvement and why?  
.....  
.....
13. Is your business licensed?  
1) Yes                    2) No  
If no, Why.....