SUSTAINABLE DELIVERY OF PRIVATIZED WATER SERVICES BY KIWASCO TO THE POOR IN THE MUNICIPALITY OF KISUMU- KENYA

BY

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Abstract

Access to safe water supply has been one of the top priorities in developing countries over the past three to four decades and billions of dollars have been invested in pursuit of the goal of "universal service" and yet the current reality is far from that goal. Local authorities in Kenya have adopted privatization as a strategy for efficient and effective management and delivery of water services. The poor have not come to terms with the new water policy that emphasizes cost recovery. They view water as a basic need and human right and feel that the government has the responsibility of ensuring that it is available, accessible, adequate, safe and affordable. Water is widely viewed as a social and not economic good. Water utilities often serve only a fraction of the urban population with the vast majority relying on alternative sources. The poor households rely on vending systems and often pay vendors 2-10 times unit price paid by the connected households. The specific objectives were to; assess the level of accessibility to water services by urban residents; evaluate the affordability of privatized water services by the urban poor; and analyse the quality of water consumed by urban residents. The study has used both primary and secondary sources of data. The researcher sampled 367 from 8583 households distributed in the four categories, namely; high income, middle income, low income planned and low income unplanned residential estates in Municipality of Kisumu. Interviews were also conducted with key informants including KIWASCO as well as LVSWSB officials. The data was analyzed using ANOVA to assess the difference in the expenditure on and demand for water within and between the estates. Correlation Analysis has also been used to assess the degree of association between household income and water use amongst the residents, while t-test was used to determine the level of water affordability. The study found out that the proportion of households with access to safe water supply within a distance of 200m is 77.1 per cent and only 65.6 per cent of the basic water requirements of the households are met. The mean daily per capita water use is 32.92 litres compared with the WHO recommended 50l/c/d, with the high income households using about 2.5 times more than the unplanned settlement households. Private in-house piped connection is the most important, yet only 19.8 per cent of the sampled households use them as their primary source. Vast majority of the households depend on either vendors or kiosks as their primary source of water. Based on 5 per cent benchmark ratio, the study revealed that 75.7 per cent of the households find the cost of water unaffordable. The study further found out that the proportion of a household's income or

budget spent on water service and affordability are negatively correlated and that expenditure on water constitutes a significant household budget, just like rent, fees and food. The majority of the households felt that, despite the good impressions of taste, smell and colour of water, they still found it necessary to treat their water either by boiling or use of chemicals. The study concludes that the proportion of households with access to safe water in the study area is quite low, below even the national average and the residents have to contend with multiple sources meet the daily water demand. The total water requirement of the households can be determined from the data collected and KIWASCO would have a better sense of how much water to produce. The expenditure on water constitutes a significant household budget and based on of 5 per cent benchmark ratio, ¾ of the residents find the cost of water unaffordable. The study recommends that to expand access to safe water services there is need for upfront investment on rehabilitation and extension of existing water network in addition to upgrading of treatment plant, thus reducing the cost of maintenance and unaccounted for water and making better use of economies of scale. New water ethics and demand-based service delivery should also be adopted for better management and services. Surveillance tests by other bodies like NEMA, WSB and KEBS should also be intensified through establishment of more test points and frequent regular tests both at the end points as well as treatment plant.

CHAPTER ONE

1. INTRODUCTION

1.1. Background to the Study

At the 2000 Millennium Summit, member countries of the United Nations unanimously agreed on a set of 8 goals to reduce poverty by 2015: among which is reducing by half the proportion of households that do not have access to safe water (Galiani *et al,* 2005). According to UNDP (2006) 2040 is a more likely date for this goal to be reached in Africa unless there is accelerated investment in the sector. While most countries have committed to increasing access to safe water, there is little consensus on how to actually achieve this goal. One provision under consideration by many governments is to privatize water provision. Governments who want to privatize water systems are typically motivated by potential efficiency gains. They hope that these efficiency gains will be translated into expanded access and enhanced service quality and thereby improve health outcomes (Asingo, 2005).

Water is a basic need and human right and as such modern governments have the responsibility of ensuring that it is available, accessible, adequate, safe and affordable. There has been an increasing trend towards privatization of public utilities worldwide. The trend is for the local governments to relinquish some or all their control over the design, construction, ownership and operation of water services. Local governments that lack the financial resources to upgrade aging water systems are tempted by large private offers that promise to retain quality service at more competitive rates. Private water corporations claim they can offer better rates because of lower operating costs and higher efficiency (Segal, 2001).

In addition, if water becomes a private commodity, economically poor communities may be priced out of the water market. While public entities have good reasons to consider social equity and affordability, private corporations, in their desire to increase profits and operational efficiency, may not. Several case studies have documented inequity in water service and quality between high income and low income of the majority neighbourhoods (Mann, 1993). In spite of decades of government and donor-supported investments in the water supply and sanitation, public utilities in many African countries have been unable to fully meet the demand for water and sanitation services. Africa has the lowest water supply and sanitation coverage in the world. Current coverage levels stand at 62 per cent for water supply and 60 per cent for sanitation (Water Utility Partnership, 2002). In Kenya, access to safe drinking water is estimated at 68 per cent in urban areas and 49 per cent in rural areas (Kenya, 2005).

The water sector in Africa has changed a lot over the recent past. Many countries in Africa are pursuing reforms of the water sector which aim at the involvement of the private sector in the management of water resources. Privatization of water services in the developing countries has been a donor driven initiative. In Sri Lanka, in 1996, the Ministry of Planning with technical assistance from the Asian Development Bank (ADB) started the preparation of a National Water Policy. ADB imposed a condition that if water policy was not approved, no funds were to be allocated to the water sector in Sri Lanka (ADB, 1997).

In Tanzania privatizing Dar es Salaam Water and Sewerage Authority was one of the conditions given if the country was to receive the Highly Indebted Poor Countries (HIPC) debt relief (Akande, 2004). The project consisted of improving 'in terms of

accessibility, quality, reliability and affordability of water services to the population'. Further the project was expected to contribute to poverty reduction and improve the economic and social well being of the people of Tanzania by providing them with a better access to clean water, thereby reducing the incidence of water borne diseases among the vulnerable groups. Critics do not agree that poverty reduction is the aim of privatization. The skeptics fear that it only enriches a few people.

In Kenya, however, at local authority's level the impetus appear to be more towards commercialization under which efficiency in service delivery can be attained while ensuring that respective local authorities retain a measure of control. It is now a common trend in Kenya for local authorities to form municipal companies run on strict commercial lines. Sessional Paper No. 1 of 1999 on National Policy on Water Resources Management and Development (Kenya, 1999), tackled issues pertaining to water resources management, water and sewerage development, institutional framework and financing of the sector. Accordingly, the Water Act Cap 372 underwent various amendments which resulted to the Water Act 2002 which became operational on the 18th March 2003. The Act has, therefore, seen local authorities form municipal water companies, which operate on strict commercial lines.

1.2. Statement of the Research Problem

Kenya like any other developing country is facing challenges in ensuring that its citizens have increased access to improved water and sanitation. Despite various initiatives by the Government of Kenya (GoK), Development Partners, Local Authorities, Non Governmental Organizations (NGOs) and individuals to improve water and sanitation provision, urban residents have continued to experience poor

quality, unreliable, inadequate and unaffordable water services. Rapid urbanization and lack of financial resources have made it difficult for urban authorities to respond to the growing demands for water and sanitation infrastructure. In Municipality of Kisumu (MoK), the capacities for the water works are estimated at 18,000m^3 while the present demand is estimated to be 48,000m^3(KIWASCO, 2007). The informal squatter settlements often lack piped water or any kind of conventional waste disposal, making their residents prone to high rates of diarrhoea and other diseases.

Water Sector in Kenya and especially MoK faces the following challenges, namely, inadequate investments for rapid infrastructural development to increase access to water and sanitation; old, poor and dilapidated state of existing infrastructure and high Unaccounted For Water (UFW); the challenge of revising tariff to be cost recovery. It is therefore necessary to carry out a study on a paradigm shift from public to private to identify and quantify the effects of privatization of water on accessibility, reliability, affordability and quality and track the progress towards achieving the MDG.

In Kenya, over the past few years, the government has been undertaking reforms in the water sector but few have seen these translating into drops of water. The shortfall is still high, despite of five years experience of water sector reforms. The GoK policy on cost-sharing in the water sector has been in place since the 1974-78 Development Plan periods. It has been made clear that all consumers should pay for water service thus making water to be considered as an economic good. All water consumers are to pay for water on the basis of the user-pays principle. On the other hand, Poverty Reduction Strategy Paper (PRSP) recognized that water is a basic need and an important catalyst in both economic and social development of the country (Kenya, 2003). Water is

therefore seen both as a social and an economic good. Since water is a basic human need, with privatization, could there be need to provide minimum amount irrespective of affordability by the consumers? The dilemma is, what is the minimum amount to be provided before applying the economic principles?

Whereas commercial water tariffs should embody real economic cost of water supply, it should be appreciated that their universal application is likely to have adverse effects on the more vulnerable sections of the population. There is therefore need to develop a tariff structure that both ensures adequate cost recovery on the water supplies and protects the poor. Commercial price design may make the cost of water be beyond the reach of urban poor. This may affect their accessibility to safe drinking water or incomes. The poor are rarely connected as utilities view them as commercially unattractive and those connected are seldom metered; and end up paying flat rates for water that serves more than one household.

The number of connections in MoK is 10,800 and only 4,400 are categorized as active connections. 60 per cent are therefore faulty meters, which are being charged on average. The water distribution network is old. Pipes laid before 1970 accounts for 81 per cent of the total length. Although laid over a wide area of town, water is currently supplied on a continuous basis only in limited areas. According to JICA, 2001, the population with continuous supply is 8 per cent, limited supply is 34 per cent, while 58 per cent of the population is supplied by kiosks. This has resulted in inadequate supply and extremely high levels of unaccounted for water reaching as high as 70 per cent (Kenya, 2005)

1.3. Objectives of the Study

The overall objective of the study was to examine the impact of privatization of water services on urban residents. The specific objectives of the study were to:

1. Assess the level of accessibility to water services by the urban populace after privatization.
2. Evaluate the affordability of privatized water services by the urban poor
3. Assess the quality of water consumed by urban residents.

1.4. Hypotheses

1) That there is no significant difference in the level of accessibility to water services between the residential categories.
2) That a significant urban population does not afford safe drinking water as per World Bank benchmark.
3) That privatization of water services has not improved the quality of water consumed by urban residents.

1.5. Significance of the Study

The development of water and sanitation systems has been a priority for many African countries. It is an essential step for the improvement of the country's economic and industrial growth to ensure a better health of the population. Improved health is likely to improve the productivity of the citizens and hence wealth creation. Moreover, the GoK has recognized that improved access to water and sanitation services is one of the strategies to tackle poverty. The MoK is on the shore of Lake Victoria, third largest fresh water lake in the World, yet the inhabitants experience perennial water problems. There is, therefore, an urgent need to plan for the provision of safe water.

Private sector would be motivated to invest in areas where there is corresponding level of profitability within a reasonable foreseeable future. The poor are viewed by such investors as commercially unattractive. The study would establish the minimum water requirement by the urban poor and propose pro-poor water tariffs since water is viewed both as a social as well as economic good. The study hopes to stir up further debate on possible decision options that could revitalize water sector strategies in the MoK and Kenya in general.

Water is a public good service and hence subjecting it to the whims of profit driven private sector heightens the fear that its availability, affordability and quality will not be guaranteed once it is privatized. Data on the impact of privatization of water in Kenya's local authorities are both varied and incomplete. This is due to the fact that privatization is relatively recent development in Kenya. Information on the impacts generated by the study would therefore be useful to water companies, NGO's and the GoK to improve the delivery of the service.

The empirical study approach which is adopted with special reference to Kisumu Water and Sewerage Company (KIWASCO) is intended to offer an opportunity to assess the performance of the water company in supporting the overall achievement of the Millennium Development Goals (MDG's). Access to safe drinking water and sanitation services is essential to achieving most of the other MDG's. To this end, it is anticipated that the study will generate data on commoditization of water which is regarded as a human right. Lessons from other places provide stimulating decision making options and as such, brief comparative references of attempts at privatizing water services are incorporated so as to broaden conceptual spectrum and to possibly

evolve guiding principles that may be useful for water sector reforms in Kenya. It is, however, recognized that different communities usually have different traditions, value systems and attitudes to the extent, that replication of one successful procedure from one community in another may not be easy. Knowledge of experience in other places is, however, useful in evolving suitable models of doing things.

The study is based on and supported by a case study on urban water services in the MoK. The characteristics of MoK and its water sector in many ways typify those of other municipalities in Kenya and in deed other low income economies with high levels of poverty, limited access to water and crumbling network. Hence its experience with privatization and the lessons associated with it should be relevant elsewhere.

1.6. Scope of the Study

Unlike other studies which have tended to address water sector reforms in terms of governance and policy issues, this study recognizes the need to study water both as an economic good as well as basic necessity. The scope of this study may be said to be concerned with examining the impact of privatization of water services on quality of water consumed, expenditure on water services, reliability of water supply and access to safe drinking water by the urban residents. The study assesses the services provided by a water company to enhance accessibility to the vital service by urban populace. The services of the private water company which became operational in 2003 is singled out for analysis. The study attempts to answer water privatization issues in Kenyan urban centres and hopes to widen the scope for further debate by raising specific key issues on the implementation of water reform agenda.

The study was confined to MoK and focused on the areas covered by the KIWASCO water supply system. The general characteristics of the MoK were found from the four residential estates that were selected. The estates depicted the zonation characteristics and income categories of the neighbourhoods. The estates included, Milimani, Migosi, Arina and Nyalenda. Milimani Estate represents high income, low density residential area; Migosi Estate represents middle income medium density estate; Arina Estate- low income planned estate, while Nyalenda Estate represents low income, high density and unplanned estate. The residential estates are viewed as basic planning units for providing services at reasonable distances to a well functioning hierarchy of urban settlements.

CHAPTER TWO

2. LITERATURE REVIEW

2.1. Introduction

In this chapter review of some of the privatization policies and principles that have been available to the governments as instruments for sustainable access to safe drinking water have been made. The thrust of this chapter is to review the concept of privatization in general and water in particular. Given, however, that there is immense literature on both privatization and water, only a few conceptual descriptions are presented here, just to give a glimpse of consumer perception and reactions to privatization of water. Highlights of crucial water reform agenda and issues such as accessibility, reliability, cost recovery, availability and quality of water are discussed. The rationale of these discussions is to bring into perspective the impact of water privatization on sustainable access to safe drinking water. This chapter has been divided into the following sections; Water privatization and accessibility, which provides debates around access to privatized water services; Water tariff versus affordability and Quality of Water Services

The study has attempted to estimate the amount of water consumed by households for domestic uses for both developing and developed countries. This review provides benchmark figures with which to compare estimates of water consumption obtained in this study.

2.2. Water Privatization and Accessibility

Privatization is a very broad term describing many policy tools for shifting some degree of responsibility for services to the private sector. Water privatization is an important issue in many African countries. Water is literally the source of all life and the debates over the privatization of its treatment and delivery merit the intensity and scope of discussions that are now taking place.

It's important to understand that there are many different possible forms of privatization. Privatization can be partial, leading to public/private partnerships, or it can be complete, leading to the total elimination of government responsibility for water systems. Bayliss (2001) in her studies on '*Water Privatization in Africa*' identified two main types of private sector participation in water supply and sanitation, namely, the "British Model" and the "French Model". The British Model consists of privatizing both the assets and the operations, while in the French Model, the assets remain publicly owned. There are three major types "French model"

- Management contract, under which the private operator is responsible only for running the system, in exchange for a fee (usually performance-related). Investment is typically financed and carried out by the public sector, but implementation may be delegated.

- Lease contract, under which assets are leased to the private operator, who recoups the cost from end users. Investment is typically financed and carried out by the public sector, but implementation may be delegated, KIWASCO is an example.

- Concession, under which the private operator is responsible for running the entire system, including planning and financing investment. Concession contracts usually run for 20-30 years.

- Build-Operate-Transfer (BOT) exists for the carrying out of specific new investments. The BOT contract involves the private partner constructing the plant and then running it for a number of years (during which payment is received for the treatment capacity provided) before handing it over to the public water company.

Private companies can merely manage and operate the system, or they can own the infrastructure outright. In MoK, the water company has only leased the assets and the asset development is done by the Water Service Board.

Private sector participation (PSP) in water is one of the most controversial debates of the development discourse today. On one side are the proponents who argue that since the GoK has failed in providing access to everyone, private sector can solve this problem by using the market principles (Prasad, 2006). Those who advocate the involvement of private sector in water supply such as the World Bank, international financial institutions, bilateral donors and professional associations among others argue that private sector will improve efficiency, increase extension of service, bring in more investments and will relieve local governments from budget deficits (World Bank, 2004b)

Prasad (2006) while studying '*Current Issues in Private Sector Participation (PSP) in Water Services*' further observed that on the other side of the spectrum are those who consider that water is a common good and should not be in the hands of the private sector. They argue that since water is unlike any other resource and because of the fact that water is the essence of life itself, it should not be treated like a commodity based on market principles. The private sector cannot apply a just criteria for this basic need. Access to water for everyone then becomes a human right and it is the government's obligation to provide this vital resource to everyone. But does the State have the capacity to deliver this service to everyone? It is important to set the context in which these debates take place.

Privatization is a political strategy which creates new rules and new roles between the governments, market, and the civil society (Savas, 1987). It is argued that private ownership is more efficient in delivering services compared to the State. In other words, privatization takes place to increase economic efficiency (Yarrow, 1999). The World Bank (2003a) noted that private involvement in water supply has a long history. Indeed, in some places, private ownership and provision of water was the norm, until governments began to assume these responsibilities. France, for example, has used mainly private water providers for over one hundred years and United Kingdom has used a largely private system since the late 1980s. In Africa, water privatization first came in 1969 in Cote d'Ivoire followed by Guinea in 1989 and that privatization was embraced by most countries in the post 90's. In Kenya, privatization has even a shorter history and a research on sustainable delivery of privatized water services would very useful.

Currently there is a rush to privatize water services around the world. The World Bank and International Monetary Fund (IMF) are pushing for the privatization of water services. They are pushing privatization through stipulations in trade agreements and loan conditions to developing countries (Grossman, 2004). These privatization programs started in the early 1990's and have since emerged in India, Bolivia, Chile, Argentina, Nigeria, Mexico, Malaysia, Australia, and the Philippines, to name a few. Supporters of privatization say that it has a great track record of success, increasing the efficiency, quality, reliability and affordability of services to the population. Izaguirre and Rao (2000) say that privatization and public–private partnerships provide the guiding theory and principles in the extension of service coverage and in the improvement of the service performance.

Grusky (2001) argues that water deregulation is a common demand of the World Bank and IMF as part of their loan conditions. In 2000, out of 40 IMF loans distributed through the International Finance Corporation, 12 had requirements of partial or full privatization of water supplies. They also insisted on the creation of policies to stimulate "full cost recovery" and the elimination of subsidies. African governments, such as Ghana, increasingly give in to pressures for water privatization. In Ghana, the World Bank and IMF policies forced the sale of water at market rate, requiring the poor to spend up to 50 percent of their earnings on water purchases. Water privatization is largely donor sponsored which means that the release of aid funds is often conditional on the privatization of water

Water privatization is not just about providing clean water and being efficient. It involves the handing over or the transfer of the management and control of water supply to private hands. Santiago (2005) carried out a study in Malaysia, on '*Why water must not fall into private hands'* and specifically observed that, water privatization involves organizing the water supply system around the rules of the market - to generate profits, to increase stock values of privatized firms and to cater to other investment considerations.

Maude and Clarke (2004) in their report on *World Bank Latest Market Fantasy* recognized that underlying water privatization is the notion that access to water is no longer conceived as a human right or a social good but as an economic good and a commodity that can be bought and sold to the highest bidder. Essentially, water privatization involves transforming water – the source of life, a common good that belongs to all – into a profitable commodity. Furthermore, in a privatized environment, market forces and the profit motive take precedence over the fundamental needs and rights of human beings and society.

Bayliss (2001) indicated that despite some early adopters, major international efforts to privatize water systems and markets are still a relatively recent phenomenon, with major transfers taking place only over the past ten to twenty years. By the end of 2000, at least 93 countries had partially privatized water or wastewater services, including Argentina, Chile, China, Colombia, Philippines, South Africa, Australia and United Kingdom (UK), but less than ten percent of all water is currently managed by the private sector.

According to Estache and Goicoechea (2005), there were 35% of the developing countries that had Private Sector Participation (PSP) and 80% for developed countries. The poorest regions of the world have difficulty in attracting private sector investment, due mainly to the high levels of commercial risks. This is manifested by the fact that only 13% of the countries in South Asia have PSP, 20% for sub-Saharan Africa, 21% for Middle East & North Africa. East Asia & Pacific has 64%, followed closely by Eastern Europe & Central Asia with 62% and 41% for Latin America and Caribbean. Poorer countries have higher risks which leads to having higher cost of capital, which implies higher tariff for the poor (Estache and Pinglo 2004).

Privatization of public infrastructure became the mantra of many development agencies since the late 1980s. Water supply was not an exception and different forms of PSP in water supply have been experimented. Among the policy circles, privatization became the objective in itself rather than a means of increasing access or helping the poor and increasing the overall performance of the economy (Prasad, 2006). This thesis examines the impacts of privatization of water services.

In the UK, the water industry was one of a number of publicly owned enterprises and assets which were privatized during the 1980s. The UK's privatization programme, introduced with much fanfare in the 1980s in the face of enormous public opposition, has been emulated throughout the world in the 1990s. It was justified on the basis of the greater efficiency and benefits to all that would follow from private ownership (Moore, 1985).

The privatization of water supply and sewage disposal is a current political issue in many countries in the world (Shiva, 2002 and Swyngedouw, 2004). It is highly contested because water is an indispensable good and to exclude people from access to drinking water means to deprive them of the basis of their existence and that lack of access to sanitation systems is a threat to living quality because it can be the cause of serious diseases. Furthermore, water is used as a resource and means of production that cannot be substituted by other resources.

It was argued that PSP will bring in the much needed investment, increase access, and improve quality of the water supply (Moore, 1985 and Prasad, 2006). Historically, most water system in European countries was initiated by the private sector. Today it is the public system which provides water & sanitation in most of the countries. It is estimated that over 90% of the world's population is currently supplied by the public sector (Bayliss, 2001).

It should be noted that according to World Health Organization, 50 liters per day per person is the minimum amount of water needed to sustain oneself. In the More Developed Countries (MDCs) each person uses 150 liters per day, whereas in Less Developed Countries (LDCs) it could be as little as 20 liters per day. With a consumption of 30-50 liters per capita, the poorest 20% of the population would only consume 6% of a typical city's total water consumption (World Bank, 2003a). This study has evaluated the quantity of water consumed by the urban residents in different estate categories in MoK and has shown the extent of the deficit in the water demand.

In Bolivia, World Bank backed privatization of water as part of its commitment to the world water crisis (Mosher, 2007). The challenge we face is finding the resources needed to provide water and sanitation for everyone. Many countries do not have the money or the expertise needed to deliver safe water to all their people. Consequently, they look to the private sector to build, maintain and manage water system.

According to Dageleviron (2006), the proportion of the Zambian population with access to safe water declined from 73 per cent in 1990, before the start of commercialization, to 53 per cent in 2005. What is interesting is that data from the Zambian Demographic and Health Surveys indicate a significant deterioration in the "quality of access" to water, as reflected by the proportion of urban population who lost their access to residential pipes and became dependent on public taps, wells or boreholes

Shirley (2002) argued that water sector crisis in Africa followed the recessionary conditions of the 1970's when many suppliers found themselves in a financial vicious circle caused by a decline in government funding of capital expenditure, low tariffs, low billing, low revenue collections and increasing demand for water. This research assesses efficiency gains created by water sector reforms. Mulreany *et al* (2006) demonstrated that privatization is not a good policy option for improving access and public health. On a more philosophical level, they argue that privatization prefers the "non-poor" and is profit-motivated and therefore it is not an appropriate policy on equity and social justice ground. In addition, through privatization of water services, government distances itself from providing one of the essential basic needs to its people. There has been an increasing feeling of discontent and active resistance

against privatization in LDCs and MDCs alike. It is argued that the economic benefits of privatization have not been achieved and that the social impact of privatization were not thoroughly analyzed, especially the impact on the poor.

Halving the estimated 1.1 billion people without access to safe drinking water by 2015 is one of the MDGs. At the current rate of progress, it is unlikely that this target will be achieved in many parts of the developing world (Dageleviren, 2006). According to Human Development Report (2006), 2040 is a more likely date for this goal to be reached in Africa unless there is an accelerated investment in the sector.

Most existing water supply and sewerage collection treatment and disposal systems in Kenya were constructed 20–40 years ago (Asingo, 2005). With inadequate maintenance, non-replacement of obsolete equipment and failure to establish new assets coupled with declining allocations from the exchequer, these existing water and sewerage facilities have been deteriorating rapidly, and currently fail to meet water demand in terms of both quality and quantity of the increasing population. This results in extremely high levels of Unaccounted For Water (UFW) reaching as high as 40% - 70% on the average (Kenya, 2005). This means that for every $100m^3$ of water produced, only $30m^3$ may be delivered to the beneficiaries.

2.3. Water Tariff and Affordability

World Bank study on access and affordability recognizes that PSP in the infrastructure did not take into account the sensitive social issues and as a result did not have any specific social policy framework (Foster 2004). Estache *et al.* (2001) also highlight that the PSP produces distributional effects, which has been neglected. They also

show that the relation between the poor and PSP is complex and ambiguous. However, they argue that the social issues of PSP should be tackled within the general framework of the poverty alleviations programmes and not directly within the utility reforms (Estache *et al.* 2002). PSP does not necessarily improve coverage and there is no evidence that the poor suffer as a result of private sector participation in the water supply (Clarke *et al.* 2004).

UNDP (2006) reported that experiments of more than a decade have shown that privatization of water services were a poor policy prescription, involving spectacular failures. The problems have been associated with the difficulty of establishing competitive market structures, ineffectiveness of regulation in the presence of information asymmetries and incomplete contracts (Kessides, 2004 and Kirkpatrick and Parker, 2006).

In another study Estache *et al.* (2002) demonstrated that although the total welfare increases as a result of the PSP, the gains are not shared with the poor. Estache *et al.* (2005) demonstrated that there appears to be no difference between private and public operation in terms of efficiency performance. Kessides (2004) recognized that more in-depth analysis is needed to evaluate the impact of private sector participation on the poor. World Bank (2004) recognized that PSP is not necessarily superior to the public sector in the provision of water services. This research examines the state of water services in MoK under public sector and private water company regimes.

There is very little empirical work done regarding the effects of the PSP in water supply in LDCs and hence most results are inconclusive (Clarke *et al.* 2004). They are not able to show whether private sector was responsible for increasing coverage since coverage also increased in areas with public sector management. As for the connection rates for the poor, there is no evidence that this increase is associated with the private sector.

Clarke *et al.* (2004) found that prices increased after the PSP. Raising water prices is counterproductive and increases inequality, taking into account the low level of prices and income elasticity for water. Water consumption varies very little with income since water needs of each person are similar in terms of drinking, hygiene and sanitation among others. So they will have to pay no matter how high the prices would be. For example, according to Smets (2004) water consumption in Europe varies around 75% between the first and last income deciles whereas income varies around 600%. Empirical studies done on the affordability issues and privatization of water services in LDCs is, therefore, necessary to establish the proportion of income spent on water. The term 'affordability' has been calibrated and, therefore, understood, in terms of the percentage of household income spent on water and sewerage services. Although no affordability threshold or benchmark has been developed for water in Kenya, the proportion of a household's income or budget spent on the service and affordability are negatively correlated. The higher the proportion of household income spent on water and sewerage charges, the less affordable they are. The affordability benchmark therefore provides grounds for judging whether charges are in fact affordable or not.

In the LDCs each household pays between 0.5-2% (1.3 in Germany and Netherlands, 1.2 in France) of their income for water bills (Smets 2004,). Those who earn the minimum salary in France and Germany pay between 3.4-5.2% of their income. In the UK, the poorest 1% of households pays over 10% of their income in water while in Mexico the poorest pay 5.2% of their income for water, whereas the rich pay only 0.8% (Smets 2004). According to international practices, this should not go beyond 5% of a household's income.

Santiago (2005) observed that privatization involves the implementation of full cost recovery in order for private sector investments to be economically viable. Under the full cost recovery strategy, consumers would be expected to meet the full operating and maintenance costs of water facilities and services. This means that all subsidies and cross subsidies would be eliminated. It would also involve tariff hikes, disconnections and the transfer of water from poor to rich neighbourhoods. Collectively, water privatization would hit the poor and vulnerable groups the hardest.

Galiani *et al.* (2005) in their paper "*Water for Life: The impact of Privatization of Water Services on Child Mortality*" demonstrate that for the case of Argentina, not only privatized firms were more efficient, invested more and provided better service, but the access also increased in privatized areas. In addition, they also show that welfare increases more with the PSP since for same levels of connection, child mortality decreased more in PSP compared to that of the public sector and that it was the poor who benefited the most. Birdsall and Nellis (2003) on the other hand concurred that privatization has indeed aggravated the asset distribution and income,

and have increased inequality. They also show that access increases and in most cases together with price increase.

Moore, (1985) argued that in the UK, despite a marked increase in attention given to the water affordability issue by academics and policymakers over the last decade, no consensus has yet emerged as to the way in which affordability may be defined, measured and calibrated. Even the use of the word 'affordability' has been challenged by those who regard 'poverty' as a more appropriate label for the underlying phenomenon. Since water does not have substitute and is directly linked to public health and environmental concerns, affordability is one of the key concerns. It is argued by Balance & Taylor (2005) that even if competition were possible, the benefits of such competition would be minimal. Water industry is an unusual business and does not fit into standard economic theory regarding competition.

Although access to clean water is a pre-condition to the attainment of many human rights, for example, 1948 Universal Declaration of Human Rights; 1966 International Covenant on Economic Social and Cultural Rights (ICESCR); 1966 International Covenant Civil and Political Rights; 1989 Convention of the Rights of Child, water is explicitly mentioned only in the Convention of the Rights of the Child of 1989 (Galiani *et al*, 2005). This raises the question of whether water is a derivative right or is water a fundamental resource, like air, that it was thought unnecessary to explicitly include reference to it at the time these agreements were forged?. Several of the explicit rights protected by the international rights conventions and agreements specifically those guaranteeing the rights to food, human health and development can not be attained or guaranteed without also guaranteeing access to basic clean water.

If we accept that there is a human right to water, to what extent does a state have an obligation to provide that water to its citizens? While many international declarations and formal conference statements supporting a right to water do not directly require states to meet individuals' water requirements, Article 2(1) of the ICESCR obligates states to provide institutional, economic and social environment necessary to help individuals to progressively realize those rights. In certain circumstances, however, when individuals are unable to meet basic needs for reasons beyond their control, including disaster, discrimination, economic impoverishment, age or disability, states must provide for basic needs (Gleick, 1996)

Water pricing varies from country to country, and depends largely on whether the water company is privatized or state owned. According to Segal *et al* (2003) and World Bank (1987) water is a commodity like any other and its price is souring. In the developing countries there is a marked reluctance to come to terms with water costs. Urban consumers in the MDCs pay all the recurrent costs for their water supplies and sewerage connections. In the LDCs, however, those provided with services pay far less, only an average 35 per cent of the costs. The proportion of investment generated internally by utilities and Water boards is also dropping, and their financial situation is also constantly worsening. The poor have, therefore, to come to terms with the new water policy that emphasizes cost recovery. How will the poor access the services if strict commercial principles have to be applied?

In the Republic of South Africa, the anti-privatization principle has been that basic needs, such as water, are fundamental human rights, not privileges to be enjoyed only by those who can afford them (Beck, 2007). With the assistance of anti privatization

forum and other progressive organizations township residents have launched a campaign called Operation Vulamanzi (Water for All). The operation has helped residents defy certain privatized water control measures such as trickler systems, or devices that severely limit the amount of water flowing from a tap and rerouted piping. Residents by-pass these control by tampering with the trickler systems or by laying pipes to access water from central mains. The residents have also destroyed the pre-paid meters.

Designed to prevent monopoly pricing, price regulation of water utilities has generated several forms of inefficiency. First, poorly designed rates misallocate water among different consumers and may result in insufficient revenues to cover costs. Secondly, the lack of incentives to minimize water provision costs creates cost inefficiency. Finally, scarce regulatory resources are wasted when the costs of regulation exceed the benefits. By generating pricing signals that more accurately reflect water's scarcity value, these initiatives would be consistent with the development of market-based allocation systems for regional water supplies (Mann, 1993).

The USAID (1992) observed that people will pay for good service and further noted that for example, in Costa Rica people actually raised their own fees by 300-400 percent. In Honduras people are willing to pay for outrageous prices, tolerating increases of 2000-3000 percent for drinking water. So it is a misconception that basic services in developing countries can not be made self sustaining. USAID did not propose affordable water tariffs. In Nelspruit City, Republic of South Africa, the tariffs were to escalate annually for the first five years at a rate equivalent to the

consumer price index. Though water prices in Kisumu have not changed since the inception of KIWASCO, price of water in MoK is almost three and two times more than the rates in Nairobi and Mombasa respectively (SANA International, 2007).

People in urban centres buy their water from the vendors. According to one study carried out in 16 cities (World Bank, 1987) the cost of water from a vendor is between 4 – 100 times more expensive than the cost of water from a piped supply. In Lima, for example a poor family pays a vendor $3 per cubic meter, 20 times the amount paid by middle class family with a household connection. Not only can the cost of water be a major household item for a poor and struggling family, its costs do not end there. It is very likely to be unsafe and fuel would be needed to boil it. The cost of doing so would, according Moore (2002) amount to 29 per cent of the income of the family in a squatter compound. In MoK, kiosk operators sell water to vendors who operate in unregulated market and charge unregulated prices which a lot of times hurt the poor.

The cost of sanitary latrine – one that confines human waste so that it does not pollute either surface or groundwater- is often too high for a single household to manage. Proper sanitation, however desirable, is not essential to life in the same way as drinking water, so slum families may regard it as unaffordable luxury. Domestic water shortage in slums especially in tropical cities and unsafe drinking water, carry serious public health risks. The historical record is graphic; typhoid and cholera epidemics plagued 19th Century European cities and are today reappearing in Latin America and elsewhere. In 1952, the average age of death, in the Dudley, England was 17 years, a state of affairs attributed to a complete absence of piped water in the urban centre and the presence of human excrement in all back streets, courts and all other eligible

places (Cointreu, 1995). In Kisumu's informal settlements the houses do not have sewerage connections hence prone to epidemics. Access to adequate and reliable supply of clean water is likely to stimulate economic growth and improve public health. To tackle poverty, therefore, there is need to evolve a conscious strategy aimed at providing safe water to the poor as a basis for promoting other development endeavours that would uplift their living standards.

Water systems include both the supply of clean water and the treatment and removal of sewage. These services are natural monopoly involving large fixed costs and significant economies of scale (Noll *et al*, 2000). There is typically little competition to a well functioning water system from alternative sources (Foster, 1999; Estache *et al*, 2001). The main alternative is household self provision through pumped wells, rain water catchments, and septic tanks. Self-provision suffers from low quality and high cost (Abdala and Spiller, 1999).

In Zambia, households have been charged for water according to the housing category they occupy. Families occupying low cost housing pay less than those in medium and high cost housing (Dageleviron, 2006). Those who use public tap pay the least. In Zambia, charges for metered connections have been much lower for smaller consumption than for un-metered connections. Having metered connections halve the water bills of the families in low cost housing with a consumption of less than 15 m^3 per month. Segal et al, 2003 noted that the poor are concerned about price and access to water, quality of water, hours of service and reliability. Efforts should, therefore, be made to find pro-poor objectives for reforms. Issues to be considered for pro-poor

reforms relate to improving the lives of the poor, doing away with the assumption that poor customers are high risk, low return customers.

2.4. Quality of Water Service.

The WHO (1970) stated that the water intended for human consumption must be free from chemical substances and organisms which might be a hazard to health. The WHO further states that supplies of drinking water should not only be safe-that is to say free from danger to health but should be as attractive to drink as circumstances can allow. Absence of turbidity, colour and any other disagreeable taste or smell are of utmost importance to public supplies of drinking water. The study has assessed the level of compliance by KIWASCO to the WHO's Guidelines for Drinking-water Quality set up in Geneva, 1993. Chemical, physical and biological parameters have been used for the assessment.

While the vast majority of outbreaks of waterborne diseases result from microbial (bacteriological, viral, protozoan or other biological) contamination, serious health concerns may also arise as a result of chemical contamination of drinking-water. These considerations explain the need to achieve common, high standards of drinking-water quality, to reduce the burden of diseases attributable to poor water, sanitation and hygiene (Valent F *et al,* 2004).

Shiva (2002) in her book; "*Water Wars: Privatization, Pollution, and Profit*" says that water industry has a track record of hazards and failures. For example, private companies most often violate standards of operation, and engage in price fixing

without considering many consequences. This leads to water stress among the poor populations of these areas, causing people to drink water that is often very contaminated and hazardous to their health (even though case studies have shown that privatized water can be very contaminated as well). She listed experiences underpinning water privatization of different countries, which were summarized as rising prices and deteriorating water quality.

Australia - In 1998, the water in Sydney, was contaminated with high levels of giardia and cryptosporidium shortly after its water was overtaken by Suez Lyonnaise des Eaux.

Canada - At least seven people died as a result of E. coli bacteria in Walkerton, Ontario, after water testing had been privatized by A&L Labs. The company treated the test results as "confidential intellectual property" and did not make them public.

Morocco - Consumers saw the price of water increase threefold after the water service was privatized in Casablanca.

Argentina - When a Suez Lyonnaise des Eaux subsidiary purchased the state-run water company Obras Sanitarias de la Nacion, water rates doubled but water quality deteriorated. The company was forced to leave the country when residents refused to pay their bills.

Britain - Water and sewage bills increased 67 percent between 1989 and 1995. The rate at which people's services were disconnected rose by 177 percent.

New Zealand - Citizens took to the streets to protest the commercialization of water.

South Africa - Water became inaccessible, unaffordable, and unsafe after the water

supply was privatized by Suez Lyonnaise des Eaux in Johannesburg. Cholera infections became widespread and thousands of people were disconnected from their supply of water.

Access to safe drinking water is strongly connected to basic health benefits. Hence, from the public health point of view, the proportion of population with access to safe drinking-water is an indicator that measures the extent to which basic needs (as defined by the UN in recognition of water as a fundamental human right) are met. Disease outbreaks related to contamination of drinking-water continue however to occur even in economically developed European countries and can severely affect human health. Infants and young children bear the highest risk. According to WHO/UNICEF (2006) estimates, poor quality of drinking water causes over 13,000 deaths from diarrhoea in children aged 0-14 years in the European Region (5.3% of all deaths in that age group). This research assesses the quality of water service provided by KIWASCO in Kisumu Municipality.

Dageleviren (2006) observes that in low income countries enduring a prolonged period of economic austerity, the privatization of water services has been an instrument for governments to relinquish their responsibility for funding investments in network expansion. While in general, water sector reforms for improving efficiency, service quality and access are welcome, heavy reliance on tariff rationalization without paying much attention to investment and maintenance needs could be a serious problem.

As is already evident, once these private water giants take over water services, prices skyrocket. After privatization, customer fees in France increased 150 percent while the water quality declined. In a French government report, it was revealed that over 5.2 million people had received "bacterially unacceptable water". Meanwhile, the British Medical Association condemned water privatization for its health effects because dysentery increased six-fold. Grossman (2004) outlined examples of the failures of water privatization that occur in developed countries and concluded that the most severe effects have been on the developing world. The high rises in pricing along with deteriorating water quality because of water privatization has led to much public scrutiny and uprisings by affected communities around the world.

Rainer (2006) said that, rather than contributing to poverty reduction, water privatization and greater cost recovery make water less accessible and less affordable to the low income communities that make up the majority of the population in developing countries. The alternative is to revert to unsafe water sources or more distant sources. The most immediate impact of reducing the accessibility and affordability of water falls on women and children. Worldwide, more than five million people, most of them children, die every year from illnesses caused by drinking poor quality water. Grusky (2006) observed that when water becomes more expensive and less accessible, women and children, who bear most of the burden of daily household chores, must travel farther and work harder to collect water - often resorting to water from polluted streams and rivers.

Safe drinking water is vital for human health and efficiency. More than one billion people in the world lack access to an adequate supply of safe water for household use

and growing water scarcity, which make it difficult to meet increasing demands (WHO, 1998). Diarrhea caused by unsafe drinking water is among the World's greatest killers contributing to deaths of 3 million children annually and also causing about 900 million persons episodes of illness each year (Panda 1997). Sachchidananda (1999) has indicated that diarrhoea death rates are 60 percent higher among those without safe drinking water. Hence providing access to safe water yields direct economic benefits. The study establishes the proportion of the households in Kisumu Municipality with access to safe drinking water.

Safe drinking water is the birthright of all humankind-as much a birthright as clean air. The majority of the world's population, however, does not have access to safe drinking water. This is certainly true in most parts of Africa and Asia. Even in relatively advanced countries such as India, safe drinking water is not readily available; particularly in the rural areas. Eaton *et al*, 1995 say that one reason why safe drinking water is of paramount concern is that 75 per cent of all the diseases in developing countries arise from polluted drinking water.

Safe drinking water is a basic right and nobody should be denied access to it. In Kenya, when there was talk of untreated piped water, those who could afford it resorted to bottled mineral water. The rest started boiling drinking water. Some unscrupulous individuals took to bottling water of uncertified quality to maximize profits (Nyambura, 2003). The study has examined the proportion of income spent on boiling drinking.

Bayliss (2002) says that although there is little technical data, in Guinea, it was found out that water quality had improved after privatization. Customer service had also improved (Menard and Clarke 2002). In Gabon, targets regarding quality and sanctions were left vague and are still not in place, five years after the start of the contract. However, researchers consider that the water is clearer (with less turbidity) in Libreville but the 'drinking quality of water everywhere is not guaranteed' (Tremolet and Neale 2002). In Senegal, the water company had exceeded targets for water quality since 1999 and customer service had improved (Tremolet et al 2002).

Tremolet et al (2002) observed that in Cote d'Ivoire, the utility SODECI, was providing high quality water in the early 1980s, and met 99% of WHO water standards in 1997 (Menard and Clarke 2000). However, in 2002 it was reported that performance had begun to decline and a third of the production centres, many of them in the interior, no longer met the WHO's water quality standards.

In Kenyan urban areas, most slum dwellers, 85% of which fall below the poverty line depend largely on water vendors and communal water points where water, mostly of low quality, is bought at exorbitant price. The sanitation facilities in these areas are also of poor standards resulting in high incidence of illness (Kenya, 2005). There is need to establish and enforce standards for water quality to both formal and informal service providers

The first governance concern in privatization of essential services is why the service has to be privatized in the first place. Asingo (2005) in his paper "*Privatization of Water in Kenyan Local Authorities: Governance and Policy Issues*" says that the

rationale for the buzzing wave of privatization of local authority services lies in the failure of the central and local governments to provide services to the population. He says that in Republic of South Africa for example, the Nespruit Local Authority entered into public-private sector partnership to relieve it of the financial burden of upgrading water and sanitation services and ensuring efficient service provision. The report does not show whether the involvement of the private sector has resulted to a speedy, reliable and affordable way of rendering water and sanitation services to the communities.

Shleifer (1998) noted that weak efficiency incentives in public firms might be tolerable when cost reduction by private suppliers come at the expense of undesirable quality deterioration or reductions in access by the poor. In particular, unregulated private providers may undersupply the socially optimal quality of water in the presence of externalities, because they fail to take into account the marginal social benefits in their decisions. Similarly, private owners may exclude low income households from the network by raising prices, strictly enforcing payments and concentrating their investments in high income areas.

However, the fear of quality deterioration or access exclusion can only be genuine when supply conditions are non-contractible. Shleifer (1998) explained that the water industry, information asymmetries in service quality are relatively unimportant, and regulatory agencies can monitor water quality, pressure, repair delays and shortages. Network expansions and universal coverage can also be enforced through regulation. The arguments in favour of private provision are even stronger when we consider non-

benevolent governments. Politicians may use the control of state firms to channel benefits for themselves and their supporters (Shleifer and Vishny, 1994).

2.5. Conceptual Framework

The research benefited from the institutional set up under the water sector in Kenya. The Water Act 2002 provides the framework for the implementation of new institutional arrangements. The functions of the various institutions show the relationship between the variables in the study. Figure 1-1 shows the relationship between some of the institutions which were created by the Water Act 2002 and how they combine to influence delivery of water services. The central concern in this study is to explain how water privatization affects delivery of safe drinking water. As shown in the model, sustainable delivery of water depends on management of water resources to determine the quantity of water available for different uses; regulation of water quality and tariff and development of water infrastructure for the efficient and economical provision of water services. The reforms have brought commercial approach to the management of water and sewerage service. This has improved performance of the utilities.

The study examines three aspects of the water service, namely, accessibility, affordability and quality. The various institutions within the water sector play specific roles with regard to accessibility, affordability and quality of water services. Conceptualization is based on separation of roles by different institutions. These reforms revolve around the following four themes, namely: separation of the management of water resources from the provision of water services; the separation of policy making from day to day administration and regulation; decentralization of

functions to lower level state organs and involvement of non-government entities in the management of water resources and in the provision of water services.

Water Resources Management Authority (WRMA) regulates water allocation, hence availability and amount to be provided by the water service providers like the KIWASCO as shown in Figure 1-1. The WRMA also manages raw water quality and pollution control of the water available to the service providers. The Water Services Regulatory Board (WSRB) on the other hand issues licence to Water Services Board (WSB) for example Lake Victoria Services Water Services Board (LVSWSB). The WSB is expected to ensure efficient and economical provision of water and sanitation. The WSB enters a lease agreement with a water company like KIWASCO, thereby delegating their responsibility to the water company. The Water Act 2002 requires that the WSBs contract agents, Water Service Providers (WSPs) to execute mandated services directly to the consumers.

The study has used this framework to identify the various institutions set under the Water Act 2002 and how these institutions have influenced accessibility to water services, affordability and quality of water services provided by the water company. The amount of water available to the water company is influenced by WRMA. The water tariffs are proposed by the WSBs and approved by WSRB. The water is abstracted by the service provider-water company. The treatment and distribution of the water is done by the water company. In the case KIWASCO, water tests are carried out by the water company. Surveillance tests are carried by WSB. The study sets out the framework that is intended to bring about a culture that promotes comprehensive water resources management and development with the private sector

and community participation as the prime movers in the process to guarantee sustainability.

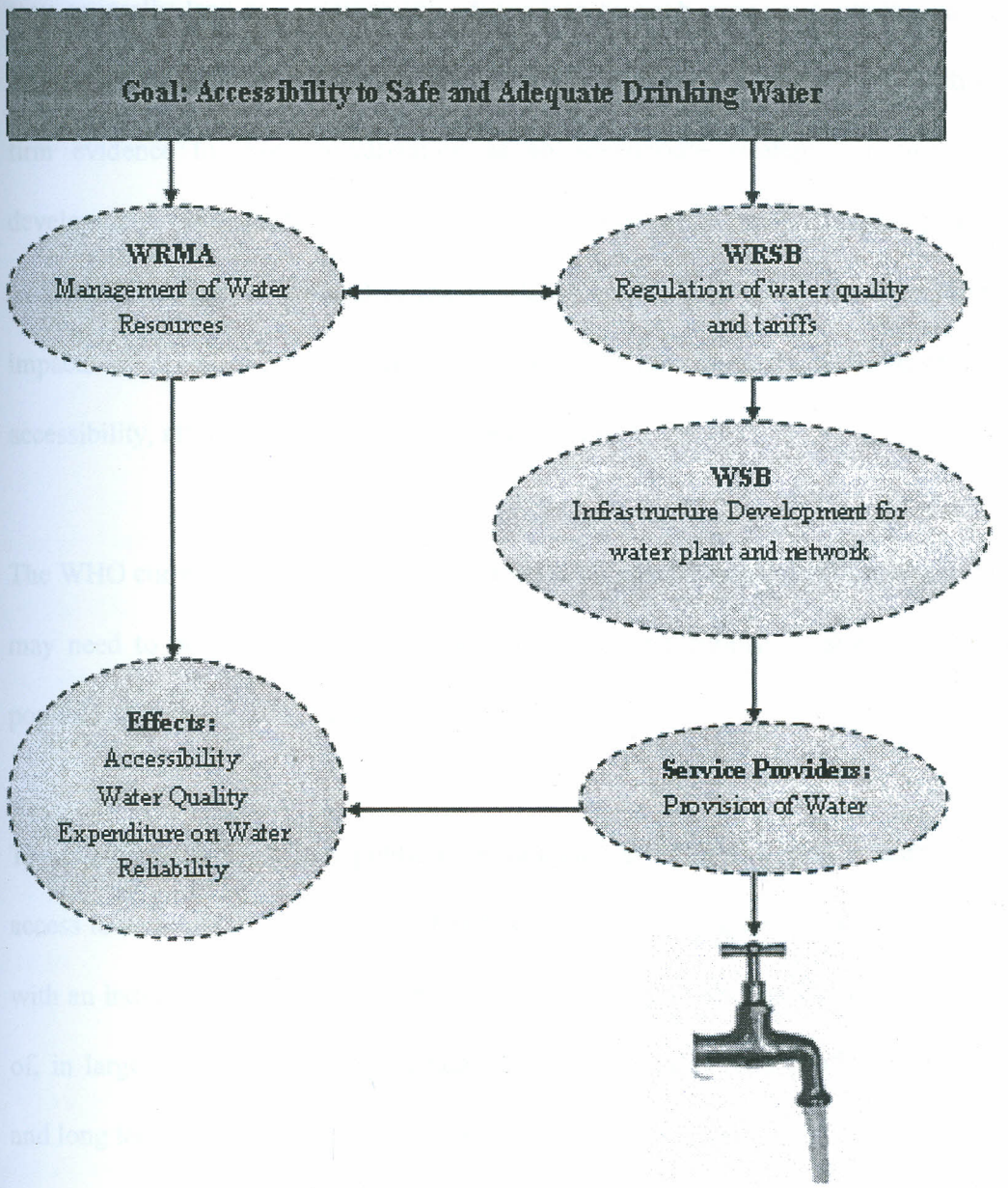

Figure 2-1: Conceptual Framework

***Source**: Modified from institutional set-up under the Water Act, 2002*

2.6. Conclusion

Privatization strategy of water services is taken in the belief that market forces may help achieve efficiency and effectiveness. Although privatization of water services may generally lead to sustainability of services through economic pricing and the application of efficiency sensitive private sector business practices, there is still no firm evidence to show privatization as an appropriate strategy for sustainable development, particularly when seen on social, political and environmental grounds. In Kenya, the history of privatization is relatively short and more documentation of impacts of privatization is necessary. This study has assessed these impacts on accessibility, affordability and quality of water service.

The WHO current planning standard for domestic water consumption of about 50 l/c/d may need to be reexamined in the light of increasing supply constraints, growing population and unit cost of water.

The transfer of control from public to private entities of such a basic human right as access to water raises public interest and concern. Entrusting a profit driven company with an indispensable public service has always been a controversial concept because of, in large part, the possible contradiction between short term profit maximization and long term needs to protect infrastructure and natural resources.

CHAPTER THREE

3. RESEARCH METHODOLOGY

3.1. Introduction

This chapter outlines the main methods the study used in collecting, processing, analyzing and interpreting the data. They include reconnaissance and a range of methodologies used for collecting data. The focus of the study was an examination of privatization of water services with regard to accessibility to water services, quality of water consumed and affordability of privatized water by the urban poor.

The survey was carried out in four estates MoK, namely; Milimani, Migosi, Arina and Nyalenda. These estates fall within the supply zone of KIWASCO.The physical and socio-economic characteristics of MoK has also been described. This provides background information about the location and size of the MoK; topography and drainage; climate; geology and soils; demography; economy and water supply system. These variables have influence on water resource management and services over space and time.

3.2. Study Area Profile

The MoK was established following the construction of the original Uganda Railway which reached Kisumu (then called Port Florence) on December 20, 1901. By February the following year, the line was open for goods and passenger traffic. In 1903 the township boundaries were gazetted and gradually the former name Port

Florence was dropped and the new town was called Kisumu. At this time old Kisumu was a two-row affair of shops on Mumias Road north of the gulf (MCK, 2005).

After the World War I, Kisumu gained importance by becoming the collection centre for a variety of crops grown throughout the area. These crops included maize, cotton, groundnuts, simsim. Trade in hides and skins also developed. The first bank to open a branch in Kisumu was the National Bank of India in 1912, followed by the Standard Bank in 1918, Barclays in 1937and Bank of Baroda in 1959 (MCK, 2005).

In 1930's many GoK and private houses were built. Electric power was installed by the then East African Power Company in 1947. Other buildings constructed at this time included the Law Courts, Town Hall, Social Hall and Ofafa Memorial Hall. The town was elevated to the status of Kisumu Municipal Board in 1940 and later to Kisumu Municipal Council in 1960.

The MoK is the district and provincial headquarters of Kisumu East and Nyanza respectively. It is ideally situated for manufacturing and distributive industries to meet a large consumer potential of the urban centres around Lake Victoria (Figure 3-1).

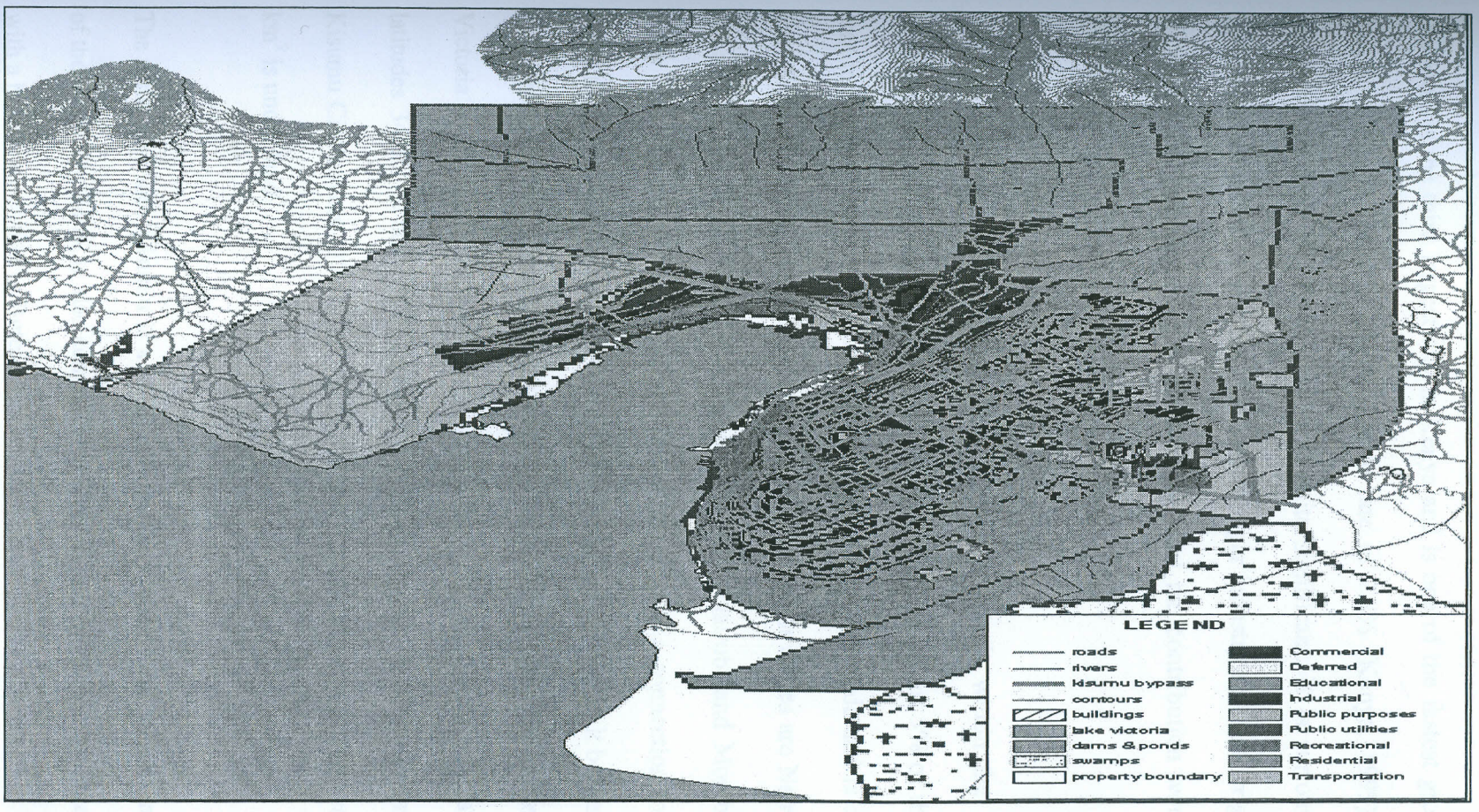

Figure 3-1: Land Use within Municipality of Kisumu

Source: Kenya, 1989

3.2.1. The National Context

The MoK is the third largest city in Kenya and is one of the fastest growing urban centres in Kenya with an annual growth rate of 2.8% (Kenya, 1999). Kisumu's contribution to the national economy is quite significant. It is surrounded by an agriculturally rich hinterland with large scale sugar industry and rice irrigation. With the fishing industry and revival of molasses plant the contribution would increase significantly.

The MoK is located in Kisumu East District, which is within the Lake Basin Development Authority region, a spatial extent covering about 5% of the total land area in Kenya. It has been designated as a regional growth node and is connected to the nation and the region by four major roads. The major routes are Nairobi Road to the southwest, which connects Kisumu to Nakuru, Nairobi and Mombasa. To the north is a connection to Kakamega while to the west is a connection to Busia. The Busia route provides an alternative road to Uganda. To the North, it borders the Nandi Escarpment, to the East and South it borders the Kano Plains and to the West Lake Victoria and part of Kisumu Rural Constituency. Kisumu Town is situated between latitudes $34^{0}35^{1}$ E and $0^{0}0^{1}$S and $0^{0}12^{1}$ S (GoK, 1989). In terms of land area, the Kisumu City covers 417km^2 of which 157 km^2 (35.5%) is covered by water and 260 km^2 is under land.

The forth road into Kisumu is a small connection to Kibos and Muhoroni to the east of the town. The MoK is also connected to Nairobi and Mombasa by a major rail link, with a branch extension to Butere.

Figure 3-2: Kisumu in the National Context

Source: UN Habitat, 2005

Being the convergence point of the great north road, Kisumu is well connected to Uganda, Tanzania and by extension Rwanda, Burundi and Congo D.R. in the west, Zambia to the south and Sudan to the north.The town is also served with an airport with the capacity to handle local and regional flights, while steamer operations provide further communication to other lakeshore urban centres in Kenya, Tanzania and Uganda.

A major challenge to the city within the national context is that of reducing the high poverty levels which currently stands at 48 per cent compared to the national average of 29 per cent (Kisumu City Development Strategy, 2004-2009). This translates to defining strategies that would efficiently and sustainably exploit natural resource base inherent in the area to derive optimal benefits for the local community. The National frameworks that provide reference basis for localized action are the Poverty Reduction Strategy Paper (GoK, 2001) and the Economic Recovery Strategy for Wealth and Employment Creation GoK, 2003).

3.2.2. Topography and Drainage

The area may be divided into two topographic regions, the hilly north and southern plains. The hilly north (Konya, Kadero, and Dago sub-locations including Kisian Hills) is composed of undulating rolling hills from which the land slopes steadily to the central parts of the MoK. This gives way to areas of very low gradient to the relatively flat land in the south (comprising Nyalenda, Chiga and Manyatta sub-locations). Originally, the MoK covered the residual hills which now contains half the built up area including the commercial centre and the better residential areas. This is due to the fact that this area is better drained (UN Habitat, 2006).

The city has however expanded to include the poorly drained areas such as Nyalenda and Nyamasaria. Expansion of the MoK is limited by Riat Hills to the north, Lake Victoria to the South West, Miwani sugar plantations, Ahero irrigation scheme and seasonal swamps to the east. All the streams within the MoK drain into Winam Gulf, however, due to the very gentle gradient some of the streams form vast expanses of swamps (Wagah, 1993).

The hilly north is drained by rivers Nyangori and Awach in Konya sub-location. In Dago sub-location, there are a number of small streams draining the region.

Kisian hills form the boundary of the northern limits of the western part of the city. The area is well drained by River Kisian and its tributaries. The south western part is drained by Muguruk River and its tributaries. The major channels draining the eastern parts of the MoK are Kibos, Nyamasaria, Luanda and Lielango (Onyango, 1987).

3.2.3. Rainfall

The mean annual rainfall varies with altitude, with higher areas receiving more rain than those areas adjacent to the lake. The MoK receives an annual rainfall ranging from 876mm to 1306mm. The region has a minimal rainfall regime with more than 40% of the total rain falling between March and May (first peak) and the second peak between September and December (Figure 3-3).

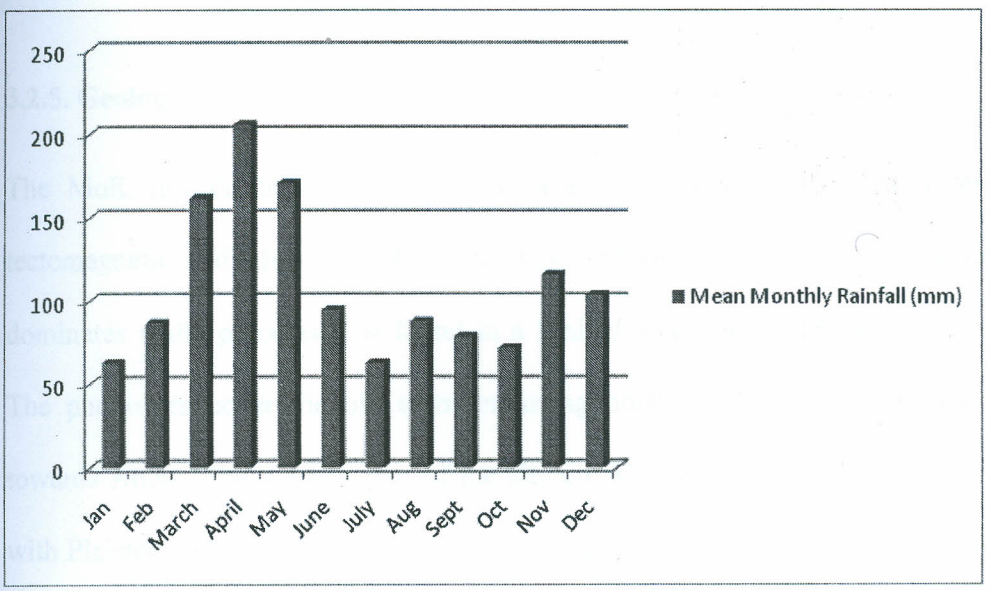

Figure 3-3: Rainfall Distribution in Kisumu

Source: Kisumu Metrological Station, 2007

The variation in the distribution of rainfall over the year forms a significant factor in water shortage problem within the expanded boundaries of the city.

3.2.4. Temperature

The presence of Lake Victoria is an important factor in understanding the local climate. The influences of land and lake breezes in the areas adjacent to the lake exert the greatest influence on temperature. The low lying plains around the lake are frequently hot and humid. The higher areas to the north such as Riat hills also experience relative lower temperatures due to the influence of the altitude.

The MoK generally experiences high temperatures throughout the year. The mean monthly maximum temperatures, range from 27.7^0C to 30.8^0C. The mean minimum range from 16.1^0C to 17.9^0C.

3.2.5. Geology

The MoK lies on the arm of tertiary lava which were formed as a result of tectomagnetic activities. The phonolite which is associated with black cotton soil dominates while pyroclastic is found in a limited extent in some parts of the MoK. The phonolites cover the old town including northern areas below Kiboswa and towards Ahero. The western part of the city comprises of recent alluvium associated with Pleistocene period. Intrusives such as Kisian hills are also found. They date from post Nyanzian to pre-Bukobian period. In general, the bedrocks in the city are of the Nyanzian system whose geological stability makes the town a reliable place to make heavy investment (Kenya, 1989)

3.2.6. Demography

The 1999 national census put population figures at 345,312 (Kenya, 1999). It is estimated that the figures presently stand at approximately half a million people. The boundary extensions of 1971 encompassed the immediate peri-urban areas outside the old municipality where uncontrolled developments had been taking place for decades. With a population of 345,312 residents, and an annual growth rate of 2.8% (GoK, 1999) it is the third largest town in Kenya.

The average population density of the town is 828 per Sq. Km while the sex ratio stands at 1:1. The densities vary considerably. The highest population densities are the peri-urban low income areas of Manyatta and Nyalenda which are estimated to house 60% of the city's total population. The rapid growth of the urban population has led to the unprecedented perennial problem of inadequate service delivery including water.

3.2.7. Economy

MoK currently experiences the highest urban poverty levels at 48% against national average of 29%. It is a net food importer, registers one of the highest indices of food poverty with 53% of its population living below food poverty line as compared to Nairobi (8.4%), Mombasa (38.6%) and Nakuru (30%) (Kisumu City Development Strategy 2004-2009). Urban poverty in the MoK manifests itself in reduced living standards, the increasing number of street children, increased informal trade activities of hawking and peddling, increase in commercial sex activities and crime, especially in the low-income settlements.

Major industries in such as the Kisumu Cotton Mills (KICOMI), Kenya Matches, the Fish processing, Kenya Breweries and Agro-based Industries to name a few, have closed down. While unemployment is over 30 per cent, majority of the city's population (who are in employment) rely on low paying wage in the informal sector earning between kshs.3000 to 4000 per month (UN Habitat, 2004). It is hoped that the on-going poverty reduction strategies and programmes will reduce poverty level amongst residents in Kisumu.

3.2.8. Housing

The city lacks adequate affordable shelter. Due to the high poverty levels, approximately 60% of the urban population resides in the peri-urban and informal settlements lacking basic services resulting in high congestion of housing units (150 single rooms units per hectare) in these areas. Approximately 75% of the peri-urban inhabitants live in temporary and semi-permanent structures, since they cannot afford better built houses (UN Habitat, 2006). Settlements that have already been exposed to site and service schemes are gradually being modernized, with more landowners sub-dividing their parcels and selling them out for economic gain. The result is a planning nightmare with a confused blend of modern houses dwarfing the mud-thatched structures. Rents in the informal settlements range from kshs.300-800 for a single room unit with communal facilities.

3.2.9. Institutional Framework for Water

The KIWASCO is the service provider mandated to provide water and sewerage services. KIWASCO was incorporated in the year 2000 under the Company's Act Cap 486. In July, 2003, the company was operationalized and the former Water and Sewerage Department of Kisumu Council became Kisumu Water and Sewerage Company. The company is 100 per cent owned by Kisumu Municipal Council.

KIWASCO's mandate is to effectively and efficiently provide quality and affordable water to customers and collect, treat and dispose sewerage in a safe and environmentally friendly manner. KIWASCO is managed by a team comprising of Managing Director, Technical Manager, Human Resources Manager and Commercial Manager. There are also other junior managers like Accountants, Auditor, Water and Sewerage Superintendents.

The KIWASCO was transferred from the MoK Water Department, under the Service Provision Agreement. Under that Agreement, KIWASCO provides water within an area of 279km^2- the area covered by the municipal boundary. Also under the same Agreement the assets were also transferred to the Company under the Lease Agreement. Under the Agreement, KIWASCO pays lease fee to the Municipal Council because the assets and all staff below corporate management team came from the council.

Within the water reform structure, the Company falls under Lake Victoria South Water Service Board. Water Service Board (WSB) is mandated to license Water Service Providers to provide water and sewerage services to the consumers. Under the Water Act 2002, the WSB is the asset developer and holder. It is the responsibility of the WSB to develop and give the assets to the service providers to use and maintain for the provision of services. The Water Act 2002 repealed the Local Authority Act Cap 265, which initially mandated the Municipal Council to provide the services. WSB is allowed by the Act to possess the assets which were hitherto held by the Municipal Council.

In Kisumu Municipality there are two raw water services for the piped water system. A river source at Kajulu which is about 15km away from the city center and the lake source at Dunga about 2km from the city center. In addition, there are small-scale water supply systems that cover areas outside the service areas of the KIWASCO water supply system, operated by communities, government institutions and church organizations. These include; springs, small streams, shallow wells, boreholes and the lake. Water quality from these sources is generally not suitable for drinking and some sources dry up during the dry season.

Kajulu Water Works is the oldest having been first constructed in 1922, while the Lake Water works was constructed for the first time in 1953. Both works have undergone rehabilitation and expansion over the years. Kajulu Water Works has an estimated daily capacity of 1400 cubic meters, while the Lake Water Works estimated capacity is 17,500 cubic meters. The current projected water production is 18,000m^3, while the present demand is estimated to be 48,000m^3. . JICA had projected production to increase to 67,800m^3 by the year 2005 but this did not take place. This indicates a big short fall which must be met by other sources.

Most residents in peri-urban areas of Kisumu have resorted to use of shallow wells, often situated in close proximity with the pit latrines, increasing the chances of cross contamination. Piped water is supplied to these areas via hand cart vendors who charge nearly 50% higher than the cost of receiving the water directly through the supply meter. As a consequence, this population feels the bigger burden of disease as it has to contend with frequent exposure from use of water from shallow wells, depriving them of much needed income for other household needs.

The number of connections is 10,800 and only 4,400 are categorized as active connections. Sixty percent are therefore faulty meters, which are being charged on average. The water distribution network is old and comprises of about 112km of pipes ranging from 80-350mm diameter pipes. Pipes laid before 1970 accounts for 81% of the total length. The old pipes present frequent leakages and bursts hence water losses. Although the pipes are laid over a wide area of the city, water is currently supplied on a continuous basis only in limited areas. According to JICA, 2001, the population with continuous supply is 8%, limited supply is 34%, while 58% of the population is supplied by kiosks. However due to breakdown of booster pumps coupled with aging galvanized steel pipe reticulation network, a relatively high proportion of the previous customers (about 60%) today do not get adequate water or none at all as compared to the mid eighties. Nonetheless, they obtain water from the vendors (KIWASCO, 2007).

Water service collapsed in many areas within Kisumu, particularly, Arina, Ondiek, Migosi, Okore and Mosque Estates. This has lead customers in those areas to apply for disconnection because they were not getting services. KIWASCO, through its Community Outreach Unit, has been sensitizing people to reconnect water. On average, 65 accounts are being reactivated every month. According to KIWASCO Strategic Plan, 2007, all the inactive accounts should be all reactivated by 2011.

3.2.10. Sewerage System

The existing sewerage system covers limited areas of the central parts of the city, with the remainder being on on-site sanitation. The total length of the trunk and branch sewers is 19.9km while the total area coverage is 6.04km^2. Some areas are served by on-site sanitation, septic tanks or pit latrines (KIWASCO, 2007). Pit latrines are commonly used in peri-urban areas, but in locations subject to flooding they are prone to collapse.

There are two sewage treatments; the conventional sewage treatment works at Kisat and the waste stabilization ponds at Nyalenda. The former handles most of the town's effluent drawn from domestic and industrial users while the later handles predominantly domestic effluent. Kisat has a design capacity of 6,800m^3 per day, while the current daily flow averages 5,000m^3 per day (KIWASCO, 2007).

Lack of adequate water supply in areas sewered by the Nyalenda pond systems is responsible for the current flow of 2000m^3 per day against its design capacity of 9000m^3 per day. Most of the sewers were laid in 1950's and 1960's and a combination of age and poor routine maintenance practices has led to the collapse and massive blockages.

In areas served by on-site sanitation, septic tanks or in other cases pit latrines are used especially in low density residential areas. Pit latrines are commonly used in peri-urban areas, but in locations subject to flooding they are prone to collapse.

Empting of pits and septic tanks is a problem as this falls under the mandate of the Municipal Health Department. For sometime now, there has been no exhauster vehicle serving from the Health Department and the residents have to hire the only one private exhauster lorry at their expense. The other problem on septage sanitation includes limited or no vehicular access within the densely-settled neighbourhoods.

3.2.11. Urban Planning

There is non existence of up to date land use plans in the town. This poses as a major stumbling block in the execution of physical interventions. The laying of new water supply and sewerage pipes, construction of new pumping stations, storm water drainage, water kiosks, public pit latrines, opening of new dump sites, water kiosks etc., need to be guided by up to date land use plans in terms of recommended land use., town expansion, land ownership and land tenure among others (Figure 3-4). There are also serious constraints in Kisumu in relation to capacity (skilled staff and equipment) to prepare and implement plans.

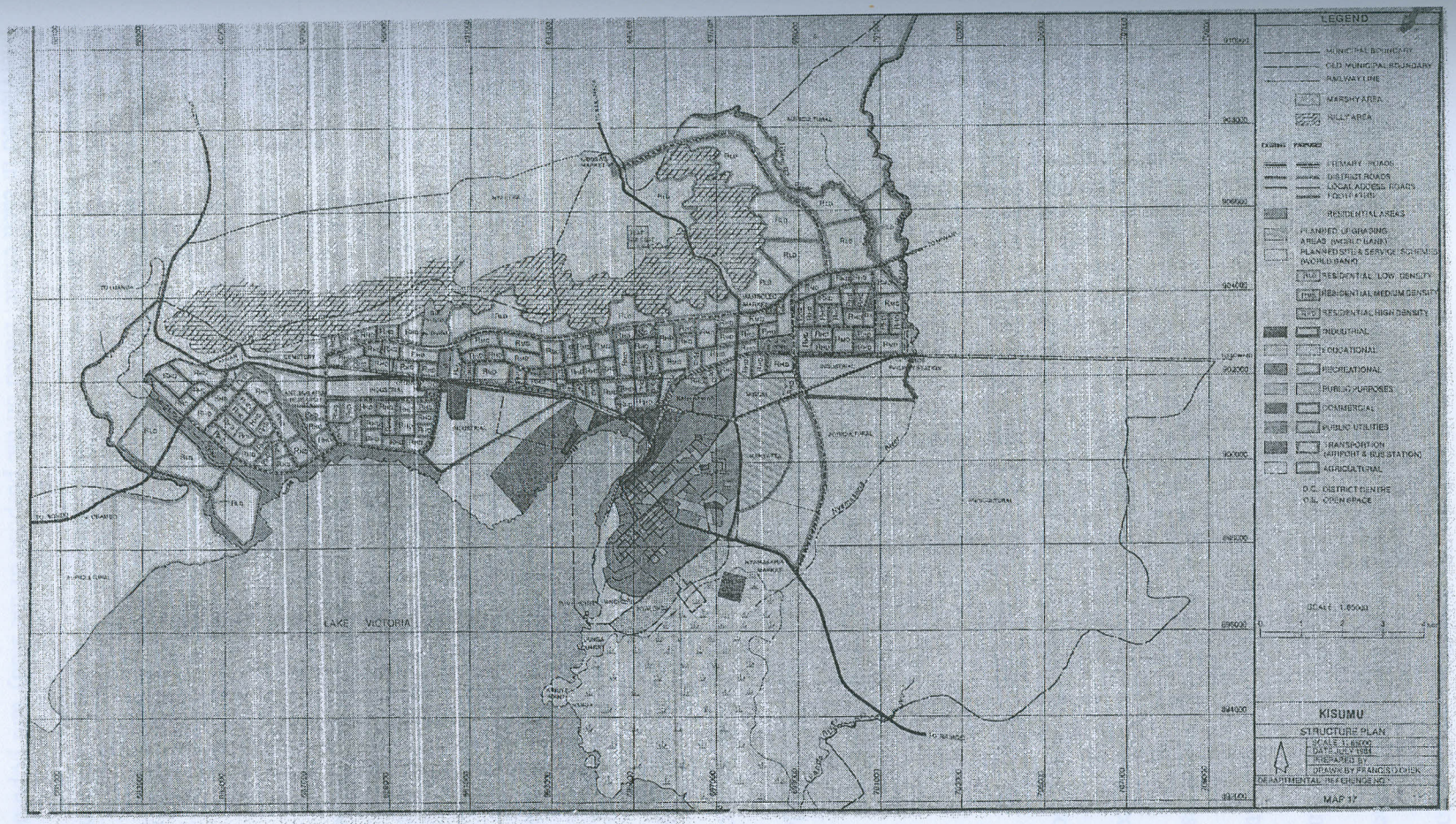

Figure 3-4: Kisumu Structure Plan

Source: Kenya, 1989

3.3 Sampling Procedure

The study was based on MoK and employed stratified random sampling to select the estates to be studied. Four strata were identified within the supply zone, the high income-low density estate; middle income-medium density; low income planned estate and the low income unplanned estate. The researcher used the estates as the basic unit of planning and supply zone by KIWASCO. Four estates representing and depicting various residential and income categories were surveyed. Wide participation was ensured, covering all groups ranging from the high income to low income brackets.

The residential areas surveyed during the study were categorized into four strata, namely, high income, middle income and low income planned and low income unplanned. To assess the experiences of high income group, residents of Milimani Estate were interviewed. Residents of Migosi were targeted to assess the levels of water services of middle income groups. To understand the experiences of residents of low income planned and unplanned neighbourhoods, Arina and Nyalenda Estates respectively were surveyed. The outcome of the assessments was used to measure the levels of accessibility to water services provided by KIWASCO and other alternative sources; the quality of water consumed by residents in Kisumu Municipality and the affordability of the water services by the urban poor.

A representative sample was randomly selected from each of the four estates. Purposive sampling method was used to arrive at the actual respondents to be interviewed in each estate. Based on the purpose of the study and population size, the

appropriate sample size was determined by; the level of precision, the level of confidence or risk, and the degree of variability in the attributes being measured (Anderson *et al* (1987).

Statistics on the number of households in each estate was provided by Central Bureau of Statistics – Nyanza Provincial Office. The total number of households in the selected estates is 8583. The water supply zones are shown in Figure 5-2 while the population data for the entire area is shown in Appendix 1. To ensure wide participation the researcher surveyed four estates in the city. Each estate represented specific residential category, namely, high income, middle income, low income planned estates and low income unplanned settlement.

The following formula was used to determine sample size;

$$n_f = \frac{n}{1 + n/N}$$ Mugenda *et al* (1999)

Where n_f = the desired sample size when the population is less than 10,000

n= the desired sample size (when the population is more than 10,000)

N= the estimate of the population size

$$n_f = \frac{384}{1 + 384/8583}$$

$$= 367$$

The appropriate minimum sample size is 367 households which represented 4.3 per cent of all the households. The sample size per estate was calculated to be proportional to the number of households within each estate. Freund (1988) has

indicated that an adequately representative sample which is randomly selected permits logical generalization. The researcher applied simple random sampling to select the households. Enumeration map was used to identify the households from the sampled areas. To select the respondents systematic random sampling was employed. In each sampled area the n^{th} respondent was determined by dividing sample population with sample size. The Structured questionnaire was administered to the household heads to collect data (Appendix 2).

The structured questionnaires were used to collect detailed information relating to socio-economic background of the household; water sources and utilization; availability of water service and monthly expenditure on water. In addition, Water Company and Water Service Board officials' opinions about the functioning, utilization and quality of water service were also obtained. In each of the estates surveys were conducted in various residential sites to ensure inclusion of a wide range of settlement and housing types, as well as diversity in the households, socioeconomic status and access to services. Within each estate the households were randomly selected. A total of 367 households were randomly selected, distributed as shown in Table 3-1 below. The survey was conducted during the year 2006-2007.

The researcher used data kept by KIWASCO lab on the test results to analyze the quality of water supplied by the water company. The analyses were done for raw water, clarifier and treated water. At the treatment plant the researcher used tests records which were kept by KIWASCO lab. These included physical parameters which were done at one hour interval everyday, while the chemical and biological tests were done once a week. Additionally, water analyses were also done at the end

points to determine any contamination along the distribution network. End point tests were done twice a week in all the supply zones. The researcher used these data to compute the mean results and compared with the WHO standards to assess the level of compliance.

Table 3-1: Sample Frame

Income Category	Sampled Estate	Total no. of households	Selected households	Percentage
High income	Milimani	1302	55	15
Middle income	Migosi	2012	86	23.4
Low income	Arina	575	33	9
Unplanned Settlement	Nyalenda	4694	193	52.6
	Total	8583	367	100

3.3.1 Estates Surveyed

The data was collected from a household survey conducted in March, 2007 in Milimani, Migosi, Arina and Nyalenda Estates. The four residential estates selected to participate in the survey differ in various ways, including density of development and population, geographical situation, socioeconomic status of the households, nature of water supply, and the range of water sources and sanitation facility. The estates represent the four residential categories, namely; high income; middle income; low income and unplanned settlement.

3.3.2 Sources of Data

The study used both primary and secondary sources of data. These were drawn from the field, libraries, internet and various institutions like KIWASCO, Lake Victoria South Water Service Board, Water Resources Management Authority, Kisumu Municipal Council and NEMA among others.

3.3.2.1 Primary Data Collection

The primary data was collected by use of several instruments to assess the level of access to water services, quality of water, expenditure on water and coping mechanism regarding water services in Kisumu Municipality.

- **Questionnaires:** open ended and structured standard questionnaires (appendix 2) were administered to the sample group. The questionnaires were administered to the households, to assess the feelings of water consumers on availability, accessibility and affordability of water under a privatized delivery regime. Data on household background, family income and expenditure, amount of water used per day or per month, water and sanitation facilities, hours of water service, distance to the nearest water source and awareness of water reforms were also collected.
- **Interviews:** This was administered to key informants in charge of institutions engaged in water and sanitation services, namely, MWI, KIWASCO, WSB, and WRMA. The interviews targeted information about the Water Act 2002, the progress on water reforms and Water Company, water infrastructure and services status, human and financial resources.

- **Focus Group Discussions**: This was conducted with Water Kiosk Operators and vendors. This provided information on the new management approaches to water, community water projects, and public education.
- **Observation:** A survey of various sites was made to observe water infrastructure and services and human activities related to water and sanitation. The water treatment plant was visited; water kiosks and households were also visited. Photographs were taken to depict water supply conditions.

3.3.2.2 Secondary Sources

This involved review of related literature. Documents such as project proposals, published and unpublished materials were used. Annual reports as well as status and progress reports were also sought. This helped the researcher to gain further insights into the study problem and progress that has been made by the water company.

3.3.3 Data needed for the indicators

The primary objective of the study is to examine the impact of water privatization by local authorities in Kenya, with specific reference to Kisumu Municipality. To assess the above variables the following data were collected:

a) Accessibility to water safe water

Accessibility was measured in terms of the proportion of the households with access to adequate amount of safe drinking water in a dwelling or located within a distance of not more than 200m from a house to a public stand post. Data was collected on:

- The amount of water used per day per households and per person. The quantity of water used per day was measured in litres. Water bills issued by the water company also provided vital indicator of water used by various households.
- The number of people with access to adequate and safe water.
- Distance to primary source of water.
- Data on the source of water, for example, house tap or yard pipe,
- Family size:
- Primary and secondary water sources.
- Household Income: The research sought information on the incomes of each household. The respondents gave their monthly household incomes. The income of the household determines the quantity of water consumed.
- Recommended Basic Water Requirement- the amount of water needed to satisfy metabolic, hygienic, and domestic requirements.

b) Affordability threshold or benchmark

- Monthly Income of the households
- Daily and monthly expenditure on water by the households
- Quantity of water used per day per household and per person
- Benchmark ratio
- Family size
- Water tariffs used by KIWASCO and prices of water charged by kiosk operators and vendors

c) Water Service

- Collection time
- Primary sources of water for the households
- Hours of service
- Continuity of supply
- Water delivery mode used by the residents
- Degree of responsiveness of service providers to customer complaints

d) Water Quality

Data on water quality was provided by the water company. Laboratory tests were done for both treated and untreated water to monitor the level of compliance with the required standards. Further test were carried out for the end point users to determine any contamination during the distribution.

- Physical Characteristics
- Chemical Characteristics
- Biological Characteristics
- World Health Organization Standards
- Treatment Plant Data
- Endpoint Data
- Water Storage facilities and capacity

3.4 Validity and Reliability of Instruments.

The instruments were piloted to ascertain their reliability and validity where reliability refers to dependability and validity refers to soundness. Anderson *et al* (1987) expands that reliability is the extent to which we obtain information that is free of measurement error while validity refers to the degree of relevance of the instrument. A pilot study was curried out in the four sampled estates to capture various socio-economic characteristics. Questionnaires were administered to twelve households with varying access to water services. The surveyed households were not part of the final sample in order to avoid distortion of data and subjectivity of responses. It was after the pilot study that reliability and validity of instruments were confirmed through test retest method.

Similar questionnaires were administered to the same households after two weeks and their responses in the two sets of questionnaires were correlated, and found out that r=0.672. The instruments were judged as reliable when they were consistent with attaining a Pearson's Product Moment Correlation Coefficient of 0.50 and above (Shenoy *et al*, 1992). The instruments were corrected as per the results of the pilot study. Improved versions of the questionnaires were prepared so that only items considered relevant to the study were taken and modified to suit the purpose of the study.

3.5. Data Analysis, Interpretation and Presentation

The research employed qualitative and quantitative techniques of analysis. Medina (1998) observes that by combining the two techniques, social scientists balance the strengths and weaknesses of the two and will achieve a higher degree of reliability and

validity, compared with the use of only one. The researcher used SPSS computer programme to process the data gathered from the field. Descriptive statistics have been used to describe proportions and distributions.

The level of accessibility was also measured in terms of quantity of water consumed daily per person (l/c/d) and the mean distance to safe primary source of water. The number of household connections and the distance to the nearest piped water point was used to assess the level of accessibility to safe water. This was expressed as a proportion of the households with access to safe water. The daily per capita water consumption (l/c/d) was used to assess the extent to which basic water requirement is met in Kisumu Municipality. The mean l/c/d for each estate was computed from the daily or the monthly water consumption. The differences in mean l/c/d have been tested using ANOVA Technique. The technique has been used to determine if there is significant difference in quantity of water used between and within the various residential categories.

The water affordability by the households was calculated using Benchmark ratio. The researcher used data on household monthly expenditure on water and compared with monthly household income. A benchmark ratio of 5 per cent was adopted for the study. Households spending more than 5 per cent of their monthly income on water were considered to be using unaffordable water. The affordability of the water services was assessed using Correlation Analysis. The mean monthly household income was correlated with the mean monthly expenditure on water in each estate. Correlation Analysis therefore showed the degree of relationship between the household monthly income and expenditure on water. The study used t-test to assess

the difference between the mean proportion of household income spent on water and the World Bank Benchmark ratio.

Water quality was tested to show the level of compliance with safe drinking water standards as provided by World Health Organization. The tests were carried out both at the treatment plant and the end point to verify any contamination along the network. The test results kept by KIWASCO were used for the analysis. The mean monthly results on physico-chemical and biological properties have been compared with the World Health Organization Drinking Water Standards. Quality of water service was measured in terms of number of hours of water availability and continuity of service in the selected households. Households with 24 hour service and private piped connection were considered to have the best service while households with below 6 hours of service or relying on vendors were considered to be receiving suboptimal service. The researcher has used proportions to describe the quality of service. Data has been presented using charts, tables, pictures and statements to describe various aspects of water services and household income and expenditure.

CHAPTER FOUR

4 RESULTS AND DISCUSSIONS

4.1 Introduction

This chapter presents the results of the study. The results are organized as per themes derived from the objectives of the study. The purpose of the study was to examine the impact of privatization of water services in the MoK. The analyses were done in relation to accessibility, affordability and quality of privatized water services. The variables used include, the proportion of the urban population with private piped water or public stand pipe within a distance of 200 metres; household daily or monthly water consumption; primary water sources and distance to those sources , household monthly income and expenditure on water. Duration of water service, primary sources of water and water tests results of physical, chemical and biological characteristics of water have also been outlined.

4.2 Daily Water Use versus Income

From detailed household surveys on water use the study examined; the extent to which the urban poor are served by private water service providers and if water consumption increases by income levels of households. The respondents were asked to estimate the daily amount of water used by their households. To estimate the daily water use, the researcher asked the surveyed households their monthly water bills as issued by KIWASCO where there is piped connection or the number of 25 litre jerry

cans used per day for those relying on vending systems or kiosks. The mean quantity of water consumed daily by each household was measured in litres.

The mean monthly household income for each residential estate was computed from the reported individual household monthly income. Table 5-1 shows the mean monthly household income and the daily amount of water used per household in each estate. The analysis is based on the reported incomes and estimated quantities of water consumed.

Table 4-1: Estimated mean daily amount of water used per household (Liters)

Name of Estate	Mean Monthly household income (kshs)	Mean Daily water used(litres	Mean Family size	Mean Per capita daily water use (litres)	Deviation from the recommended basic water requirement
High income	26,650	205.00	3.64	56.32	+6.32
Middle income	17,950	167.29	4.31	38.82	-11.18
Low income	16,750	177.32	4.32	41.05	-8.95
Unplanned settlement	7,150	112.48	5.01	22.45	-27.55
Mean	17,125	149.50	4.54	32.92	-17.18

4.2.1 Daily Water Use

It is evident from Table 4-1 that, the mean monthly household income is Kshs. 17,125/- and the mean household water consumption is 149.50 litres per day, resulting in a mean per capita per day of 32.92 litres while the national average is 45.2 litres

(Table 4-4). Using the recommended basic water requirement of 50 l/c/d (World Bank, 2003), in the study area, there is a mean daily water per capita shortfall of 17.18 litres. The shortfall represents 34.4 per cent of daily per capita water requirement. This implies that only 65.6 per cent of the basic water requirements of the residents of Kisumu Municipality are met.

The results in Table 4-1 also indicate that the per capita daily water use varies according to the income category of the estates. The highest amount was reported in Milimani, consuming an average of 56.32 litres of water per person per day while the low income unplanned Nyalenda Estate reported the lowest water use of 22.45 litres per person per day. The per capita water use in Milimani Estate is therefore about 2.5 times more than the poor individuals in Nyalenda Estate. Migosi Estate, although categorized as middle income estate, the l/c/d is lower than Arina Estate. This could be attributed to the presence of water kiosks in Arina and not Migosi Estate. The water use level by the poor in Kisumu Municipality is much lower than the national average of 45.2 lcd (Table 4-1). This suggests gloomy picture in Kisumu Municipality. To validate the results of this study, the results were compared with the findings of a study by Gleick, 1996 that recommended a basic water requirement of 25 l/c/d to meet the most basic of human needs, with an additional 15 l/c/d for bathing and 10 l/c/d for cooking. This basic water requirement is for meeting domestic basic needs, independent of climate, technology and culture.

The study found out that the low and middle income estates access less than 50 per cent of the recommended basic water requirement. Only 15 per cent of the households in the study area therefore access the 50 l/c/d recommended basic water requirement for drinking, cooking, and personal hygiene. This has serious health implications as is evidenced by the prevalent water related diseases in the study area. The water requirement of the urban residents is still far from being met. The recent rehabilitation of the main line by LVSWSB has not changed the amount received at the end points.

Mean daily per capita water use, graphically shows downward trend, with low income estates reporting lower daily per capita water use (Figure 4-1).

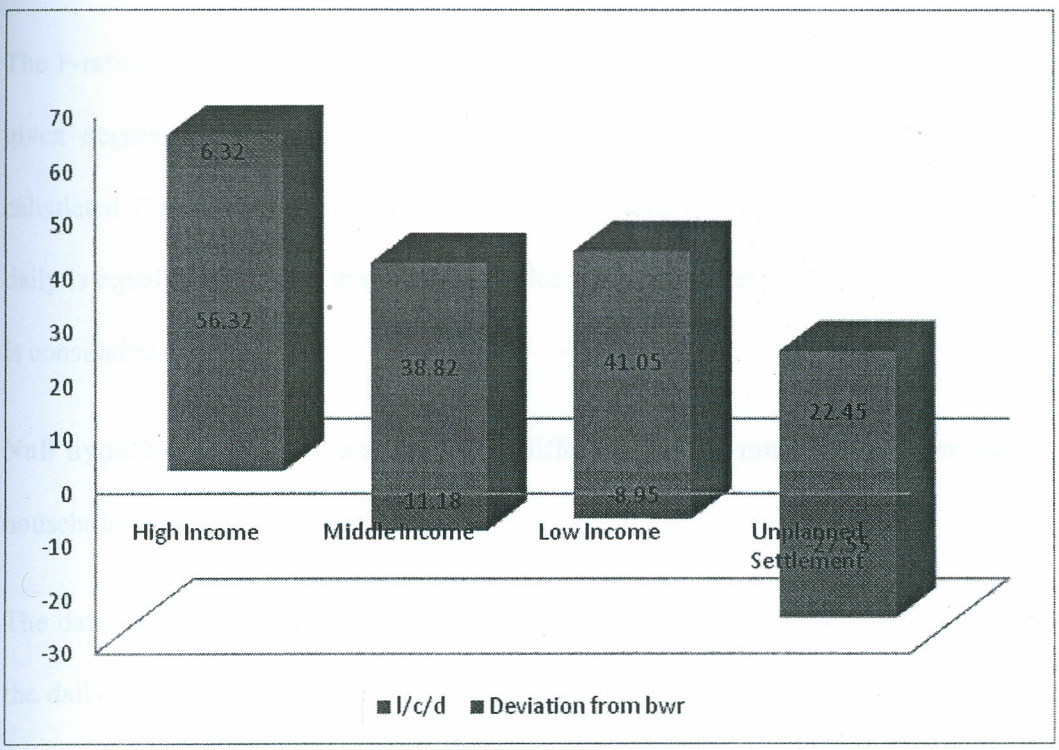

Figure 4-1: Mean daily per capita water use

To test the differences in the mean daily water use per household between and within the estates the study employed ANOVA Technique of analysis. This technique is useful when multiple sample cases are involved. The significance of the differences between the means of two samples can be judged through either z-test or t-test. In this research, difficulty arises in examining the significance of differences between more than two samples using z-test or t-test. The ANOVA technique enables us to perform this simultaneous test and is considered to be more appropriate when comparing the means of more than one sample. It is a test of the difference between means for two or more groups.

The F-ratios were computed and compared with their corresponding table values, for given degrees of freedom at 5 percent significance level. If it is found that the calculated F-ratio concerning variation between mean quantities of water consumed daily is equal to or greater than its table value, then the difference between the means is considered significant.

Null hypothesis: There is no significant difference in the mean daily water use per household between the estates.

The data in Table 4-1 was used to generate ANOVA table. The results indicate that the daily household water use varies according to income levels of the estates. Using ANOVA technique we can determine the critical value by locating the value corresponding to the numerator degrees of freedom equal to k-1 = 4-1 = 3 where, k denotes the number of estates surveyed; and denominator degrees of freedom equal to nT – k = 367 – 4 = 363 where nT denotes the number of sampled households. The ANOVA results for the differences in mean daily water use are as shown in Table 4-2.

To determine the significance of the test, the computed F value is compared with the critical table value. If the obtained value is greater than the critical value, the null hypothesis is rejected at a specified level of significance. Table 4-2 shows the computed F value is 31.189, while the table value of F is 2.60 at 95% Confidence Level, the d.f. being v_1=3 and v_2=363. Since Fo > Fe the Null Hypothesis is rejected at 0.05 significance levels; hence there is significant difference in the mean daily water use per household between the estates.

Table 4-2: ANOVA results for the differences in mean daily water use

	Sum of Squares	**df**	**Mean Square**	**F**	**Significance**
Between Groups	412051.96	3	137350.656	31.189	.05
Within Groups	1448837.2	363	4403.761		
Total	1860889.2	3367			

The results suggest that the high income estates inhabitants' exhibit relatively higher l/c/d compared to the inhabitants of low income estates. This trend could be explained by availability of private in house connections in the high income areas. The high income households with private piped connections are likely to consume more water due to convenience in accessibility. Additionally, the high income households are likely to devote more financial resources to access more water. This corresponds to the commonly held belief that the amount of water used is higher in the high income residential neighbourhoods compared to low income estates.

Lake Victoria South Water Service Board has the mission of ensuring the provision of safe, adequate and sustainable water and sanitation services for economic growth by developing water service providers and facilities. The Water Service Board does this by developing water infrastructure and licensing a water company to carry out service provision.

In Kisumu, Municipal Council of Kisumu under the Companies Act Chapter 486, Laws of Kenya, established a water company by the name Kisumu Water and Sewerage Company (KIWASCO) in 2001 but became operational in 2003. The service provider, (KIWASCO) is responsible for providing water and sewerage services to customers connected to the network. The Municipal Council is responsible for on-site and public sanitation. Within the water reform structure the company falls under the Water Services Board (WSB). WSB is allowed by the Act to possess the assets which were hitherto held by the municipal council. The company was given delegated authority by WSB to provide water and sewerage services. To effect this, the company entered an Urgency Agreement with WSB.

The company was transferred from Kisumu Municipal Council under Service Provision Urgency Agreement. Under that Agreement the company was to provide water within an area of 297 km^2-the area covered by the municipal boundary (Figure 4-2). Also under the same agreement the assets were also transferred to the company under the Lease Agreement. The company pays a lease fee of Kshs.1,500,000 and Kshs.1,000,000 debt resolution per month to the municipal council because the assets and all staff below corporate management team all came from the council.

The water company also pay a further regulatory levy to WRSB calculated at the rate of 1 per cent of the monthly revenue. KIWASCO also pays licence fee to LVSWSB of 5 per cent of their monthly revenue. Currently, KIWASCO realizes revenue collection efficiency of 93 per cent.

Figure 4-2 shows that while KIWASCO was to provide water within the entire municipal boundaries, so far the reticulation has been confined to the built up area. The existing network is the old distribution system which was done by Kisumu Municipal Council. The vast area of MoK, therefore, is not under distribution network

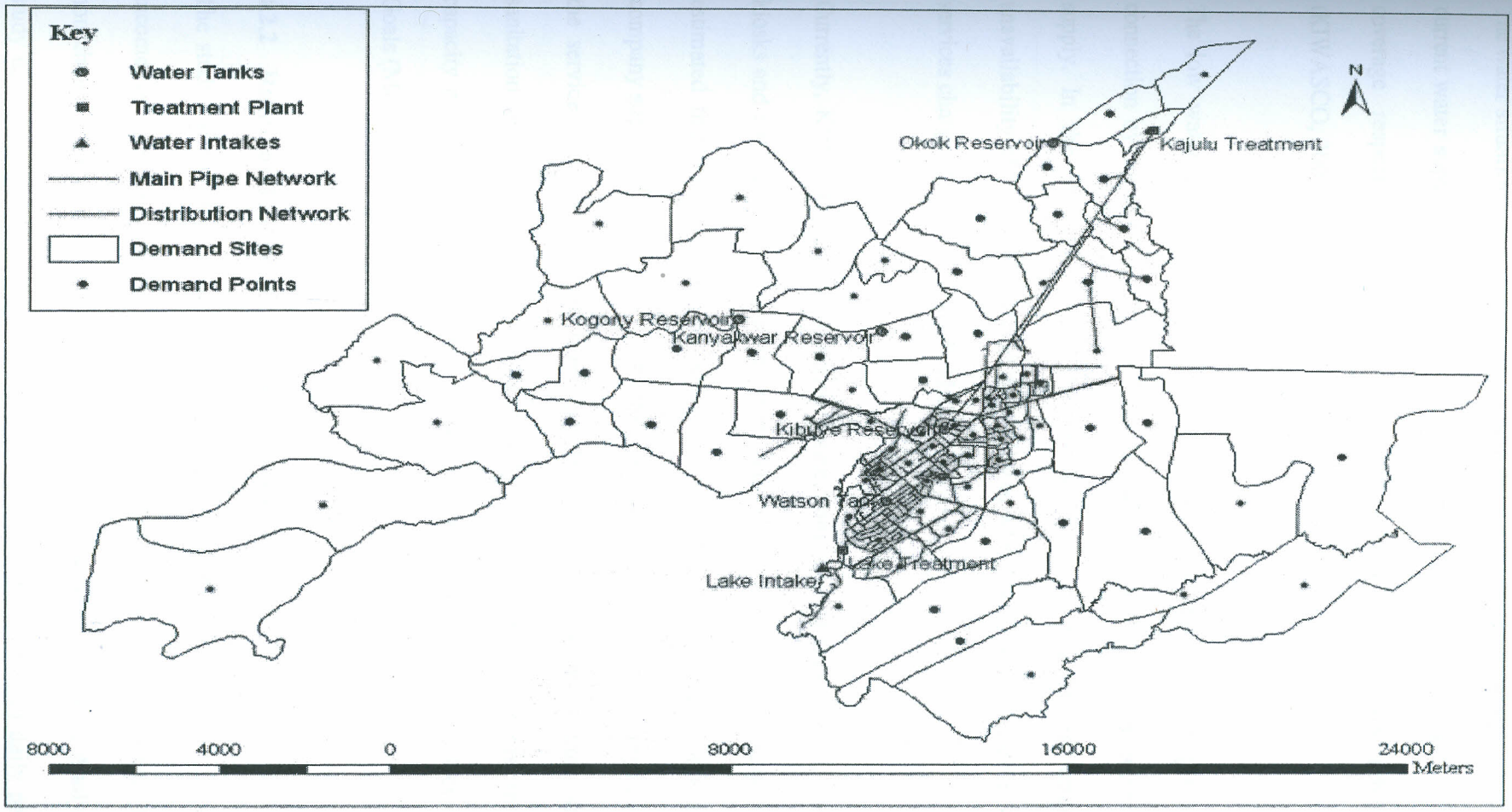

Figure 4-1: Water Supply Zones in Kisumu

The water situation in Kisumu presents both unique challenges and opportunities. The current water supply network and sewerage system commands 40% and 10% spatial coverage respectively, mainly concentrated within the built-up urban centre (KIWASCO, 2005).

The low water use in Nyalenda estate could be attributed to low private water connection by households. There are also households with piped connection without supply. In the study, this was phenomenal in Arina and Migosi estates. The unavailability of water has affected the ability of KIWASCO to collect even sewerage services charges from such households.

Currently, KIWASCO has 9020 active connections. Out of these, 240 are for water kiosks and 6800 are domestic connections. There are 5800 inactive connections. It is estimated that each water kiosk serves 50 households. The water and sanitation company supplies approximately, 180,000 consumers (40 per cent of the population in the service area). This is up from the 93,000 consumers the former water and sanitation department of Kisumu Municipality used to supply. Therefore, the current capacity needs to be increased by 1.18 times to meet the Millennium Development Goals (MDGs) target.

4.2.2 Relationship between Income and Water Use

The study examined the relationship between per capita water use and the monthly income of the households. The strength of the relationship between monthly household income and water use was tested using Pearson Correlation Analysis. The study used the reported mean monthly household income and mean daily per capita

water use in each estate. Using the data in Table , the correlation coefficient was computed. The results show that the coefficient of correlation is 0.992 at 95 per cent Confidence Level (Table 4-3). This shows strong positive correlation between household income and daily per capita water use. Households in high income estates exhibit higher demand for water per day than the low income residents, hence the higher the income, the higher the water consumption and vice versa.

Table 4-3: Correlation between household income and daily per capita water use

		Monthly household income	Daily per capita water use
Monthly household income	Pearson Correlation	1	.992(**)
	N	4	4
Daily per capita water use	Pearson Correlation	.992(**)	1
	N	4	4

(**) Very strong positive correlation

The data for the study area has been compared with data from Drawers of Water II study, 2000 (Table 4-4)

Table 4-4: Daily per capita water use (litres)

	All households	Piped Households	Unpiped Households
Kenya	45.2	47.4	27.7
Tanzania	70.5	76.5	25.1
Uganda	47.0	64.7	23.5

Source: Thompson et al, 2000.

Comparisons with Tanzania and Uganda reveal the following; although water use in urban Kenya is only marginally lower than the 47 l/c/d estimated for the urban Uganda in the DOW II study, it is 60-70 per cent lower than in neighbouring Tanzania, where the average water use in urban areas is about 71 l/c/d. And it is even lower when compared with water use levels reported for several non-African cities in the developing world. The Latin American Cities average water use range between 143-237 l/c/d. Similarly water use in 13 Asian Cities was found to be in the range of 91-209 l/c/d.

Table 4-5: Per Capita Water Use in Asian and Latin American Cities

Asian Cities	Water use (l/c/d)
Kathmandu, Nepal	91
Dhaka, Bangladesh	95
Beijing, China	96
Mandalay, Myanmar	110
Hong-Kong, China	112
Suva, Fiji	135
Shanghai, China	143
Colombo, Sri Lanka	165
Singapore	183
Kuala Lumpur, Malaysia	200
Manila, Philippines	202
Seoul, Korea	209
Delhi, India	209

Latin America	
Sta, Catarina, Brazil	143
Minas, Brazil	154
Bogotá, Colombia	167
Santiago, Chile	204
Costa Rica	208
Brasilia, Brazil	211
Sao Paulo, Brazil	237

Source: Asian Development Bank, 1997 and Yepes and Diandera, 1996

We find that neither the low income nor the high income households are being well served. The clearest evidence of poor service comes from one of the most basic and important service variable- quantity. In direct contrast to the literature, we find that both the low income and the high income are using little water and paying a lot for it. Kisumu has been suffering serious water shortages since the 1980's. There has been a steady increase in population since then with no expansion in supply capacity. As a result, the water deficit has continued to grow. Water vendors is an important service and business in Kisumu Municipality (Plate 4-1)

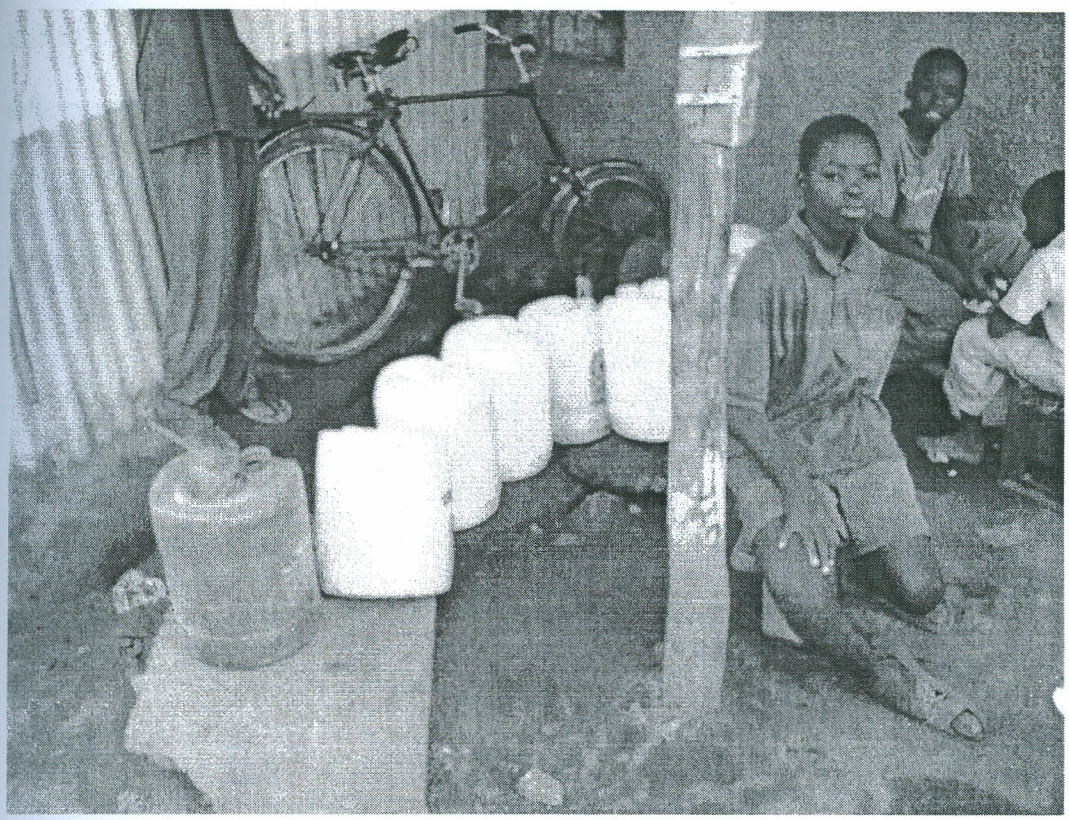

Plate 4-1: A water-dispensing kiosk in Nyalenda estate

Previous studies in Jakarta and Port-au-Prince, for example, found that the non-poor use 2-14 times as much water as the poor. Specifically in Port-au-Prince, Fass (1988) estimates that households with connections (mostly the rich) use 156 l/c/d compared with the 11 l/c/d used by the poor households that rely on the vending system. For Jakarta, Crane (1994) reports that households with private connections use 62.2 l/c/d as compared with 27.5 l/c/d used by those relying on hydrants and 14.6 l/c/d for those relying on vendors. Crane also notes that vendors in Jakarta charge up to US$ 2.6 per cubic meter; which he estimates is about 30 times the rate charged by the public utility.

In Kenya, we find that poor households use less water than the non-poor, but the difference is no where near as large as the literature and conventional wisdom would suggest. Specifically, the poor use an average of 33 l/c/d, compared with 44 l/c/d by non-poor households based on a study on three Kenyan towns (World Bank, 2005). The non-poor use about 1.33 times as much (33 per cent) more than the poor.

4.3 Distances to the Nearest Primary Water Source

Accessibility was also measured in terms of the proportion of the households with access to adequate amount of safe drinking water in a dwelling or located within a distance of not more than 200m from a house to a public stand post. Data was collected on the primary sources for household water. Residents were asked to estimate the shortest distance to the primary sources of water.

Households in Kisumu Municipality travel varying distance to access safe water as show in Table 4-6. The average distance to the primary source of water indicates that on average, only 24 per cent of the households have water within their houses. 53.1 per cent of the households access water outside their houses but within 200m distance. 22.8 per cent of the households have to walk over 200m to reach the nearest source of water. The mean distance to the nearest water source varies in each of the estates, with high-income Milimani estate having the highest in-house connections (90.5% of the households) and only 9.5% getting water from outside their houses. Middle-income Migosi Estate has the least private connections (only 8.6% of the households) while the rest rely on wells and water vendors. In low –income Arina Estate only 23.9 per cent of the households have in-house connections while in unplanned Nyalenda

Estate, the residents largely rely on water kiosks, and a paltry 12.7% have private connections.

Table 4-6: Distance to the nearest water source

Category of Estate	Name of Estate	within the house	upto 200m	over 200m
High income	Millimani	90.5%	9.5%	.0%
Middle income	Migosi	8.6%	52.9%	38.6%
Low income	Arina	23.9%	43.7%	32.4%
Unplanned settlement	Nyalenda	12.7%	70.0%	17.3%
	Mean	24.0%	53.1%	22.8%

The study therefore found out that 77.1 per cent of the households access water within a distance of upto 200 metres or less. The study further found out that Nyalenda Estate, unplanned low income neighbourhood, enjoys shorter distance to the nearest water source than low income Arina and middle income Migosi estates. This is because of the existence of many water kiosks in Nyalenda Estate. The kiosks have been established at closer intervals hence reducing distance travelled by households to the nearest water points. Only 17.3% of the households in unplanned Nyalenda Estate travel a distance of over 200m to reach the nearest water point compared to Migosi and Arina Estate where 38.6% and 32.4% respectively travel the same distance. Accessibility to water services is lowest in Migosi Estate due to none availability of private piped connections and water kiosks. The residents rely largely on the water vendors who transport water over longer distances. KIWASCO has established delegated water management in Nyalenda Estate by appointing master water operators

who operate the kiosks and maintain the network along their system. The delegated model has led to emergence of many water kiosks in the neighbourhood thereby bringing water closer to the households. KIWASCO was mandated to provide economical and efficient water supply to the entire city. So far the progress on network distribution has been confined to the built-up area of the city, leaving a large proportion without direct house connection (Figure 4-3). The water distribution network is old and comprises of about 112km of pipes ranging from 80-350mm diameter pipes.

Infrastructure development is the responsibility of the LVSWSB. So far, Phase I of the project has been completed, which involved construction and rehabilitation of the main line from Dunga Treatment Works to Tom Mboya Storage Tank. Phase II is yet to begin, which will involve rehabilitation and extension of distribution network.

Distance to the primary source affects water consumption as well as socio- economic status of the households. Longer distances to the nearest water source imply longer hours spent on fetching water. The time spent on fetching water could be more productively used elsewhere. The weight of the water also affects health status of the people involved in fetching water who are coincidentally mostly women and children. Some residents are tempted to carry water on their own to save money on water expenditure. The residents can also resort to alternative water sources like wells which may be polluted, if the piped sources are far.

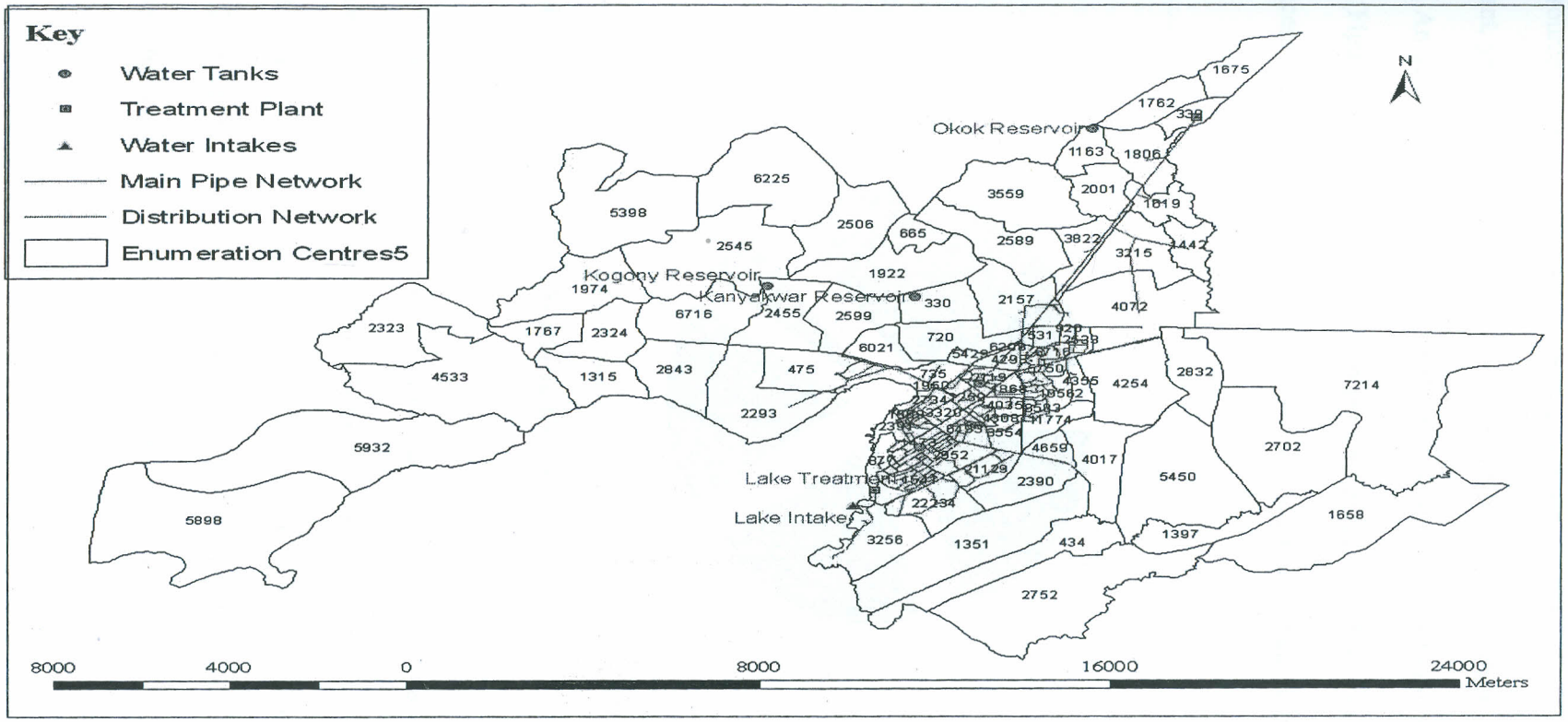

Figure 4-3: Distribution network in Kisumu Municipality

Households surveyed in the four estates of Kisumu Municipality use a number of water sources to meet their needs. Private in-house piped connection is the most important, yet only 19.8 per cent of the sampled households use them as their primary source. An additional 18.6 per cent of the households use yard taps as their primary source (Figure 4-4). In other words, 38.4 per cent of the households in the four estates have access to piped water supply, either in their houses or in their yard.

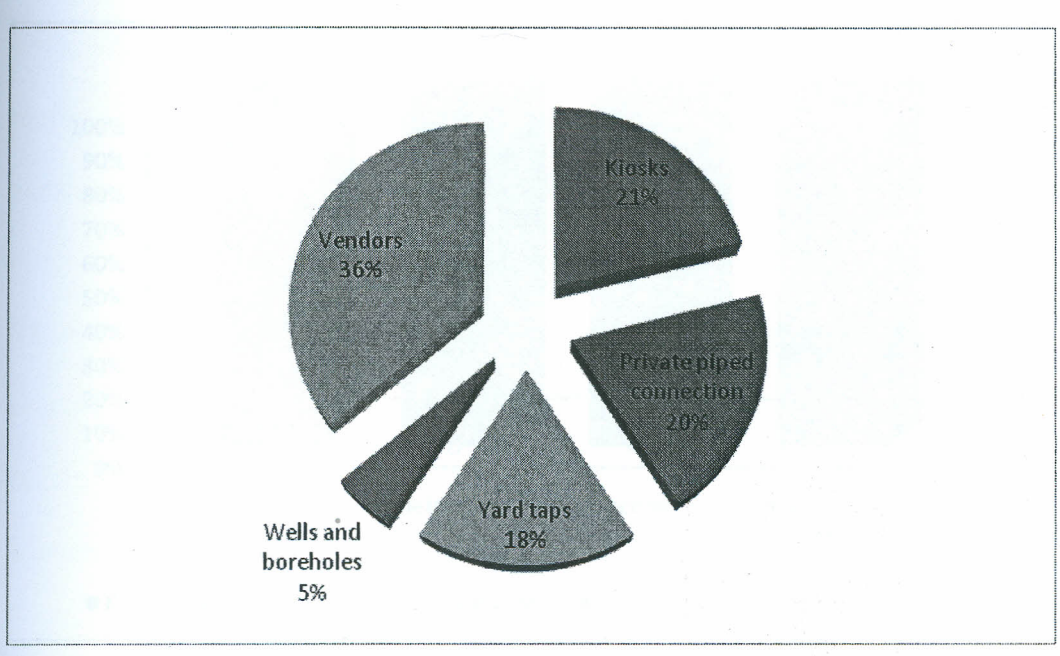

Figure 4-4: Primary Source of Water in Kisumu

The study found out that 35.7 per cent of the sampled households use the vendors as their primary source, while 21 per cent rely on the kiosks (Figure 4-4). Therefore, 56.7 per cent of the households in the four estates surveyed depend on either vendors or kiosks. Kiosk operators sell their water to both the vendors and household customers who therefore have to transport the water over varying distances.

Figure 4-5 shows that water vending is by far the most prevalent alternative to piped supplies, with 35.7 per cent of the households using them as their primary source. The overwhelming majority of whom are from middle income Migosi Estate with 85.7 per cent of the households relying on water vendors, followed by low income Arina Estate where 66.2% also use vendors as their primary source of water. Kiosks and wells/boreholes serve as the primary source for 25.8 per cent of the households.

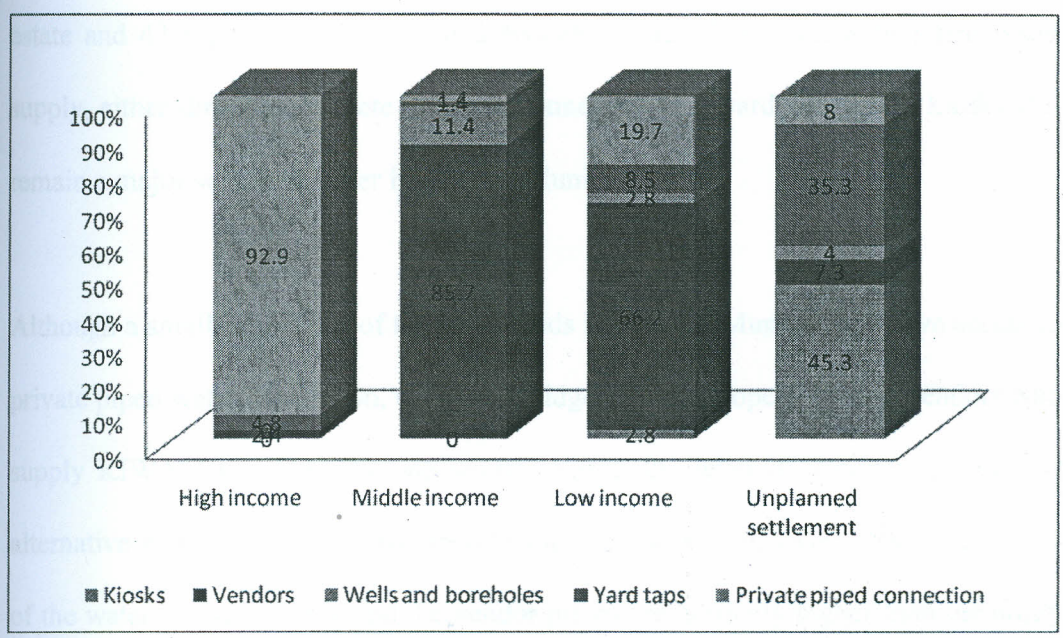

Figure 4-5: Sources of water by residential category

The reliance on water kiosks is more prevalent in Nyalenda Estate where 45.3 percent of the households source their water direct from the water kiosks. The residents of Nyalenda Estate largely rely on water kiosks due to close proximity to the kiosks. Many kiosks have been established in Nyalenda Estate, in line with the principle of delegated management model. The prevalence of water kiosks and not house connection could be attributed to water culture where the water company still views

the poor as unattractive investment/customers while the residents prefer to meet daily water costs as opposed to monthly bills.

Utility coverage or the proportion of the household with access to piped water supply in Kisumu Municipality is only 43 per cent, which is quite low. Specifically, in high income Milimani estate we find that 97.6 per cent of the households, 2.8 per cent of the households in middle income Migosi estate, 27.2 per cent in low income Arina estate and 43.3 per cent in unplanned Nyalenda estate have access to piped water supply, either through a private in-house connection or a yard tap. Water kiosks still remain a major source of water in Kisumu Municipality.

Although a small proportion of the households in Kisumu Municipality have access to private piped water connection, the gap is bridged by kiosk operators and vendors who supply KIWASCO water. As one would expect, the level of service provided by alternative sources such as kiosk operators and vendors is also very low. The quality of the water is questionable and the vendor prices are normally higher than the utility prices.

With only19.8 per cent of the residents interviewed in the survey having access to main water connections, alternative sources are by far the most prevalent. The situation was more deplorable in middle income Migosi Estate where only 1.4 per of the respondents interviewed have direct water connections, and in unplanned Nyalenda Estate, it is slightly better with 8 per cent of the respondents having direct connection while in low income Arina Estate, the figure stood at 19.7 per cent. In

Migosi and Arina Estates, the houses have network connections but most of the houses do not receive water. Still a large proportion of the population is relying on water kiosks. The study attempted to factor the above parameters to assess the proportion of the households that can be considered to have access to water services as shown on Table 4-7

Table 4-7 shows that when different parameters are used to assess the proportion of the households that have accessibility to water services, different figures result. When all the parameters are applied, the results indicate that high income Milimani Estate still enjoys the highest accessibility, with 99.26 per cent of the households having access to water services. Middle income Migosi Estate has the lowest connectivity, with only 21.4 per cent of the households categorised as having accessibility.

Table 4-7: Summary of water accessibility parameters

	Milimani	Migosi	Arina	Nyalenda	Mean
Recommended 50l/c/d	100	0	0	0	25
Distance within 200m	100	61.5	67.6	82.7	77.1
Private piped Connection or Yard tap	97.6	2.8	28.2	43.3	43.0
Mean	99.26	21.4	31.9	42	48.4

The proportion of households with access to water services in Arina and Nyalenda Estates are 31.9 and 42 per cent respectively. Migosi Estate has the lowest connectivity due to non-existent or dilapidated networks while Arina and Nyalenda

estates have relatively better accessibility due to the presence of water kiosks within the neighbourhoods.

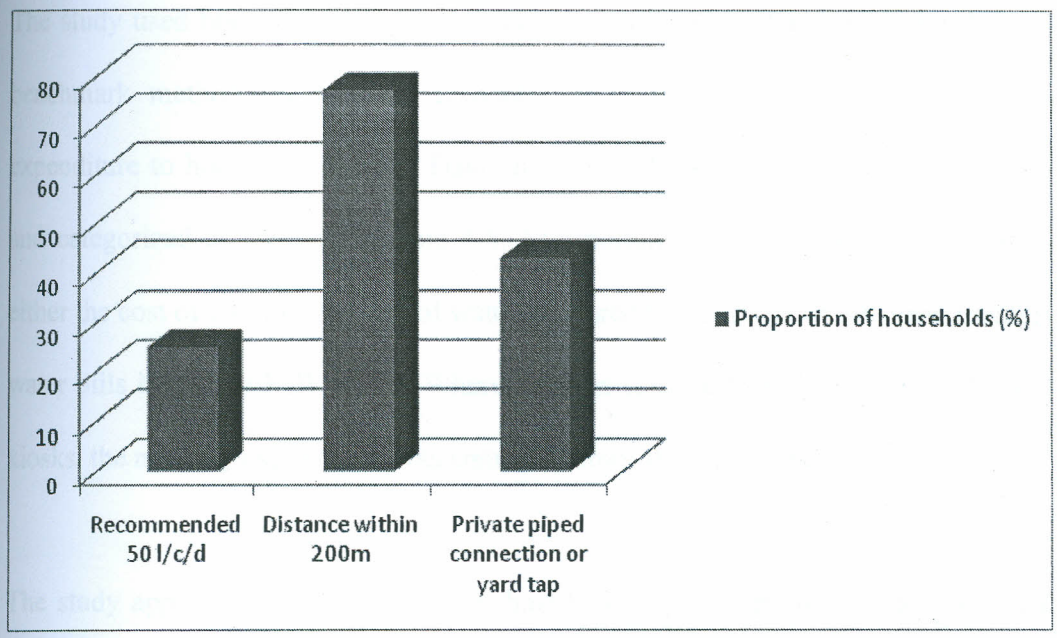

Figure 4-6: Water Accessibility Parameters

Based on the three variables, the study found out that only 48.4 per cent of households in Kisumu Municipality have adequate the level of accessibility to safe water services. The Kenya Integrated Household Budget Survey (KIHBS) 2005/06 estimates that access to safe water is 83 per cent in the urban areas and 49 per cent in the rural areas. The foregoing figures imply that accessibility to safe water in Kisumu Municipality is far below the national average. LVSWSB therefore has Herculean task to make the town realize their goal of adequate access to safe water in line with the MDG's.

4.4 Benchmarking affordability

The study used benchmark ratio to assess the affordability of the water tariffs. The benchmark method involves the computation of the ratio of household's water expenditure to household income. Data on monthly household income was collected and categorized as shown on Table 4-8. Expenditure on water was estimated from either the cost of 25 litre jerry can of water delivered to the house or the mean monthly water bills issued by KIWASCO. Where water is sourced from the vendors or water kiosks, the monthly expenditure was computed from the daily expenditure.

The study applied the World Bank benchmark which was set by the Pan American Health Organization; that households should spend no more than 5 per cent of their monthly income on water (World Bank, 2001). A recent Human Development Report (UNDP, 2006) also suggests that no household should spend more than 3 per cent of its income on water.

Although this method may appear rather arbitrary, it can be applied in countries where data limitations prevail and the results often provide valuable insights. Other methods, such as revealed or stated preferences approaches which approximate "willingness to pay" may seem more sophisticated but suffer from some problems of subjectivity (Komives *et al*, 2005) in addition, they require more data than are usually available from national household survey. The estimates of affordability in this research are based on expenditure-income ratios as shown in Table 4-9.

The study sought to know the monthly household income and the proportion spent on water to evaluate the affordability of the water service. The reported incomes were categorized, with the lowest category earning below Kshs.5000/- while the upper category receives Kshs.30,000/- and above. The study area lies in Winam Division where poverty levels are 58 per cent. In Kenya, to determine how many people are poor, a monetary poverty line is derived which represents the cost of a basic basket of goods. The poverty line is determined and based on the expenditure required to purchase a food basket that allows minimum nutritional requirements to be met, in addition to the costs of meeting basic non-food need like water (Kenya, 2000). On average the total monthly consumption expenditures per person are estimated to be about Kshs. 1,239 and Kshs. 2,648 for rural and urban households as an indicator of wellbeing (Kenya, 2003).

Table 4-8 shows that 24.3 per cent of the households in the study area receives a monthly income of Kshs.30,000/- and above, while 36.9 per cent receive Kshs.10,000/- or below. The study found out that 54% of the households receive a monthly income of Kshs.15,000/- or below. This proportion compares favourably with the poverty levels in Winam Division (Kenya, 2005). Of great significance is the fact that despite having a rich natural resource base, 48% of Kisumu's population of 345,312 live within the absolute poverty bracket comparing unfavourably with the national average of 29% (CDS, 2004).

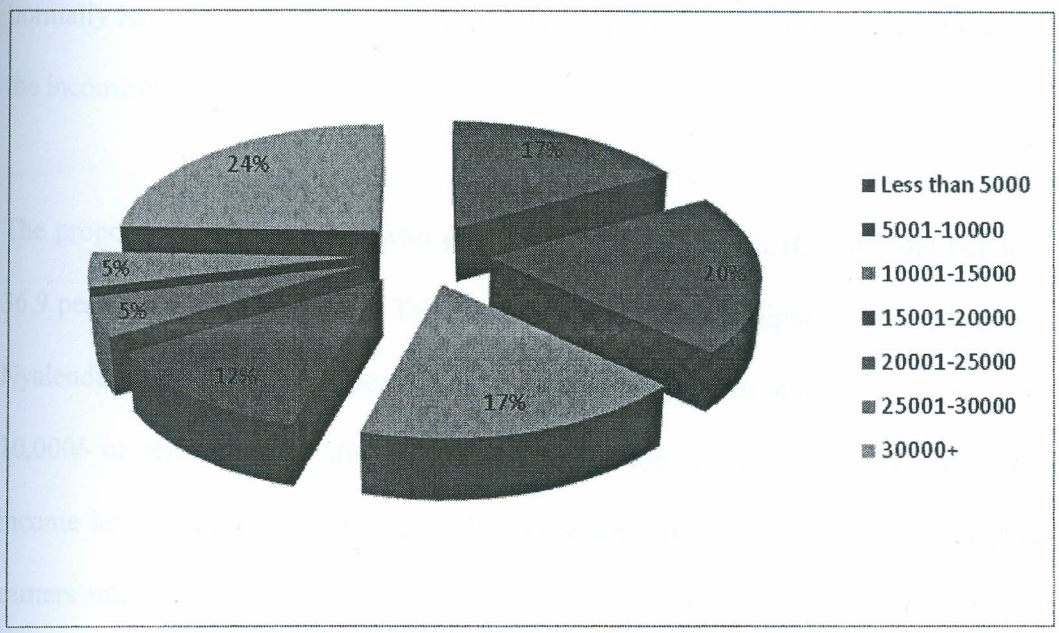

Figure 4-7: Household distribution by income category

The study also considered the distribution of income by the estates (Table 4-8). The study revealed that in the high income Milimani Estate, 73.8 per cent receive monthly income of Kshs.30,000/- or more. The proportion is lowest in the unplanned Nyalenda Estate where only 4 per cent of the households are in the same income bracket. In Migosi and Arina estates 30 and 32.4 per cent respectively are have monthly household income of Kshs.30,000/- or more. The monthly household income for the low income Arina Estate contradicts the residential category of the estate. Arina Estate is a local authority estate and the targeted inhabitants seldom occupy them. The low income estates therefore end up being occupied by the higher income households. The overall distribution of households by income categories are as shown in Figure 6-1 with more than 50 per cent of the households earning Kshs. 15000 or less. This confirms that the poverty level is more than 50 per cent. The income figures used are reported ones and may not be actual figures. It should be emphasized that people

normally have the tendency to understate their incomes and hence, the small range in the income categories.

The proportion of households who earn monthly income Ksh.10,000/- and below is 36.9 per cent as is evident from Table 4-8. The proportion is highest in the unplanned Nyalenda estate where 64.7 per of the households rely on monthly income of Kshs. 10,000/- or below. This confirms earlier categorization of the estates according to the income levels. High density residential neighbourhoods are occupied by low income earners and vice versa.

Table 4-8: Household income by Estate

Household income (Kshs./month)	Name of Estate				Percentage Total
	Millimani	Migosi	Arina	Nyalenda	
less than 5,000	.0%	7.1%	7.0%	30.7%	16.8%
5,001 - 10,000	.0%	5.7%	16.9%	34.0%	20.1%
10,001 - 15000	4.8%	18.6%	25.4%	16.7%	17.4%
15,001 - 20000	9.5%	25.7%	5.6%	9.3%	12.0%
20001 -25000	7.1%	5.7%	7.0%	2.7%	4.8%
25001 - 30000	4.8%	7.1%	5.6%	2.7%	4.5%
Over 30000	73.8%	30.0%	32.4%	4.0%	24.3%

The study found out that expenditure on water varies according to income levels of the households. The proportion of income spent on water services are higher for low income households compared to that of richer counterparts. The proportion is higher amongst the low income households due to unregulated water market environment generally and low monthly incomes amongst households of unplanned Nyalenda Estate. The price charged to kiosk operators is fixed and controlled, while the vendors

that sell to end consumers operate in a liberal market. The household income spent on water is directly proportional to the total income of the households. The main problem is that kiosk operators sell water to the vendors who operate in unregulated market and sell water according to market forces. The water company has found it difficult to regulate the vendors because they do not have contractual relationship with them.

The study revealed that expenditure on water constitutes a significant household budget, just like rent, fees and food. The quantity of water consumed is therefore likely to be affected by price of the commodity and household income, when the price of water sours, households are likely to consume less. This notion is subject to the elasticity of demand for water.

Table 4-9: Percentage of monthly income spent on water

Household income	Mean Household income spent on water (Kshs)	Percentage income spent on water (%)	Percentage Total (%)
less than 5,000	561.96	22.5	16.8
5,001 - 10,000	723.93	9.60	20.1
10,001 - 15000	964.77	7.70	17.4
15,001 - 20000	1135.59	6.40	12.0
20001 -25000	1856.92	8.25	4.8
25001 - 30000	1497.86	5.40	4.5
Over 30000	1669.86	4.10	24.3
Mean	1099.11	8.51	

The distribution of the proportion of households' monthly income spent on water is shown in Table 4-9. The table shows that majority of the urban poor and middle income households who largely rely on water vendors and kiosks (Figure 4-4)

dedicate a bigger proportion of their monthly income on water than the connected high income households.

$$t = \frac{\overline{X} - \mu}{\sigma_s / \sqrt{n}}$$

$$\sigma_s = \sqrt{\frac{\sum (x_i - \overline{X})^2}{(n-1)}}$$

$$df = (n - 1)$$

Where $\overline{X}$ = Sample Mean = 8.5

μ = Population Mean=5.

σ_s = Sample Variance = 37

t = 0.227

The t-test was carried out to test if there is significant difference between the World Bank recommended ratio of 5% and the sampled household mean monthly expenditure on water of 8.51%. t value was computed and compared with their corresponding table values, for given degrees of freedom at 5 percent significance level. If it is found that the calculated t value is equal to or greater than its table value, then the difference between the means is considered significant and the null hypothesis is rejected.

Null hypothesis: That a significant urban population does not afford safe drinking water as per World Bank benchmark ratio.

The degrees of freedom = n-1=7=1=6. At 95% Confidence Level, the table value of t is 2.447 while the computed t_o=0.227. This is within the acceptance region, we accept the Null hypothesis. This indicates that a significant urban population does not afford safe drinking water as per the World Bank benchmark. The mean proportion of the monthly household income spent on water is 8.51 per cent compared to the World Bank recommended threshold of 5 per cent.

The study revealed that expenditure on water constitutes a significant household budget, just like rent, fees and food. The proportion of a household's income or budget spent on water service and affordability are negatively correlated. The higher the monthly household income the lower the proportion spent on water. The higher the proportion of household income spent on water and sewerage charges, the less affordable they are.

According to the survey in MoK, water and sanitation bill on average accounted for 8.51% of household income. In the UK, the government considers water tariffs to be unaffordable if expenditure exceeds 3 per cent of the household income (Sawkins and Dickie, 2005). The expenditures on water are much more burdensome for low-income families than high-income families. The proportion of monthly income spent on water varies between 4.1% for the high income households and 22.5% for the low income families (Table 4-9). The results suggest that households with monthly income of Kshs.5000/- and below spend 5.5 times more on water in comparison to the well to do

households, which translates to 298 per cent more on water in comparison to the well to do households.

It is also evident from Figure 4-8 that the proportion of the income spent on water is highest amongst those who earn below Kshs.5000/- per month and this proportion reduces with increase in income. The study found out that the proportion of income spent on water is directly proportional to monthly household income. The higher the monthly household income the lower the proportion spent on water.

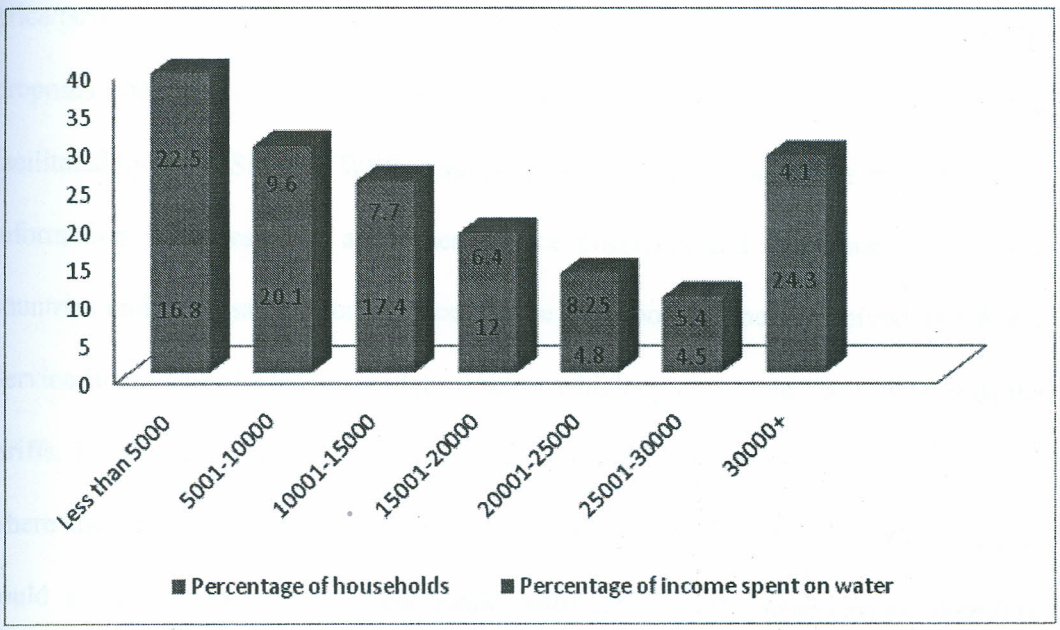

Figure 4-8: Proportion of household monthly income spent on water

Based on 5 per cent benchmark ratio, the study revealed that 75.7 per cent of the households in Kisumu Municipality find the cost of water unaffordable. Only 24.3 per cent of the households spend less than 5 per cent of their monthly income on water. The affordability of a good or service determines the quantity consumed. The quantity of water consumed is therefore constrained by the affordability of the service by the households. For example in Chile, municipalities pay (nationally funded) subsidies to

private and public water companies when water is supplied to low income households likely to pay water bills greater than 5 per cent of household income. The mix of service, tariff, and subsidy will influence the decision on which model of private participation to use and help to define the outputs that the private operator will be required to produce.

The water company is a commercial business enterprise hence profit motivated. The price/tariffs employed by the company are regulated by WSRB. The service provider proposes the tariffs to the Water Services Regulatory Board. This is done and facilitated by the WSB. The WSB is supposed to commission a service study to gather information from residents and other service providers and benchmark with other countries under the same circumstances. Once the report has been received, the Water Service Board submits to the regulatory board which approves, declines or amends the tariffs. If it is approved, it is gazetted. This is a departure from the previous practice where the approval of the tariffs was by the Municipal Council. Political interests could a lot of times override economic justifications. The new regime therefore presupposes social, economic, political and environmental considerations.

The tariffs which are being applied by the company are those that were approved in the year 2001 and it was planned to be implemented in three phases, namely, 2001, 2002 and 2003. Currently, Lake Victoria South Water Service Board (LVSWSB) has commissioned a consultant to conduct a socio-economic survey with a view to revising the tariffs.

In Lusaka, Zambia the proportion of the urban population for whom water is unaffordable using 5% benchmark is 40% and 60 % for using 3% benchmark (Dageleviren, 2006). The calculation of the proportion of households which monthly spending on water exceeds a benchmark of 5 % or 3% of their average income provides an estimate of the rate of affordability of low cost water charges. These estimates clearly show that affordability of even the lowest tariffs constitute more than 5% of the household income for more than ¾ of the households Kisumu Municipality.

The study found out that the poor and non-poor households are, on average paying very similar unit costs for their water. At least three factors help to explain the convergence in average unit costs borne by the low income and high income households in the study. First, the service provider (KIWASCO) water supply system does not provide adequate water to the connected high income households, forcing them to buy water from the vendors and kiosk operators at prices that are significantly higher than the KIWASCO tariff. This raises their average unit cost for water. In theory, the connected high income have access to water at the low and often subsidized utility tariff, but in practice they have to supplement this with water purchased from more expensive sources for example from the water vendors. This raises the average costs borne by the high income households. This was noted in Milimani and Migosi Estates. Secondly, the poor especially in the informal settlements like Nyalenda estate- can and still use water from natural sources such as streams and wells and do not incur monetary costs for it, this lowers the average unit cost of water that they use. Third, the water from the kiosks is supplied at subsidized

rate to increase accessibility by the poor. Such water kiosks are quite common in the informal settlements hence the low expenditure on water by households in Nyalenda Estate.

4.5 Water Tariffs

The tariffs employed by the company are regulated by Water Service Regulatory Board. The service provider (KIWASCO) proposes the tariffs to the Regulatory Board (WSRB). This is done and facilitated by the WSB. Currently, the WSB is supposed to commission a service study to gather information from residents and other service providers and benchmark with other countries under the same circumstances.

KIWASCO, the appointed service provider in Kisumu Municipality charges tariffs to recover their costs. According to KIWASCO, the unit cost of producing water is approximately, Ksh. 21/- per cubic metre while the average price charged by KIWASCO is shs.46/m^3. This shows a big profit margin for KIWASCO, other operational costs notwithstanding. The lowest tariffs are charged to domestic consumers while the highest tariffs are found in commercial and industrial consumers. The industrial and commercial consumers are often charged higher tariffs for higher levels of consumption (increasing block tariff). According to World Bank (2005), few utilities do recover all their costs. According to the World Bank, only 30 per cent of utilities globally, and only 50 per cent of utilities in developed countries, generate sufficient revenues to cover operation, maintenance and partial capital costs.

KIWASCO is currently applying 2003 tariffs rates that were approved by the Minister for Local Government in the year 2001 (Table 4-10). The company employs "block

tariff' or graduating system. The rates are being charged according to the amount consumed. For example domestic consumers would pay Kshs.200/- for $6m^3$, that is, approximately Kshs.33/- per cubic metre. As you graduate to say, 7-20 m^3, a new tariff is applied (Table 4-10). The highest tariff applied is Ksh.60/- per cubic metre for domestic consumers. The company charges Kshs.70/- per cubic metre for industrial and commercial consumers.

The study found out that the water service in Kisumu is characterized by cross subsidies with the intent of making water more affordable to residential low volume users that are assumed to be poor. For example, industrial and commercial users are often charged higher tariffs. Higher volume consumers who are assumed to be high income households are also subjected to increasing-block tariff. Given the low volume of water supplied to the network, cross subsidies between residential users income categories may only benefit wealthier segments of the society.

Table 4-10 Water and Sewer Charges for Domestic Consumers

Consumption in cubic metres	**Water Charges**	**Sewer Charges**
	Kshs.	**Kshs.**
Minimum	200	180
7-20	40	35
21-40	50	45
41-60	55	50
Over 60	60	55

Source: Kenya, 2001.

The tariffs which are being applied by the company are those that were approved in the year 2001 and it was planned to be implemented in three phases, namely, 2001, 2002 and 2003. KIWASCO charges kiosk operators approximately, Kshs.35/m^3. This translates to approximately, 90 cents per 25 litre jerry can. Kiosk operators in turn sell 25 litre jerrican to vendors and domestic consumers at Kshs.2/50. Even after taking into account that kiosk owners have to incur initial costs for installation of kiosks, as well as some recurrent overhead costs (including illegal payments) the difference between the price paid to the utility and the price charged for water by kiosk owners is large.

The vendors sell to the households the same water at Kshs.10/- averagely. Vendors justify their exaggerated unit prices by the transport challenges they face. Vendors use handcarts which they complain are quite cumbersome to pull.

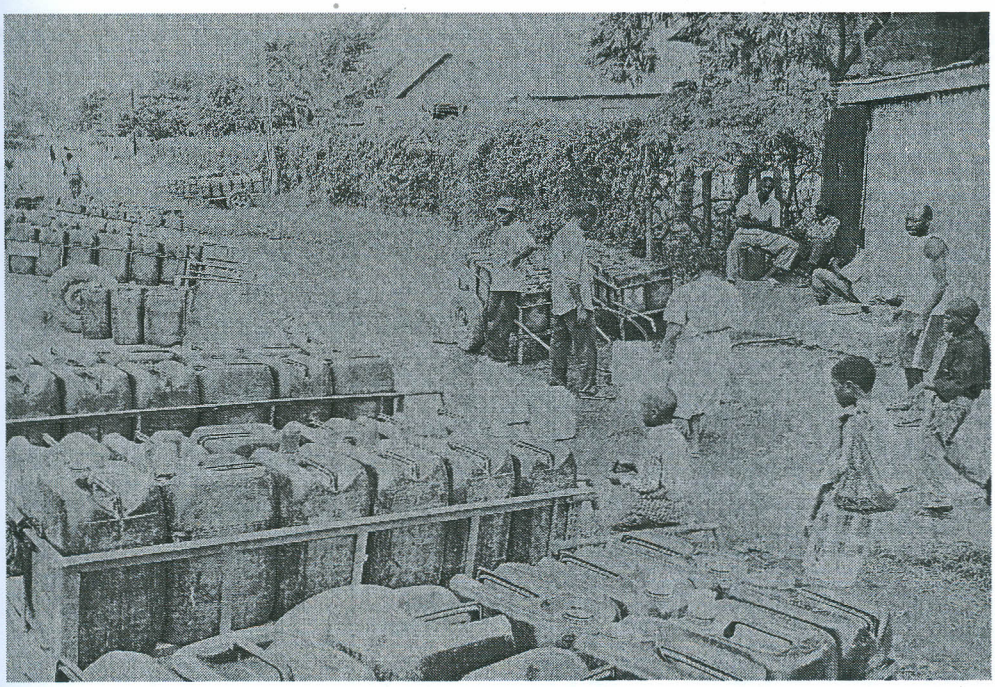

Plate 4-2: Water vendors queuing for water

Plate 4-2 shows the hand carts used by the vendors and long queues endured by the vendors at a water kiosk in Arina estate. Consumers complain that the quality of water supplied by the vendors can not be authentic since some unscrupulous vendors sell well waters which are not treated without disclosing.

We find that the rates are high relative to other prevailing utility tariffs. They are also high in absolute terms, given estimates by World Bank (2005), that full cost recovery of current water systems in some selected towns in Kenya, can be achieved at a fraction of the unit costs. The same Word Bank study also estimates that the current tariff levels are in themselves sufficient to cover capital plus operations and maintenance costs in Kenya if water utilities are run efficiently. The main reason behind the high unit cost of water reported by households in Kisumu is that, many of them, including those with private connections, are buying water from very expensive sources such as kiosks and vendors.

Table 4-11: Price of 25-litre jerry can delivered tap water

Estate category	Name of Estate	Mean (Kshs)	Std. Deviation
High income	Millimani	11.25	3.536
Middle income	Migosi	6.90	3.013
Low Income	Arina	5.86	1.861
Unplanned settlement	Nyalenda	2.99	.431
	Mean	4.79	2.729

Table 4-11 shows that mean price of 25 litre jerry can of water in the study area is Kshs.4/79. The mean price is highest in Milimani estate where 25 litre delivered water goes at Kshs.11/25 and lowest in Nyalenda estate where the households purchase and deliver water to their houses at the cost of Kshs.2/99. Water price appears lowest in Nyalenda estate partly because they do not factor transport and other incidental costs and the secure the water direct from the kiosk operators. The introduction of middlemen (vendors) leads to high water prices. Unconnected households experience long collection time and the inconvenience of carrying water but still prefer the status quo to cut on cost of water.

Collignon and Vezina (2001) calculated the minimum gross profit margin of standpipe operators (kiosks) in Nairobi to be 80 per cent and the maximum to be 90 per cent. This suggests that much of the subsidy provided by the utility is not accruing to the poor for whom it is intended; rather these subsidies are negated by the high costs of installing and running kiosks, or they accrue to kiosk owners, those collecting illegal payments from them or both.

The study revealed that although the average unit costs borne by the low income and high income households are about the same, the costs borne by the low income households are more concentrated, around this average value than the costs borne by the high income. This is evident from the standard deviation in the unit costs of 25 litre jerry can that they bear (Table 4-11). We find statistical difference (s.d.) at 5 per

cent significance level, between high income Milimani households (s.d.=3.536) and low income households in Nyalenda estate (s.d.=0.431) as indicated in Table 4-11.

As high the value of standard deviation would suggest, we find a significant proportion of high income households in Milimani Estate falling in the two tails of the distribution. In other words, the high income households are more likely to bear the least as well as the highest unit cost of water. This is because high income households are likely to use both private piped connection (low unit price) and vendors and bottled water (highest unit price). Figure 4-9 shows the downward slope of water price by income category.

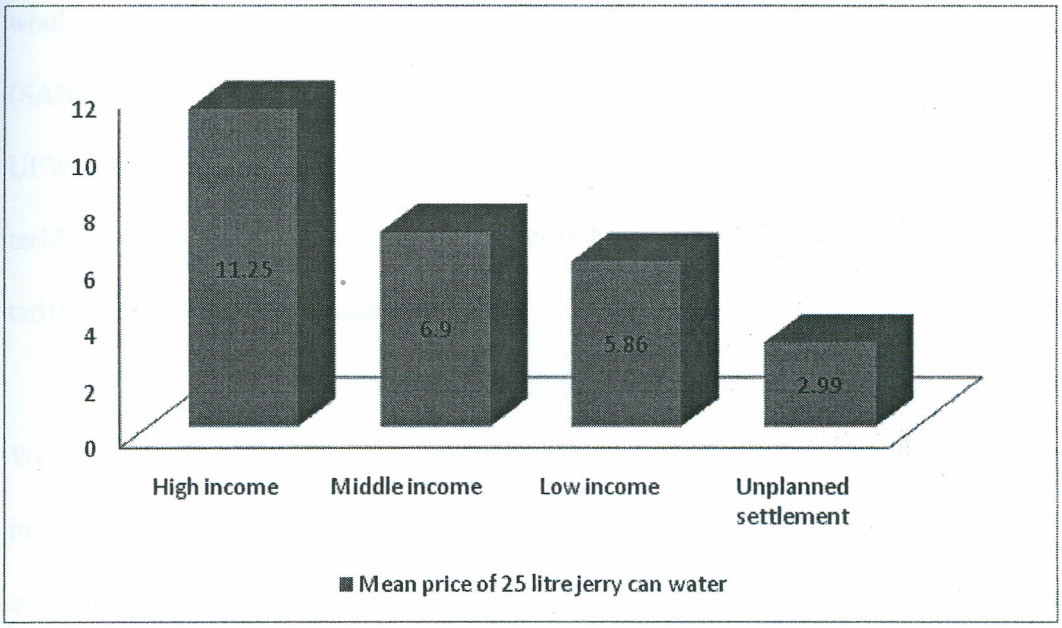

Figure 4-9: Price of 25 litre jerry can water

The mean price of 25 litre jerry can water in Kisumu is Kshs.6/75. Although KIWASCO employs uniform tariffs to all domestic consumers, the mean price

charged by water vendors is highest in high income Milimani Estate and lowest in the low income Nyalenda Estate. The water vendors charge higher rates in Milimani Estate where they believe the residents can afford. The price appears low in Nyalenda estate where water kiosks are quite many and they collect water themselves to save on the cost of transport.

The study observed that most poor consumers have to rely on water kiosks, in effect paying more than their wealthier neighbours with private connections. For instance, 50 jerry cans of water from a kiosk at Kshs. 2 each, would add up to Kshs. 100. The same consumption from a main connection, directly from a water service provider would cost Kshs. 17/-in Nairobi, Kshs. 25/- in Mombasa and Kshs. 47/- in Kisumu (SANA International, 2007). The higher water tariffs in MoK is attributed to high UFW leading to revenue loss by the KIWASCO. In spite of the unchanged water tariffs charged by the water company since its inception, the rate remains higher than tariff levels in other major cities in Kenya.

While estimates of social costs are important for public policy, we find that it is important at the household level to separate the monetary and non-monetary costs, especially in trying to understand household decision-making. Some households in the sample choose to trade-off time savings in exchange for low monetary costs.-contrary to expectations, rather than pay for the improvement in their water service. They reasoned that some of their houses are semi-permanent and the initial cost of installing water is beyond their reach.

The company charges an initial water deposit of Kshs.1800, new water connection charges ranging from Kshs.4000/- for Meter size of 12mm to Kshs.30000/- for Meter size of 100mm. Where murramed road surface is broken every 3 metres wide the company charges Ksh.10000/- and where tarmac road surface is broken every 3 metres wide the company charges Kshs.15000/-. These costs may be prohibitive to low income households thinking of installing water in the house. The company charges Ksh.5000 plus a charge equivalent to 24 months consumption as estimated by company for domestic customers as a penalty for illegal connection.

The study finds that tariffs are, in themselves, a limited and partial tool for influencing service delivery. This is a case where utilities charge cost recovery-level tariffs; but these have not automatically translated into financially solvent utilities that deliver a good service. And although utilities deliver water at a highly subsidized tariff to kiosks used by the poor, this has not translated into low purchase prices for the poor.

4.6 Willingness to Pay

This study has asked the respondents if they were willing to pay for the full cost of the service to enjoy private piped connection. The survey revealed that 42 per cent of the respondents were willing to meet the extra cost of private connection while 58 per cent said they wanted to continue with the status quo (Table 4-12). In unplanned Nyalenda Estate, for example, only 24.7 per cent of the respondents are willing to meet the cost of private piped connection while 75.5 per cent said they preferred to use water kiosks and vending services if the cost of private connection were to be met by them.

In Migosi Estate where 85.7 per cent of the households rely on the water vending systems, 68.6 per cent said they are willing to meet the full cost of private piped connection. The mean price of 25 litre jerry can water delivered by vendors to the houses Migosi is kshs.6.90. This is relatively high compared to Nyalenda where the mean price of 25 litre jerry can is shs.2.99 (Table 4-11). It should be noted that the cost appears to be relatively cheaper in the unplanned Nyalenda because they transport the water themselves and do not factor the transport cost in arriving at the cost of water.

Table4-12: Willingness to pay to get water

Estate Category	Name of Estate	Willing to pay to get water	
		yes	no
High income	Millimani	42.9%	57.1%
Middle income	Migosi	68.6%	31.4%
Low income	Arina	52.1%	47.9%
Unplanned settlement	Nyalenda	24.7%	75.3%
	Mean	42.0%	58.0%

Willingness to pay surveys conducted in recent years have shown that most consumers (especially the unconnected consumers) are willing to pay substantial amounts for better water service, in many cases more than generally accepted notions of what they should have to pay (Beck, 2007). For example in a survey of five small Moroccan cities, respondents were prepared to spend 7-10 per of total household expenditure for

an individual water connection, despite already receiving free and reliable standpipe device.

4.7 Collection Time

The study investigated the time spent per day in collecting water. This was categorized as follows, less than 30 minutes, 30minutes-1 hour and more than 2 hours (Table 4-13)

Table 4-13: Time taken per day to fetch water

Name of Estate	Time taken per day to fetch water			
	Less than 30min	30min _ 1 hr	1hr_2hrs	more than 2 hrs
High income	97.6%	2.4%	.0%	.0%
Middle income	35.7%	52.9%	11.4%	.0%
Low income	40.8%	33.8%	19.7%	5.6%
Unplanned settlement	50.7%	24.7%	22.0%	2.7%
Mean	51.4%	29.7%	16.5%	2.4%

The results show that 51.4 per cent of the households surveyed spend less than 30 minutes per day to fetch water. 29.7 per cent of the households spend 30 minutes to 1 hour per day fetching water and only 16.5 and 2.4 per cent spend 1–2 hours and more than 2 hours respectively per day to fetch water. The time spent again varies by estates, with 97.6 per cent of Milimani households spending less than 30 minutes per day to fetch water. This is because 92.5 per cent of the respondents reported that they have private in-house water connection.

On the whole, 81.1 per cent of the households spend an average of 1 hour or less per day in collecting water. The low income residents of Nyalenda Estate spend more time per day to fetch water than the high income Milimani households. 97.6% of the respondents in the high income Milimani Estate said they spend less than 30 minutes per day to fetch water, in contrast to the unplanned Nyalenda Estate where only 50.7% of the respondents said they spend less than 30 minutes per day to fetch water.

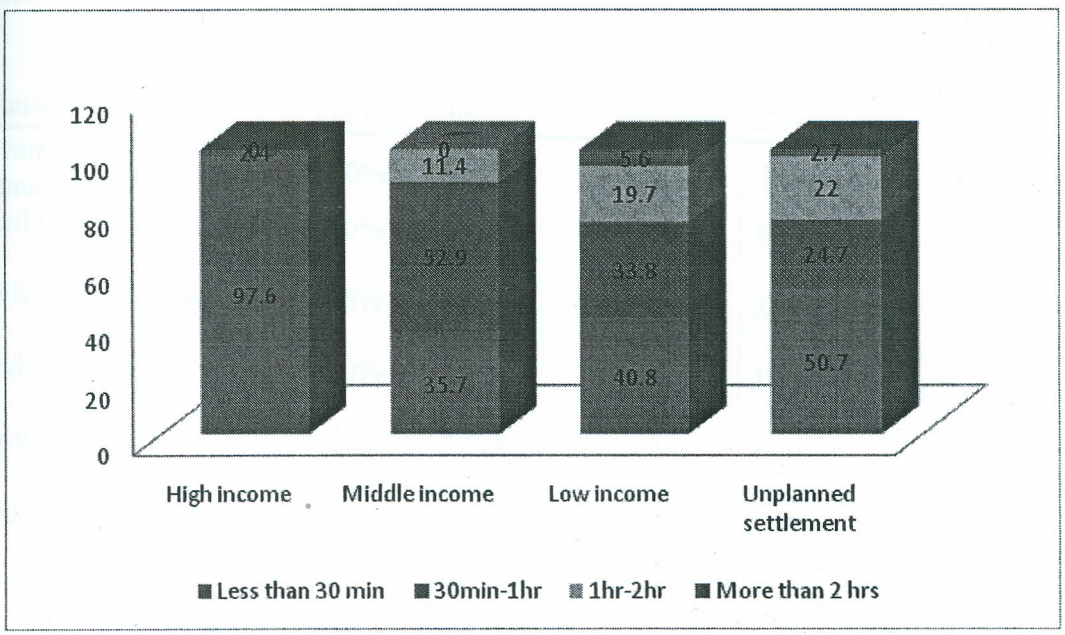

Figure 4-10: Time Taken to Collect Water

The situation is worse in middle income Migosi and low income Arina estates where only 35.7 per cent and 40.8 per cent respectively spend less than 30 minutes per day to fetch water (Figure 4-10).

As expected, collection time varies significantly by the primary source of water that households use. While those with private connections spend less than 30 minutes per day, those using kiosks spend about 1 hour per day in this task (Table 4-13). Households with private in-house connections spend the least time compared to those who depend on kiosks (Figure 4-10).

Table 4-14: Primary source of water and Time taken per day to fetch water

Primary source of water	Time taken per day to fetch water			
	Less than 30min	30min _ 1 hr	1hr_2hrs	more than 2 hrs
Private Piped Connection	97.0%	3.0%	.0%	.0%
Yard taps	79.0%	14.5%	4.8%	1.6%
Wells and boreholes	93.8%	.0%	6.3%	.0%
Vendors	21.0%	51.3%	24.4%	3.4%
Kiosks	25.7%	38.6%	31.4%	4.3%
Mean	51.4%	29.7%	16.5%	2.4%

Table 4-14 shows that 97 per cent of the households with private piped connections spend less than 30 minutes per day to fetch water. The households are mostly from the high income Milimani estate. Only 21 per cent of the households who rely on vendors and 25.7 per of those who rely on kiosks spend less than 30 minute per day to fetch water. They spend more time queuing for water. Long queues were observed in areas where the primary source of water is the kiosk. More time is also spent on fetching

water where the households have to travel over long distances to reach the primary source of water.

Figure 4-11 indicates that households who use private piped connections, wells and boreholes spend least time fetching water compared to those who rely on vendors and kiosks. They travel over relatively longer distance to water kiosks or the vendors spend longer time to reach the individual households.

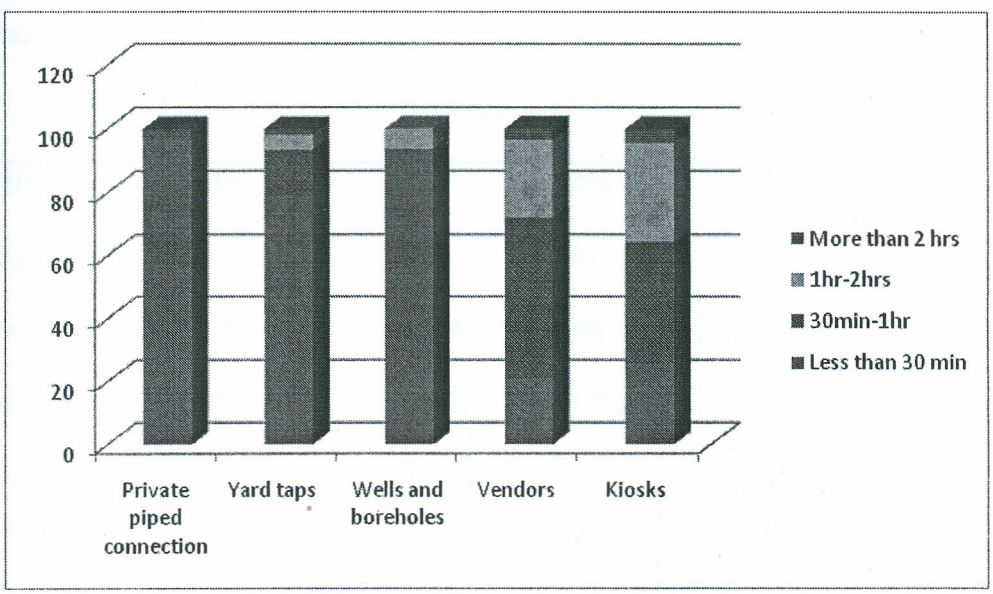

Figure 4-11: Water collection time by primary source

4.8 Duration of Water Service

The study asked whether water is available 24 hours a day, 7 days a week, or only at certain times. The study also collected data on guidelines followed by KIWASCO in meeting safe drinking water standards and quality customer service. In Kisumu City, water is only provided a few hours everyday or a few days a week. It is estimated that about half of the population in the city receives water on an intermittent basis. Table 4-14 shows the duration of water service to residents who receive KIWASCO water.

The study asked the residents of Kisumu what they feel about the hours of water service. KIWASCO supplies water to the residents at varying hours and pressure. Due to the small capacity of the treatment plant, the company is forced to ration the water supplied to the residents.

Table 4-15: Hours of water service

Name of Estate	Number of Hours of water service per day			
	Less than 6 hrs	6-12 hrs	12-18 hrs	18-24 hrs
Millimani	22.0%	.0%	2.4%	56.1%
Migosi	1.4%	.0%	.0%	.0%
Arina	15.7%	1.4%	10%	.0%
Nyalenda	8.0%	5.3%	20.7%	65.3%
Mean	11.8%	1.7%	8.4%	30.4%

Access to water has been reasonably good and considerably above the average in high income Milimani and unplanned Nyalenda estates. None of the estates receive 24 hour continuous supply. The average daily flow of water was 16 hours for high income Milimani estate. Contrary to the popular belief that water companies are reluctant to provide water in the informal settlement because the financial returns are negligible, unplanned Nyalenda estate is better served than Migosi and Arina estates.

KIWASCO rations water supplied to various consumers. Table 4-15shows that 11.8 per cent of the respondents receive water for less than 6 hours a day, 10.1 per cent receive water for 6-18 hours a day and only 30.4 per cent of the households receive water the whole day. The study found out that only 1.4 per cent of households in Migosi Estate that receive water, the supply is for less than 6 hours. The remaining 98.6 per cent of the households depend on water vendors for their domestic needs. The whole day service by the vendors shows the strong power of the private supply of water. It may therefore imply more reliable, round the clock supply by private market compared to semi-private water company.

The unplanned Nyalenda Estate appears to have the longest hours of water service, with 65.3 per cent of the households receiving water for 18-24 hours. It should be noted that most of these households rely on water kiosks (Table 4-14). The high income Milimani Estate even though it has nearly 100 per cent private piped water connection, only 56.1 per cent of the households receive water throughout the day and 22 per cent of the households receive water for less than 6 hours a day.

With regard to hours of service, 40 per cent of the connections have 24 hour supply while the rest get water through rationing. The average number of hours they get water is 6 hours. The Unaccounted for Water (UFW) is the biggest challenge the company is facing. KIWASCO believes that the rehabilitation project will mitigate this. The company looses about 66 per cent of what is produced. This is down from the 78 per cent it inherited from the municipal council. The company has set a target of 2 per cent per month reduction in UFW.

The high UFW implies that the water company earns revenues for less than 40 per cent of their production on average; since more than half of the water they produce is not billed and the amount billed is not fully collected. The small size of the system and the ageing infrastructure in Kisumu Municipality, have inflated the unit costs of accounted for water partly through high "unaccounted for water" rates over time.

The major causes of UFW include, leakages in the system due to lack of maintenance and dilapidated infrastructure, water theft through illegal connection, water wastage as result of unmeasured consumption coupled with fixed payment since 26 per of the connection are inactive (KIWASCO, 2007). There is also vandalism of the network.

The figure for unaccounted for water (UFW) is the difference between the quantity of water supplied to a city's network and the metered quantity of water used and paid for by customers. UFW in a well run utility tends to fall between 15 - 20% (World Bank, 2005). Compared to Mombasa and Nairobi, Kisumu suffers the highest rate with a UFW of 66%. In other words, well over half of the water treated and distributed by KIWASCO does not reach consumers or does not result into revenues for the company.

4.9 Water Quality

The researcher used data kept by KIWASCO lab to assess water quality supplied by the company. At the treatment plant, physical, chemical and biological tests are carried out by KIWASCO staff. Physical tests are done at one hour interval, during day and night. Chemical and biological tests are carried out once a day. The researcher

used the tests results to compute the means of the parameters for analysis. These were further used to compute the monthly means and generalizations were drawn therefrom.

The study has assessed the level of compliance by KIWASCO to the WHO's Guidelines for Drinking-water Quality set up in Geneva, 1993. Chemical, physical and biological parameters have been used for the assessment. WHO, 1993 observes that in public supplies of drinking water, absence of turbidity, colour and any other disagreeable taste or smell are of utmost importance. At KIWASCO's treatment plant chemical treatment of water is performed in order to;

- Remove colloidal and suspended particles (coagulation) done using alum;
- Kill pathogenic micro-organisms (conditioning) using soda ash;
- Adjust pH to desired value (disinfection) using mainly chlorine. Disinfection helps in the killing of the pathogens, removal of colour and taste causing organic substances and stabilization of active inorganic substances

To assess if there is any difference in the quality of water supplied by KIWASCO and the former water department in the Municipal Council of Kisumu, test results for the year 2007 and 2002, were compared when the water service was under the two respective regimes (Tables 4-15 and 4-16) The study has also used the results of raw water analysis for the year 2007. The raw water analysis shows the level of contamination before treatment.

4.9.1 Physical Analysis

The study used the daily data that were kept by KIWASCO lab to assess the physical characteristics of the water. Data on turbidity, acidity, alkalinity and colour were used to assess the suitability of the water supplied by the water company. The mean results of the physical parameters were compared with the Drinking Water Quality Standards provided by WHO. Table 4-16 shows the test results at the treatment plant for the year 2007

Table 4-16: Analysis Results for Raw Water in 2007

Month	Turbidity (NTU)	colour (tcu)	pH	alkalinity (ppm)
Jan	79.3	839	7.35	152
Feb.	121.1	1130	7.07	77
March	88.4	948	7.23	88
April	55.6	831	7.43	91
May	57.9	674	7.26	85
June	45.4	507	7.48	84
July	50.7	511	7.33	87
Aug	68.6	495	7.22	66
Sep	73.0	619	7.45	105
Oct	51.8	432	7.68	79
Nov	44.7	539	7.50	97
Dec	56.5	496	7.19	82
Mean	66.1	668	7.35	91

Source: KIWASCO (2007) Lab Records

Table 4-16 above shows the test results from Dunga Treatment Plant. The raw water is subjected to various treatments to make it safe for drinking. It was reported that the presence of water hyacinth has greatly helped to lower the turbidity of the raw water. The low turbidity at the water intake point therefore reduces the cost of treatment at the treatment plant. The pH value of the raw water is also within the accepted range

for safe drinking water but the colour has been affected by the presence of both organic and inorganic substances.

The study considers water quality as a measure of suitability of water for household uses such as drinking, washing, cooking e.t.c. Water supplied to public needs to be maintained at constant and desirable quality levels. The requirement is met by treating raw water and testing it to ensure that it conforms to set standards. The analysis is done both at the treatment plant as well as the end-point.

Table 4-17: Analysis Results for Treated Water in 2002

Month	Turbidity (NTU)	colour (tcu)	Suspended solids (ppm)	pH	alkalinity (ppm)	Residual chlorine Rcl_2 (ppm)
Jan	6.13	12	.00	7.25	70	0.55
Feb	7.39	3	.00	7.19	63	0.94
March	9.12	20	.00	7.05	21	0.72
April	12.1	25	.00	7.19	39	0.88
May	15.0	15	.00	7.22	44	1.03
June	9.22	12	.00	7.05	55	1.22
July	8.03	10	.00	7.25	59	0.43
Aug	6.39	4	.00	7.19	62	0.39
Sep	10.4	20	.00	7.13	78	0.12
Oct	8.39	25	.00	7.09	94	2.03
Nov	6.12	10	.00	7.15	82	1.00
Dec	7.49	15	.00	7.20	66	0.73
Mean	8.82	14	.00	7.16	61	0.84
Accepted Range	0-5	0-15	0	6.5-8.5	35+	0.72-1.5

Source: KIWASCO (2004) Lab Records

The results of the analysis for the treated water were compared with the 2007 results (Table 4-18). The study found out that there is a very big variation in the water quality between 2002 and 2007. This was due to the fact that, in 2002, the turbidity of the water from the intake (raw water) was too high throughout the year compared to 2007, which had good results. The presence of hyacinth lowers the turbidity of the raw water at the intake point. It was reported that in 2002, the coagulant which was in use had a low range of pH, compared to the alumunium sulphate which was in use in 2007.

Table 4-18: Analysis Results for Treated Water in 2007

Month	Turbidity (NTU)	colour (tcu)	Suspended solids (ppm)	pH	alkalinity (ppm)	Residual chlorine Rcl_2 (ppm)
Jan	5.09	0	.00	7.33	50	1.05
Feb	5.82	0	.00	7.13	84	1.25
march	4.03	0	.00	7.31	79	1.09
april	4.66	0	.00	7.56	66	0.75
may	5.84	0	.00	7.60	62	0.99
june	6.39	2	.00	7.35	51	1.10
july	4.85	0	.00	7.22	56	1.20
aug	5.00	1	.00	7.39	72	1.23
sep	4.72	1	.00	7.52	81	1.14
oct	4.97	2	.00	7.00	58	0.95
nov	7.82	0	.00	7.08	71	1.16
dec	4.70	1	.00	7.44	67	1.37
Mean	5.32	1	.00	7.33	64	1.11
Accepted Range	0-5	0-15	0	6.5-8.5	35+	0.72-1.5

Source: KIWASCO (2008) Lab Records

4.9.1.1 Turbidity

Turbidity is measured in NTU. The mean turbidity for the year 2002 and 2007 was on average 8.82ntu and 5.32ntu respectively (Table 4-16 and 4-17). The mean turbidity for the two years is slightly above the accepted range. In 2002 the highest turbidity, 15ntu, was recorded in the month of May, while the lowest turbidity, 6.12ntu, was recorded in the month of November. This means that throughout the year 2002, KIWASCO water failed the turbidity test (Figure 4-12)

During the year 2007 the turbidity of the water was generally low as shown in Table 4-17. Though the mean turbidity for the year was 5.32ntu, which is slightly above the accepted range of 0-5ntu, 58.3 percent of the cases registered the accepted turbidity.

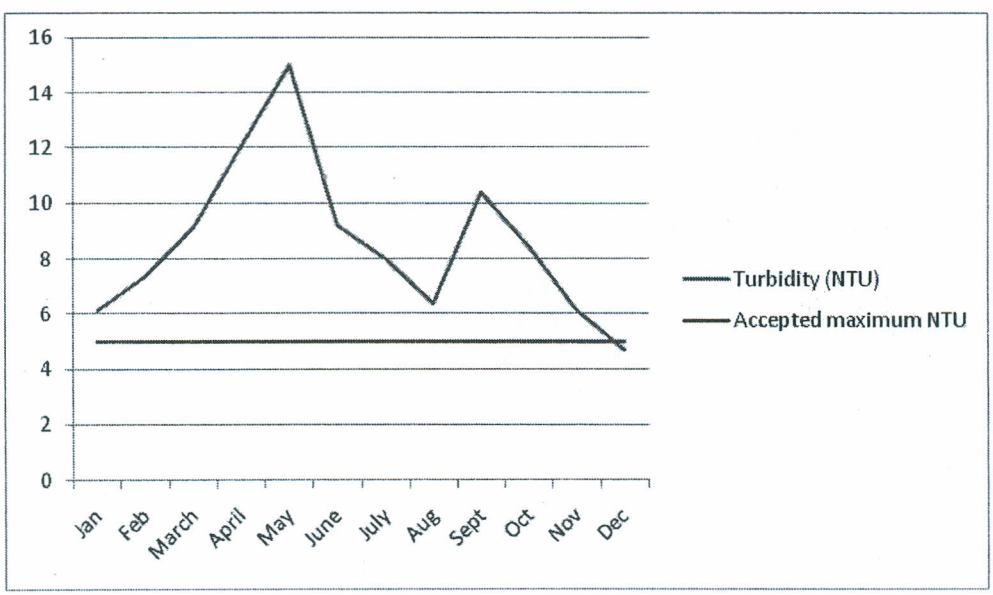

Figure 4-12: Mean Monthly Turbidity, 2002

The remaining 41.7 percent of the cases of above accepted turbidity range is not as high as the 2002 levels. The study found out that although turbidity of the treated water has improved since the water company took over, it has not stabilized and only 58.8 percent success rate has been recorded. Figure 4-13 shows that high turbidity is recorded in three seasons in the year, January-February; May-June and in November. The area above 5ntu mark indicates test failure.

Clarity of water is important in producing products destined for human consumption and in many manufacturing operations. Turbidity in water is caused by suspended and colloidal matter such as clay, silt, finely divided organic and inorganic matter and planktons. Turbidity is an expression of the optical property that causes light to be scattered and absorbed rather than transmitted with no change in direction or flux level through the sample (APHA, 1995).

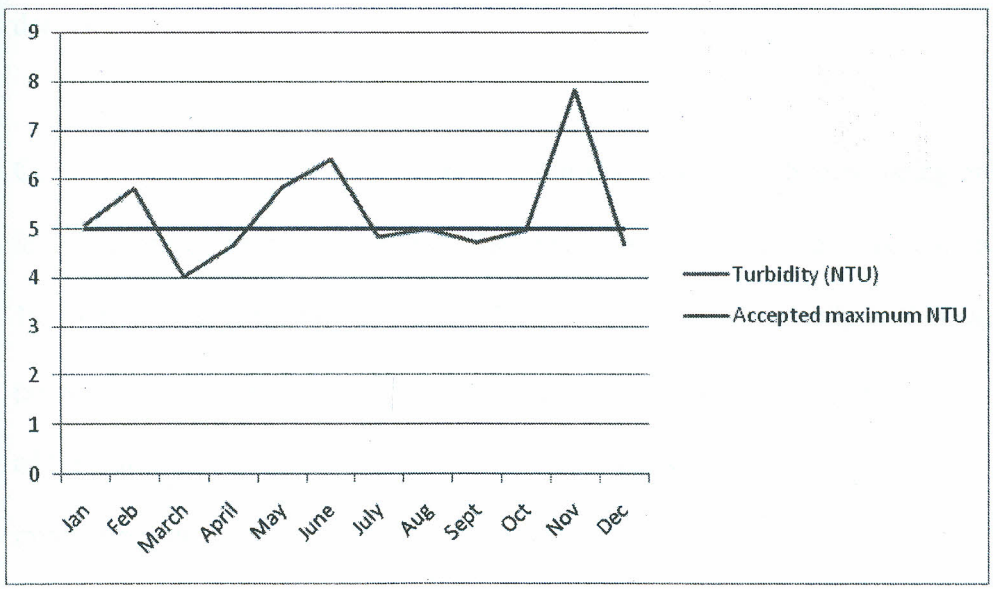

Figure 4-13: Mean monthly turbidity, 2007

4.9.1.2 Colour

Colour in water may result from the presence of natural metallic ions (irons and manganese), humus and peat materials, planktons, weeds and industrial waste. Colour is removed to make water more suitable for general and industrial applications. Coloured industrial wastewaters may require colour removal before discharge into water course. For the purpose of the study, the term colour is used to mean colour of water from which turbidity has been removed.

The results revealed that during the year 2007 the mean colour was 1tcu compared with the 2002 results which had a mean colour of 14tcu. Low tcu indicates better colour state, therefore, the mean of 1tcu for 2007 is better than the 2002 mean results of 14tcu which are marginal. The worst colours were experienced in April, September and October, 2002 which were 25tcu, 20tcu and 25tcu respectively. These are months when maximum monthly rainfalls are experienced in the region and upstream erosion deposited into the lake.

Conversely, the year 2007 had the best colour results with the highest being only 2tcu in the month of June and October. The mean colour for the year was maintained at 1tcu while several months had 0tcu (Table 4-18). This is perfectly within the range provided by KEBS (1996). The achievement of the accepted colour range creates additional aesthetic value for water. The test results show that KIWASCO is meeting minimum water colour standard.

4.9.1.3 pH Value

Water samples to test pH level of treated water were drawn every one hour everyday. The study used the average results for each month of the years 2002 and 2007 for the analysis for the treatment plant as well as the end point (Table 4-18). The results indicate that at the treatment plant, during the year 2002 and 2007, the mean pH 7.17 and 7.33 respectively. The pH analyses meet the accepted range acidity levels of 6.5-8.5 as provided by KEBS, 1996. The pHs for both years show good results partly good because the pH for the raw water is within the same range.

At the treatment plant sodium hydroxide is added to increase the pH level of water to the required standard since aluminium sulphate makes it hard. It is not automated and therefore the amount is monitored manually to be maintained at 1-2 inches. If it were automated, it should relate with the amount of water intake. The pumping capacity is approximately $350m^3$ per hour, which is monitored hourly.

Acidity of water was also analyzed to test its quantitative capacity to react with a strong base to a designated pH. The pH value of water shows whether water sample has acid or alkaline reaction. At a pH 7 the water is considered to be neutral.

At the treatment plant the pH is kept at the correct level (7.2-7.6) for coagulation process to be effective. The process is aimed at removing most of the suspended particles and colloids, which may not be able to settle freely. Coagulation, for the purpose of study, is the process of forming small solid particles in water through a chemical reaction between the water and metal salt called a coagulant. A coagulant

when added at the right pH forms flocs which bind the suspended particles and therefore settle down. The particles have power to attract other unsettled particles thus forming larger particles called flocs. Flocs are heavy enough to settle under gravity. Iron and aluminium salts are the most common coagulants used by KIWASCO.

Once the flocs have been formed, they are made to unite with each other by slow uniform agitation of the water. This is achieved in water works coagulation tanks. In water treatment, the ultimate goal is to minimize the levels of turbidity, colour and pathogens so as to render the water aesthetically and hygienically potable or acceptable. Coagulation is the cornerstone treatment process in accomplishing the acceptable levels of the three parameters above

The measured value may vary significantly with the end-point pH used in the determination. Acidity is a measure of an aggregate property of water and can be interpreted in terms of specific substances only when the chemical composition of the sample is known. Strong mineral acids, weak acids such as carbonic and acetic and hydrolyzing salts such as iron and aluminium sulphates may contribute to the measured acidity according to the method of determination.

Acids contribute to the corrosiveness and influence chemical reaction rates and biological processes. The measurement also reflects a change in the quality of the source of water.

Table 4-19: Water Analysis Results at End Point for 2007

Name of estate	Residual Chlorine	pH	turbidity	Suspended solids	colour
Milimani	.6855	7.0736	4.6621	.0000	.0000
Migosi	.8980	7.1200	3.2920	2.0000	.0000
Arina	.6150	6.6286	3.6438	4.5000	.0000
Nyalenda	2.7181	6.7112	4.8042	.3333	2.0000
Mean	1.4449	6.8475	4.3538	1.2143	0.5000

Source: KIWASCO (2008) Lab Records

The results of the treatment plant were compared with the end point analysis. It is evident from Table 4-18 that the results of treatment plant are relatively higher than the end point analysis, depending on the length of the reticulation. By the time the water gets to the end points at the furthest points the levels are as shown in Table 4-19. KIWASCO is currently guided by Kenya Bureau of Standards Specification for Drinking Water (1996) and WHO standards which provides for the following limits.

Table 4-20: Water Quality Operating Standards

Substance or characteristics	Maximum Levels
Turbidity (NTU)	5
Colour (TCU)	15
pH	6.5-8.5
Suspended Solids (ppm)	0 (nil)
Alkalinity	35-350
Residual Chlorine (mg/l)	0.72-1.5
Nitrates	10
Manganese mg/l	0.5
Flouride mg/l	1.5
Iron mg/l	0.3
Copper	2
Chromium	0.05
Sulphate	70

Source: KEBS, 1996

4.9.1.4 Residual Chlorine

The mean residual chlorine (RCl_2) level for the end points in the the study area is 1.4 ppm (Table 4-19). This level is within the limit provided for the drinking water. The residual chlorine level is relatively high in Nyalenda estate (2.7ppm) partly because water is pumped direct from the treatment plant to the end users while in other estates

the water is first pumped to the reservoir tank in Tom Mboya Estate then finally to the consumers. There is a fairly big variation between RCl_2 at the treatment plant and the end point. This is due to evaporation of RCl_2 that occurs along the network during the distribution. Chlorine assists in the disinfection of the water. When there is a burst or seepage a long the line chlorine consumption goes higher and the residual chlorine level goes down. . Chlorine is added to disinfect and remove the odour. Chlorine is also used for decolouring the water.

The mean pH level for the end points in the study area is on average 6.8. KIWASCO is expected to operate within the range of 6.5-8.5. The mean pH is therefore within the acceptable range. The mean pH level is highest in Migosi estate- 7.1 and lowest in Arina- 6.6, all these are within the acceptable range.

The mean turbidity is 4.3 NTU at the end points. The turbidity also varies from one end point to another. The highest mean was noted in Nyalenda Estate- (4.8 NTU) and the lowest in Migosi Estate (3.2 NTU). These levels are also below 5NTU which is the maximum recommended.

The suspended solids at the end points vary. The mean suspended solids level is 1ppm. This is a concern since the level is supposed to be 0ppm. It is only in Milimani where suspended solids requirement of 0ppm is met. In Arina estate the level goes as high as 4.5ppm while in Migosi and Nyalenda estate it is 2ppm and .8ppm respectively. The high amount of suspended solids could be attributed to dilapidated

networks in those areas. Cases of pipe bursts or aging pipes were reported in those areas.

The mean colour of water at the end points is 1tcu. The highest was reported in Nyalenda-2tcu while the lowest were reported in Migosi and Arina both 0tcu. The mean colour of water distributed is acceptable since the maximum accepted is 15 tcu. The colour of water also influences the use the water is put to.

Based on the above characteristics KIWASCO water is generally safe for drinking, save for a few isolated cases. But the survey revealed that even though KIWASCO water is safe for drinking, many households still carry out post-treatments. They either boil the water or apply water guard to satisfy their conscience.

Water quality problems have intensified through the ages in response to the increased growth and concentration of populations in urban centres. Often the problems have been viewed as inevitable consequences of community development, and sometimes even have been accepted as evidence of affluence and progress. For many years, a prime motivation in controlling stream pollution was to protect the public from water borne diseases. Although health is still an important consideration today, views of water pollution have broadened to recognize that its impacts on human are more complex than health alone.

4.9.2 Bacteriological Analysis

The data for biological water analysis were scanty. It was reported that the biological analyses are done twice a week. The samples are drawn from only three points within the supply area, namely, Kisat, Kisumu Polytechnic and Kajulu. Biological analyses are conducted on the water to determine the presence of E-coli or corliforms which are disease causing bacteria. The presence of *Escherichia coli(* E-coli) in water leads to the outbreak of cholera and typhoid. It involved the analysis of faecal indicator microorganisms as an indicator of faecal pollution. The verification included testing of source water, water immediately after treatment, water in distribution systems or stored household water.

The bacteriological analysis is done using 5-tubes method to detect growth. This is done in two phases, phase 1- presumptive test and phases 2 confirmative tests. If the water turns cloudy after applying the reagent, then there is bacteria growth. This is called presumptive tests. If there is presence of bacteria growth, then confirmative test is done to confirm if there is truly growth. This is done by culturing five different tubes and keeping the samples in the incubator for 24 hours. The samples are incubated at 37.0+/-0.2°C. The presumptive tests are the first biological tests done to determine the presence of any bacteria in the water. If the results are negative, then confirmatory tests are then conducted.

During the year 2007, the bacteriological analysis gave negative results. The water was therefore good for human consumption. The RCl_2 level in the water also confirms that the water was free from cholera causing bacteria. Safe drinking water must be

among the highest priorities for every government. Today contaminated water kills more people than cancer, war or accidents. (Third World Academy of Sciences, 2007). It is important that the water which human beings take be free of disease-causing germs and toxic chemicals that pose a threat to public health.

Most, but not all of these people, live in low and middle income countries, and those at the greatest risk are children and the elderly. Millions more people worldwide suffer from other water related diseases, such as bilharzia, cholera, elephantiasis and hookworm. Improvement in water supply and sanitation tend to lead to improvements in people's health and the quality of their lives. In Johannesburg, privatization has triggered several outbreaks of cholera. Not long after Suez took over Johannesburg's water supply in 2001, a cholera outbreak sickened thousands of poor families who had resorted to drinking from polluted streams (Asigo, 2005).

4.9.3 Chemical Analysis

Analysis of presence of chemical substances is done twice a week at KIWASCO lab (Plate 4-2). The study used data for treatment plant and compared with the end point results and the recommended levels by WHO. Table 4-9 shows the chemical analysis from the end point samples.

The results of the chemical tests were used to compute the mean levels of each of the chemical substances in the treated water. The mean values were compared with the maximum accepted levels to assess the level of compliance to safe drinking water. The study found out that the chemical tests results comply with the WHO drinking water standards.

Table 4-21: Results of End Point Chemical Analyses of Water

Sampling Station	Iron	Copper	Chromium	Sulphate	Phosphorous	Iodine	Bromine	Manganese	Nitrate
Milimani	0.04	0.01	0.02	20	0.08	0.86	0.10	0.6	0.1
Migosi	0.01	0.03	0.01	23	0.85	0.52	0.18	0.0	0.0
Arina	0.03	0.01	0.01	58	0.63	0.19	0.35	0.4	0.0
Nyalenda	0.03	0.01	0.02	82	0.71	0.31	0.67	0.4	0.0
Mean	0.03	0.02	0.02	46	0.57	0.47	0.33	0.4	0.0
Treat. plant	0.08	0.10	0.03	56	0.46	0.96	0.16	0.9	2.6

Source :KIWASCO(2008) Lab Records

The mean values of all the chemical substances are within the maximum range provided for drinking water. The geological formation of the area could have contributed to the favourable level of the chemical substances. Excess of substances like fluoride may lead to teeth colouring.

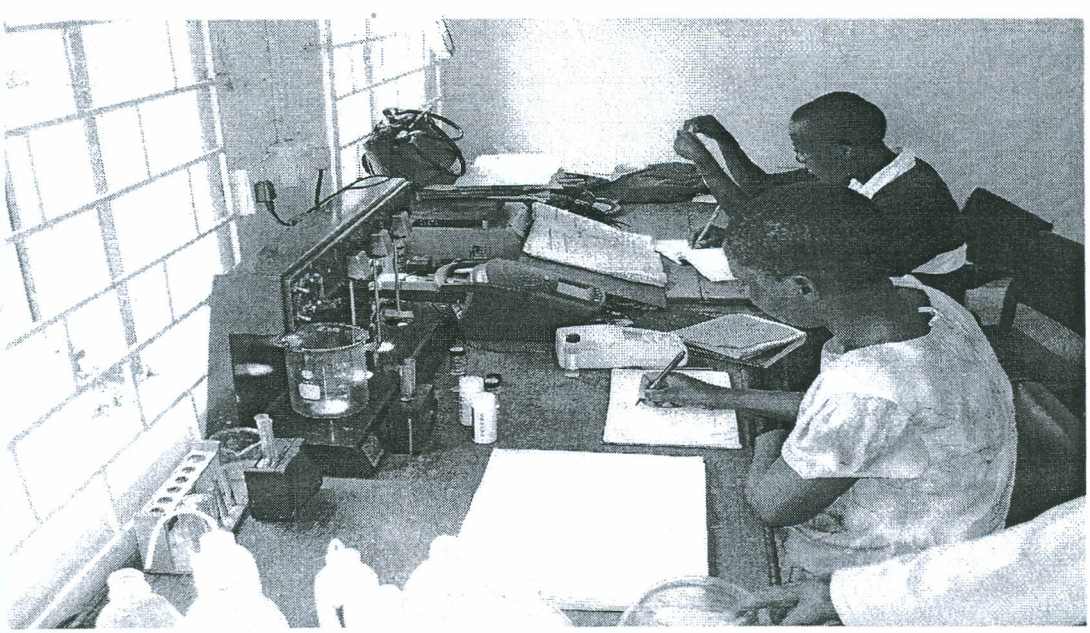

Plate 4-3: Chemists at work at the KIWASCO Water Treatment Lab

Most organic and some inorganic chemicals contribute taste or odour. These chemicals may originate from municipal and industrial waste discharges, from natural sources such as decomposition of vegetable matter, or from associated microbial activity and from disinfectants or their products (APHA, 1995)

In its purest state water is both odourless and tasteless, however, as organic and inorganic substances dissolve in water it begins to take characteristic taste and sometimes odour. Odour and taste are caused by the interactions of substances like soil particles, decaying vegetation, various inorganic salts, organic compounds and gases.

Odour like taste depends on contact of a stimulating substance with the appropriate human receptor cell. The stimuli are chemical in nature. Water is a neutral medium, always present on or at the receptors that perceive sensory response. In its pure form, water can not produce odour or taste sensations. Man and other animals can avoid many potentially toxic foods and waters because of adverse sensory response. These senses often provide the first warning of potential hazards in the environment. Ordour is recognized as a quality factor affecting acceptability of drinking water (and foods prepared with it) tainting of fish and other aquatic organisms, and aesthetics of recreational waters.

4.10 Water Storage facilities

The residents reported that due to unreliability of water services, they have to keep water storage facilities. Since the poor can not afford storage tanks, to supplement supply, they at best opt for protected sources such as rain water and covered well, and at worst, unprotected sources including rivers, streams and dugout wells, hence exposing them to waterborne diseases.

All the surveyed consumers said they had to invest in storage tanks, to respond to the water fluctuation and rationing by KIWASCO. The storage tanks are of varying mean capacities, with the highest reported in Milimani estate and the lowest in Nyalenda where the households large use jerry cans for storing water (Figure)

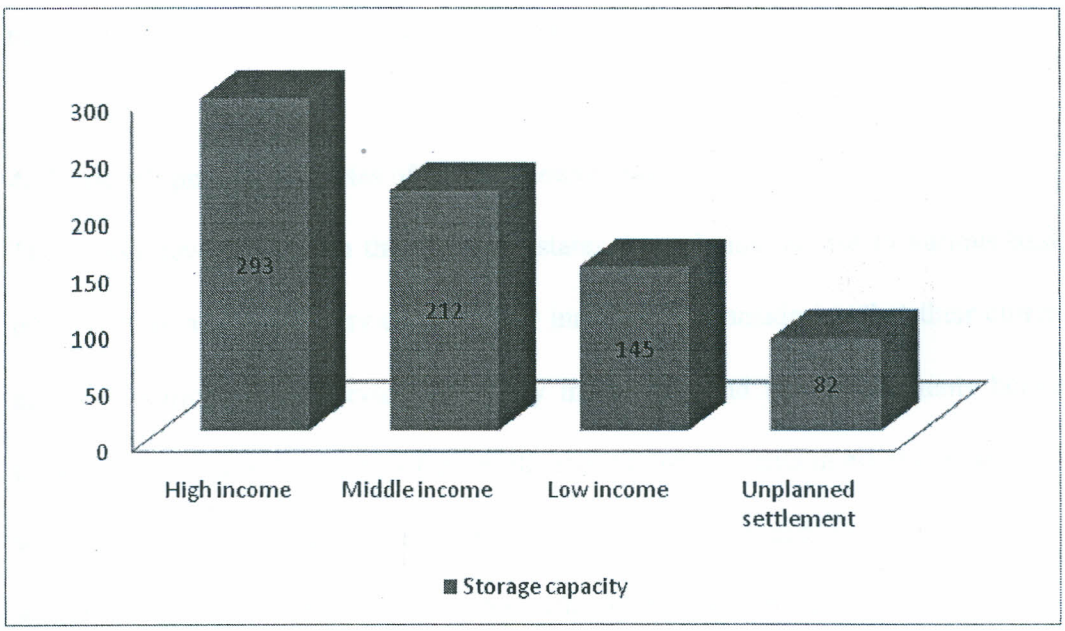

Figure 4-14: Mean Storage Capacity (Litres)

The mean capacity of the storage facilities is 149.8 litres. The mean capacity of the storage facilities is almost equivalent to mean the daily water use 149.5 litres (Table 4-1). This implies that the water storage facility has a capacity to provide only a day's water demand. Extended water supply disruption is therefore likely to impact negatively on the residents. The mean capacity of the storage tank also shows that the households' decisions are guided by their daily water use.

Even though Milimani estate has the highest direct water connection (92.9 per cent) it has the highest mean water storage capacity (293.93 litres) compared to Nyalenda Estate with only 8 per cent households with direct water connection and reported an average water storage capacity of 82.07 litres. It is evident that the higher the income category of the estate, the bigger the water storage capacity. This is because the cost of the storage tank can be prohibitive to the poor households.

4.11 Development Priorities of Urban Households

The survey revealed that in the sampled estates, households' access to various basic infrastructure and social services is highly inadequate. Considering that their current access to various basic services is highly inadequate and the governments budget constraints are unlikely to allow for simultaneous improvements in all, the households were asked what their development priorities are (that is, towards which services they would like to see resources directed). Specifically, the households were asked to rank nine services, in order of priority.

Looking at Table 4-22 the residents rank water number 1 priority in guiding their decision on the choice of residence. 37.5 per cent rank water first. The priorities vary according to neighbourhoods. In Milimani Estate, the top priority is security, with 33.3 per cent of the households prioritizing it first.

Table 4-22: Needs priority ranking by residents

Name of Estate	Priority No.1for residence (%)								
	Availability of water	Electricity	sewerage services	roads	schools	rent level	security	distance from place of work	others
Milimani	23.8	26.2	4.8	.0	.0	4.8	33.3	.0	7.1
Migosi	51.4	15.7	17.1	2.9	.0	1.4	7.1	1.4	2.9
Arina	47.9	5.6	5.6	1.4	.0	4.2	28.2	2.8	4.2
Nyalend	30.0	1.3	24.7	6.0	2.0	10.7	6.0	2.0	17.3
Total	37.5	8.4	16.5	3.6	.9	6.6	14.4	1.8	10.2

Residents of Migosi Estate predominantly feel water should be their top priority even though they do not enjoy house connections. Location of a school in a neighbourhood plays the least influence in determining the choice of residence. Less than 1 per cent of the respondents ranked it number 1 priority. This therefore underscores how basic water is to human life.

The results indicate that development of a water supply system is by far the top priority for the households in the sample as a whole. This finding holds even when the data are disaggregated by income category (that is, both the low income and the high income rate water supply as their top development priority). Electricity and sanitation or sewerage system appear to be the next two.

CHAPTER FIVE

5. SUMMARY, CONCLUSIONS AND RECOMMENDATIONS

This study set out to assess the impact of water privatization on the delivery of safe drinking water to the urban populace. The study was guided by the belief that privatization creates efficiency and effectiveness in the delivery of services. The following therefore is a summary of the main findings.

5.1 Summary

Accessibility could best be determined by a combination of the following parameters, distance to the nearest primary water source, per capita water use and connectivity to yard tap or private house connection. When different parameters are used to assess the proportion of the households that have accessibility to water services, different figures result. If a distance criterion is used the accessibility is 77.1 per cent and if the recommended basic water requirement criterion is applied then the level of accessibility to water in MoK is 25 per cent while the private piped connection shows 43 per cent level of accessibility. Distance parameter is the most generous measure of accessibility while the recommended basic water requirement is the most conservative measure of accessibility. Based on the three parameters, only 48.4 per cent of the households have access to safe drinking water. This proportion is much lower than the national average of 68 per cent in urban areas.

Using the recommended basic water requirement of 50 l/c/d only 65.6 per cent of the basic water requirements of the households of Kisumu City are met. The mean daily per capita water use is 32.92 litres, implying a shortfall of 17.08 litres. The low and middle income estates access less than 50 per cent of the recommended basic water requirement. The water use level is much lower than the national average of 45.2 l/c/d. The high income households in Milimani Estate use about 2.5 times more water than the poor households in Nyalenda Estate.

Private in-house piped connection is the most important, yet only 19.8 per cent of the sampled households use them as their primary source. 56.7 per cent of the households in the four estates surveyed depend on either vendors or kiosks as their primary source of water.

Expenditure on water constitutes a significant household budget, just like rent, fees and food. Expenditure on water varies according to income levels of the households, with high income households spending 4.1% and low income households spending 22.5% of their monthly income on water. The proportion of a household's income spent on water service and affordability are negatively correlated. The higher the monthly household income the lower the proportion spent on water. The higher the proportion of household income spent on water and sewerage charges, the less affordable they are. Households with monthly income of Kshs.5000/- and below spend 5.5 times more on water than those well to do households. The mean monthly expenditure on water is 8.51% of the household income. Based on 5 per cent benchmark ratio, the study revealed that 75.7 per cent of the households in Kisumu

find the cost of water unaffordable. Only 24.3 per cent of the households spend less than 5 per cent of their monthly income on water.

KIWASCO carries out tests on the physical, chemical and biological characteristics of water at the treatment plant as well as the end-point. The tests results are largely are within the acceptable ranges, though most of the figures are at the margin. The water company diligently carries out physical tests of water at the treatment plant and for the end points in all the supply zones. At the treatment plant the tests are done hourly and the results comply with the WHO standards for drinking water. The tests results under the former department of water in Municipal Council though are within the range, most of the figures are at the margin of the accepted range. The biological tests are done only twice a week. The samples are drawn from only three points within the supply area, namely, Kisat, Kisumu Polytechnic and Kajulu. The tests for the presence of microorganisms for the year 2007 were negative, implying that the water was safe for drinking. Analysis of presence of chemical substances was done twice a week at KIWASCO lab. The mean values of all the chemical substances are within the maximum range provided for drinking water.

Available information on Kenyan history of privatization is still scanty. Initially many felt that private operators under invest and undersupply suboptimal service quality. On the contrary, evidence from Kisumu shows that the regulated private company may not be providing first best service; they seem to be doing a much better job than the former water and sewerage department under Municipal Council.

5.2 Conclusions

The proportion of households with access to safe water in the study area is quite low, below even the national average and the residents have to contend with multiple sources meet the daily water demand. With this information on water use, the total water requirement of the households can be determined more accurately and the water company would have a better sense of how much water to produce. The level of accessibility to water reveals the proportion of people potentially exposed to water related diseases.

Access to safe water is a fundamental human right just like food, but it should be recognized that a right to water does not mean free water.

The benchmark ratio reveals the number of people in Kisumu Municipality who experience difficulties in meeting the cost of water. As water becomes more costly poor households would be forced to make trade-offs between water, food, education, medicine and health-care. This would have an impact on the quality of their life.

The whole day service by the vendors shows the strong power of the private supply of water. It may therefore imply more reliable, round the clock supply by private market compared to semi-private water company.

The estimates used in the study estimates are not precise. The mean urban incomes used in the study are based on reported incomes and expenditure. This may be considered a source of "estimation bias" leading to an over estimation of the

unaffordability of water services, since people tend to understate their income and exaggerate their expenditure. The results in Table 5-8 albeit may be imprecise, are revealing the number of people in Kisumu Municipality who experience difficulties in meeting the cost of water.

In fact, as water becomes more costly and less accessible, poor families would be forced to make trade-offs between water, food, education, medicine and health-care. This would have an impact on the quality of life and standard of living in Kisumu Municipality, especially the vulnerable groups.

Demand for water moves in opposite direction as its own price and in the same direction as household income. Therefore, increasing block tariff structure promotes equity as rich households who consume larger amounts, cross-subsidize the poor households. High income households use more water, therefore paying a higher average price for water as their use occurs in the higher priced blocks. In addition, the increasing block tariff is said to promote conservation and sustainable water use as it discourages wasteful usage which is beyond the basic requirement.

KIWASCO provides safe water to the residence of Kisumu Municipality. The quality of water is tested both at the treatment plant as well as the end-point to ensure compliance with safe water requirements. Despite the good impression of taste, smell and colour of water, majority of the households lack confidence in the quality of water and find it necessary to treat their water either by boiling or use of chemicals.

5.3 Recommendations

To expand access to safe water services there is need for upfront investment on rehabilitation and extension of existing water network in addition to upgrading of treatment plant, thus reducing the cost of maintenance and unaccounted for water and making better use of economies of scale.

Public investment in the water network could be the route to achieve reduction in unaccounted for water and hence increasing accessibility to safe water services. Cost recovery with poor infrastructure and small size of network seems a pipe dream. The water company should extend and expand well managed water kiosks.

The urban residents should adopt new water ethics to ensure sustainable delivery of safe and affordable drinking water for all. Unless people pay for a service, they tend to waste it.

The Government should aim to provide all households this basic water requirement for maintaining human survival and health. Basic human needs of water and sanitation should be enjoyed by all members of society regardless of financial circumstances.

The water company should extend and expand well managed water kiosks to the poor households. The water kiosks are within reach of network as the kiosks allow the households to buy in quantities they can pay and the kiosk operators ensure that the users pay for the water.

To breakout this low level equilibrium, government needs to adopt a 'demand driven approach' in which utilities can deliver services that people want and for which they are willing to pay. The utilities can and should charge full cost for water and use the revenues to improve service and expand coverage.

Surveillance tests by other bodies like NEMA, WSB and KEBS should be intensified through establishment of more test points and frequent regular tests both at the end points as well as treatment plant.

5.4 Suggestions for further research

There is need to carry out an objective estimate of basic water requirement by household activity such as drinking, personal hygiene, washing, cooking, and sanitation, among others, for urban population in Kenya and determine household and per capita water requirements that cuts across income classes.

Price sensitivity analysis for the low, middle and high income households to determine differential impact of water tariff adjustment and develop a demand function analysis for water services.

A study to carry out an investment analysis to determine benefits accrued from unit investment on water services.

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