UNESCO-IHE
INSTITUTE FOR WATER EDUCATION

Evaluation of the effects of water demand management on consumer behaviour in Zambia

Case study of the Lusaka peri urban areas.

Oswell Katooka

MSc Thesis MWI-2007-15
April 2007

UNESCO-IHE
Institute for Water Education

Evaluation of the effects of water demand management on consumer behaviour in Zambia

Case study of the peri urban areas in Lusaka

Master of Science Thesis
By
Oswell Katooka

Supervisors

Prof. Meine Pieter van Dijk (UNESCO-IHE)
Marco Schouten, MA (UNESCO-IHE)

Examining committee
Prof. Meine Pieter van Dijk (UNESCO-IHE)
Marco Schouten (UNESCO-IHE)
Jo Smet (IRC)

This research is done for the partial fulfilment of requirements for the Master of Science degree at the UNESCO-IHE Institute for Water Education, Delft, Netherlands

Delft

April 2007

The findings, interpretations and conclusions expressed in this study do neither necessarily reflect the views of the UNESCO-IHE Institute for Water Education, nor of the individual members of the MSc committee, nor of their respective employers.

Dedicated with love to my wife, Priscilla, my daughters Nyantika and Nyanke.
Thank you for being there for me

Abstract

The provision of adequate water supply to the fast growing urban population is increasingly becoming a problem for the Sub Saharan African. The problem is even more pronounced in the urban poor areas where the majority of the urban population who are considered poor and are in dire need of improved water services reside.

The fast growing population in the urban poor areas has put tremendous pressure on the city of Lusaka to either invest in additional water resources or expand the existing sources to meet the growing demand for water. The cost for developing new sources and extension of the existing facilities apart from being expensive, are also proving to be unsustainable in the long run. The LWSC has turned to water demand management as a preferred alternative to improving the poor service provision in the urban poor areas.

The main objective of the research was to assess how water demand management have affected water consumption and payment patterns of water consumers in the urban poor areas of Zambia. The survey was carried out in three peri urban areas of Lusaka.

The research first identified the water demand management measures that are practiced by the LWSC in the peri urban areas. This was followed by the assessment of the effect of the selected WDM measures on consumption and payment patterns of water consumers in the selected case study areas through structured interviews. The survey results showed that there is a high potential for WDM to be used as tools to influence water consumption and payment in the urban poor areas. The assessment also indicated that WDM measures differ in the way they influence water consumption and payment patterns of consumers.

From the survey, the most effective WDM measure for influencing consumption and the most effective measure for promoting better payment for the different water consumer types in the study areas was established. Metering was found to be the most effective WDM measure for controlling consumption, particularly for the communal standpipe users on the prepayment method and for the billed consumption consumers using house connections. Sensitisation (awareness) was also established to be the most effective WDM measure for promoting better payment for water in the urban poor areas.

The findings of the survey agree with the WDM literature reviewed in the study which recommended metering as one of the key components of any sustainable WDM strategy aimed at efficient water management and that awareness raising is an important WDM measure for changing the user's perception towards water use and payment.

Acknowledgements

This thesis acknowledges many people and organisations that contributed to the successful completion of my Master of Science Study Program in the Netherlands.

First and foremost I wish to thank the Government of The Netherlands and the UNESCO-IHE for the sponsorship and facilitation of my study in the Netherlands. I also wish to thank Suez Lyonnaise des Eaux for the financial support during my research study which enabled me collect data in Zambia and complete the research in the Netherlands.

My exceptional heartfelt thanks go to my mentor Mr. Marco Schouten and my supervisor Professor Meine Pieter van Dijk, whose diligent guidance, support and supervision during the research study has culminated in this important piece of work to my career.

My gratitude also goes to Mr. G. Ndongwe, Managing Director-LWSC for the support, Mr. O. Chanda, Director-NWASCO and Mr D. Mwanza-WSS Specialist-WSP for the guidance.

I am also highly indebted to the people that played a key role to the field data collection in Zambia; Mr. Kambaila (CSO), Mr Chitumbo (NWASCO), Mr. Gonga (DTF), Mr. Makala, Mr. Mayumbelo, Mrs Chibwe, Mr. Mujelemani, Mr. Mwape, Ms Kalunga Bernadette and Mr. Chama; members of staff of LWSC and Ms Kachali, Ms Lisulo and Mr. Banda who assisted in administering the interviews.

Lastly I wish to thank my wife, Priscilla and my daughters; Nyantika and Nyanke for their love and encouragement during my long absence from home, but above all I thank God for what he has done for me.

Table of Contents

List of tables

List of figures

Abbreviations

CBO	Community based organisation
CSO	Central Statistics Office
CU	Commercial Utility
DTF	Devolution Trust fund
DWAF	Department of Water Affairs and Forestry
GRZ	Government the Republic of Zambia
LCC	Lusaka City Council
LWSC	Lusaka Water and Sewerage Company
MDG	Millennium Development Goals
MWED	Ministry of Energy and Water Development
MoFNP	Ministry of Finance and National Development
MLGH	Ministry of Local Government and Housing
MoH	Ministry of Health
NGO	Non Governmental Organisations
NWASCO	National Water and Sanitation Council
PSRP	Public Service Reform Program
RDC	Resident Development Committee
SADC	Southern African Development Community
SPSS	Statistical Package for Social Studies
UFW	Unaccounted for water
UNICEF	United Nations Children's Fund
UN	United Nations
WDM	Water Demand Management
WHO	World Health Organisation
WSI	Water Services Institutions
WSS	Water Supply and Sanitation
WUP	Water Utilities Partnership
WWG	Water Watch Groups

1. Introduction

1.1. Background

The urban population particularly in developing countries is rapidly increasing due to urbanisation and population growths (Aiga and Umenai, 2002). The United Nations (UN) has estimated that by the year 2020, urban population will account for over 56% of the total global population (WHO/UNICEF, 2000). Urbanisation in many cities of developing countries has resulted in a sprung up of densely populated squatter townships. This situation has created numerous problems in relation to public health and social economic conditions (Aiga and Umenai, 2002). One of the major difficulties faced by these urban settlements is access to water supply.

It is estimated that over fifty percent of the population of the African continent will reside in urban areas by the year 2020 (WUP, 2003). With the mentioned trends, provision of water supply to match the rapid pace of population growth remains a great challenge. The challenge is even greater for the urban poor since they constitute the majority of the urban population that reside in informal and unplanned settlements.

The urban population in Southern African Development Community (SADC) is estimated to exceed 180 million inhabitants by the year 2025 while at the same time renewable fresh water abstraction are projected to increase plunging more than half of the SADC countries into water stress (Gumbo *et al.*, 2005). The ever-widening search for new water sources is a substantial expense for the region with other developmental needs; water demand management (WDM) could be a tool to resolving the problem.

Zambia is one of the most urbanised countries in sub-Sahara Africa with approximately 39% of the population living in urban areas (CSO, 2003). Rural-urban imbalances accelerated after independence as government sought to develop a modern mining and industrial economy. This resulted into rural-urban migration, which led to the concentration of people living along the line of rail. The social infrastructure provided to support this population was inadequate. This led to the proliferation of unplanned settlements around urban centres (peri-urban area), which created many social problems including inadequate water supply and sanitation services.

Lusaka city alone has 33 peri urban areas, where over 65% of the estimated 2 million people live (LWSC, 2005c). Most of the peri urban areas in Lusaka started as illegal settlements and lack the regular layout of the conventional areas. These areas are over crowded and are prone to unemployment and high poverty levels. Their unplanned nature, coupled with inadequate or non existence of basic services such as water and proper sanitation tends to make the living conditions in these areas essentially unhealthy.

The Lusaka Water and Sewerage Company (LWSC) is facing major challenges in providing water supply and sanitation services to the population in the 33 peri-urban areas of Lusaka. Some of the major challenges include the following:

Firstly the un-planned and haphazard layout of these areas presents technical and social challenges to improving water; this is because most of them start as unplanned

settlements and over time get legalised. Once they are legalised, the utility is mandated to provide water services with no regard to the utility capabilities.

Secondly; the water supply is inadequate to meet the demands for water brought about by the rapidly expanding city with a lot of unplanned areas. The daily demand for water in Lusaka is estimated at 390,000 m^3 while the current water production is 215,000 m^3. Water service coverage for the entire Lusaka is estimated at 65% (NWASCO, 2006) and only about 30% coverage has been achieved in the peri urban areas.

LWSC also lacks resources to finance water supply infrastructure development in these areas and over the years infrastructure has continued to deteriorate leading to huge water losses. This is more pronounced in the peri urban where service provision has remained poor as the low-income communities were perceived to be financially unreliable due to high poverty levels and non payment for water.

However, despite the mentioned problems, LWSC has responded positively to the challenges of service provision to the low income communities by formulating a peri urban policy which led to establishment of a peri urban department in year 2000 (LWSC, 2005c). The goal of the policy was to ensure adequate, accessible, sustainable and safe water supply and improved sanitation services are available and effectively utilised in the urban poor areas of Lusaka. LWSC has since the year 2001 been implementing WDM in the urban poor areas inorder to curb the exceptionally high UFW, the perpetual water shortages, the growing demands for water and improve revenue collections (LWSC, 2004a).

1.2. Problem Statement

Provision of water and sanitation services around the world poses a challenge to many countries. The challenge is even greater in developing countries where the majority of urban population are poor and live in settlements without adequate services (Mayumbelo, 2006). The majority of the population in peri-urban areas do not have access to adequate water supply and consequently their health is compromised leading to a reduced ability for productive work. Such a situation can lead to poverty.

It is well stated that water is an important resource that can sustain life, improve the standard of living of people and can make a significant contribution to the overall social and economic development of a country (Kampata *et al.*, 2002). In view of this, peri urban areas are of prime importance because they host the majority of the urban population in Zambia. Addressing their water needs is also a priority to also achieving the Millennium Development Goals (MDG).

Provision of water supply to the densely populated urban poor areas of Lusaka still poses great challenges to the LWSC. Despite LWSC having been conducting WDM to address the poor water supply situation in the peri urban areas, services in most these areas are still poor, the water infrastructure is in need of maintenance, the UFW is still exceptionally high averaging 65%, perpetual water shortages are a daily routine and revenue collection is still very low. In Lusaka city, nearly 56% of the water supplied by LWSC is still unaccounted for while at the same time the demands for water are not yet met (NWASCO, 2004b). The situation, calls for a need for further improvement.

As the water utility shifts to integrated and sustainable urban water management practices, there is need to investigate and take into account the social aspects, which decisively affect and formulate sustainable demand management options.

This study therefore, seeks to assess the effects of various WDM measures on changing water consumption and payment in the peri urban areas.

1.3. Research Objectives

The goal of this research is to compare the effects of WDM measures on changing water consumption patterns and payment in peri-urban areas. This approach was demonstrated through a case study of the peri urban areas in Lusaka

The specific objectives to achieve the goal are:

- To identify the WDM measures which have been implemented in peri-urban areas of Lusaka?
- To assess the consumer's behavioural changes towards water consumption and payment in view of the implemented WDM measures.
- To establish the most effective WDM measures that can be applied in peri urban areas.

1.4. Research Questions

The following will be the sub questions that this study will seek to answer:

- To what extent have the different WDM measures influenced water consumption in peri urban areas?
- To what extent have the different WDM measures influenced the payment for water in the peri urban areas?

1.5. Scope of study

The study focused on three selected peri-urban areas in Lusaka where WDM has been implemented. The unit of analysis for this study were water consumers at household level.

1.6. Thesis Outline

The thesis is organized in five interrelated chapters. The content of the chapters are summarised below:

- **Chapter 1** is the introductory part; it outlines the background of the research, describes rationale of the research, objectives of the research.

- **Chapter 2** presents the literature review which describes and discusses water supply systems in urban and peri urban poor areas. It gives back ground information on water demand management: factors for application, policies ad regulations, framework, and constraints to WDM applications.

- **Chapter 3** provides an outline of the methodology that was employed in this research. It reviews the research design, the questionnaire design, and determination of sample population. The chapter also gives a general description of the peri urban water supply situation and the water demand management measures implemented in the selected study areas. The chapter also outlines how the survey was implemented in Zambia.

- **Chapter 4** displays the results of the outcome of the data that was collected from the field survey in Zambia. The chapter first gives some background on the methods employed in analysing the data, the analysis of the data and discussions of the outcome of the results.

- **Chapter 5** presents the conclusion of the study and recommendation based on the conclusion.

2. Literature review

This chapter presents literature reviewed on peri urban water supply systems, domestic water demands, constraints to provision of water to the urban areas. The chapter also gives a highlight of concepts of water demand management, factors and different measures of water demand management applied in urban areas.

2.1. Urbanisation and peri urban areas

Cities in developing countries can be viewed as divided into two distinct sectors: formal and informal, legal and illegal, or regular and irregular. The latter sector houses the greatest number of poor families and almost by definition, those families without access to ordinary public services such as water and sanitation. Cities are centres of development that tend to attract people because of jobs and services provided therein.

Mayumbelo (2006) stated that population growth and migration to cities in sub Saharan Africa and most third world countries, results in development of informal settlements mostly because of poorly performing economies. These settlements are referred to by various names; informal settlements, squatter camps, slums and most recently peri urban areas.

2.1.1. Peri urban areas

A peri urban area is defined as a settlement within an urban centre that is unplanned or later regularised which lack basic social services, represent the epicentres of social and environmental problems; is characterised by relatively high population densities, high waterborne disease outbreaks, poverty stricken, high unemployment levels (Mayumbelo, 2006)

The Peri-Urban Water Supply and Sanitation Strategy (MLGH, 2000), defines peri-urban areas as: “informal or formal settlements, within the area of jurisdiction of a local authority, with high population density and high-density low-cost housing having inadequate or lacking basic services such as water supply, sewerage, roads, storm water drainage and solid waste disposal.”

Most peri-urban areas in Zambia are found on the outskirts of municipalities and cities. These areas are now referred to as peri-urban areas in preference to the earlier terms of “squatter” or “shanty” compound. This study will adopt the definition of peri urban areas as given by the two mentioned authors, while people residing in these areas will be referred to as the urban poor.

To supply growing cities with the basic services, resources have to be explored and exploited, Since urban centres contribute to global ecological change, there is a need for sustainable urban management to address both short and long term needs of city dwellers (Deelstra, 2005). In no sector is the need for a new approach more pressing than that of water management, especially to the urban poor. Sustainable water management is essential as the pressures of a growing world population demand better use of limited resources.

2.2. Urban poor livelihoods

Livelihood comprises the capabilities, assets (including both material and social resources) and activities required for a means of living. A livelihood is sustainable when it can cope with and recover from stresses and shocks and maintain or enhance its capabilities and assets both now and in the future, while not undermining the natural resource base (Tho, 2005)

Tho (2005) believes that sustainable livelihoods approaches are a practical way of thinking about planning and implementing development. The livelihoods approach puts the voices and concerns of the poor at the centre: people rather than the resources they use or the institutions they serve are the priority concern. The approach also stresses on aspects of peoples lives into development planning, implementation and evaluation. The approach also emphasises on the importance of understanding links between policy decisions and household level activities.

In many urban settlements in developing countries, securing a livelihood in the low income areas can be complex and confusing. Urban residents live in uncertain environments, with urban growth which outstrips economic opportunities, government services which are often reducing and deteriorating, rapid cultural change and increasing crime. People employ various strategies to earn a living such as undertaking seasonal work, earning incomes in the informal economy, shifting from one temporary household arrangement to another. Strategy outcomes often do not meet even the most basic of households' needs, increasing the vulnerability of those already marginalised.

In the context of water management, Kyessi (2005) states that diminishing state resources coupled with inadequate urban management capacity and insufficient approaches have rendered it impossible to provide adequate basic services in developing countries. The outcome from the case study of community based urban water management in the urban fringe areas of Tungi and Yumbo Dovya in Dar es Salaam brings out the strong emphasis of the role of community involvement in solving water management problems in the urban fridge areas. Access to urban infrastructure and basic services by all income groups within a community are fundamental to the step by step improvements of people's livelihoods. Sustainable livelihoods based approaches can provide a map for analysing the problems of the urban poor and assist in developing appropriate water management interventions (Kyessi, 2005).

It has for long been assumed that urban poor communities do not know their infrastructure needs especially low-income communities. Thus decisions have been made on assumptions by engineers and planners and not on actual information and understanding of household water demand. This top up approach has been recognized as the reason for the failure of many initiatives (Schuringa, 1999). Communities need to be involved in the decision making process on the water supply system based on their demands. Schuringa (1999) recommends features such as demand responsive approaches (DRA), should be incorporated into project design that involve the poor communities. Key features of the DRA are that community members be made to participate and make informed decisions in the project, an adequate flow of information should be facilitated for collective decisions within communities and their actors.

Research findings, on the case study of urban poor and water supply in Dhaka city in Bangladesh, suggest that the informal communities in Dhaka had the capacity to operate and maintain small-scale water supply system and they were also willing to help the water providers in system development. Social motivation through empowerment of the people often unites the communities to develop the water supply systems and to express their demands to politicians and the government (Akbar *et al.,* 2007).

2.3. Peri urban water supply

Since water is an important and essential resource for human survival and public health, therefore each society or community is expected to have access to a form of water supply. Different types of water systems exist in peri urban areas in the world. The common types of water systems are; springs, wells, hand pumps, water vendor delivered, piped supply system in form of public stand pipes, yard connections and house connections (Sharma, 2006).
The type of water supply system in a peri urban area depends on many factors such as; standard of living, population size, available water sources, cultural factors technological and institutional setups (Woldemeskel, 2006). Different types of water supply sources provide different amounts of water per capita/day as shown in table 2.1.

Table 2-1: Standard alternative water supply systems

Type of water system	Average water supply per person per day (litres/cap/day)
Community open wells	10 – 50
Tube wells/ boreholes	10 – 50
Water vendor	5 – 50
Public tanker trucks	5 – 50
Water kiosks	5 – 20
Community Standpipes	10 – 50
Roof tanks	30 – 50
Yard taps	30 – 100
House connections	40 – 250

Source: Sharma (2006).

Woldemeskel (2006) states that the quantity of water collected from each water supply system is directly related to the location of the source from users and time spent to collect it as illustrated in table 2-2
Table 2-2: Water service levels and quantity collected

Service level	Access measure (distance or time)	Quantity to be collected
No access	> 1km; > 30 mins round trip	Very low: 5 l/capita per day
Basic access	Within 1km ; within 30 min round trip	Average approximately 20 litres per capita per day
Intermediate access	Water provided within the yard through at least one tap	Average approximately 50 litres per capita per day
Optional access	Supply of water through multiple taps within the house	Average 100 - 200 lcapita/ day

Source: Woldemeskel (2006).

2.3.1. Water supply constraints to peri urban areas

The constraints regarding providing water and sanitation services to the urban poor areas stated by Sharma (2006) and Solo et al. (1993) are discussed in this study. These constraints are categorized under i.e. physical and technical, economic and financial, institutional and capacity building and community involvement.

2.3.1.1. Physical and technical constraints

The urban poor tend to settle on pieces of land that is undesirable and in most cases unplanned. They do it for clear and rational reasons: the less the market value of land and therefore the more affordable it is. Most of these areas are densely populated and haphazardly built up leaving no room for access roads or service right-of-ways. Laying pipes under such circumstances calls for the creation of streets and the consequent removal and relocation of houses. In these situations, the cost of service delivery is higher, both in financial and social terms resulting in areas lagging behind in services.

The lack of secure land tenure also makes any intervention in these areas problematic and risky. More critical however, is the concern amongst the local authority that if pipes are installed in areas without legal status, their permanence may be seen as providing a stamp of approval or some degree of legitimacy to the residents

The other constraint is that of inappropriateness of technology that is installed in urban poor areas. Past experiences have shown that local expertise prefer to use service-delivery systems which they are familiar with, in most cases the most modern, even though these systems may turn out to be inappropriate for the difficult topography, soils, and other conditions of informal neighborhoods. Appropriate technology requires much higher levels of user involvement to function properly but. Engineers, who formulate most sector projects, often have little regard for the social mechanics of projects, such as mobilizing communities and involving future users rendering the systems unsustainable.

2.3.1.2. Economic and financial constraints

These constraints include the costs of water and sanitation, and low family income; the shortage of capital for investment; While even the lowest-income families can usually afford potable water as it is delivered, the provision of indoor connections or connections close to the house can become unaffordable because of attendant costs that are not taken into account in project feasibility studies. These include: external delivery costs; land legalization and regularization costs; and the initial connection fee and additional such costs to the family.

A limited finance for extending WSS services to informal or unplanned areas is another constraint. Most water providers direct their resources to formal or planned areas where there is a higher possibility of recovering the costs. There is a general perception that service delivery to informal or unplanned settlements is a loss-making venture due to the inappropriate payment arrangements, pricing policies and the socio-economic factors such as low and/or irregular incomes. Atempts to attract independent financiers to fund infrastructure development in urban poor areas have been largely unsuccessful.

2.3.1.3. Institutional arrangements

Inappropriate institutional arrangements and unclear organisational mandates greatly hinder service provision. This applies to utilities, local authorities and other water supply agencies. Service delivery institutions require clear strategies and actions for reaching low-income households. Furthermore a lack of inter-agency coordination particularly between governmental and non governmental organizations leads to duplication of effort, contradiction or inconsistency.

Woldemeskel (2006), states that major institutional constraints to the provision of WSS are primarily the result of ineffective public works systems. Public works systems have long been recognised as complicated and disorganized, two conditions that make the provision of satisfactory service and expanded coverage difficult. The focus on getting public works companies to apply financial discipline by increasing their charges and collection of payments makes investment in poor areas increasingly unattractive. This approach has tended to emphasize eliminating deficits and providing autonomy at the expense of addressing consumer needs.

Public works in most developing countries depend on external support to install WSS services in the urban poor. Public works companies are often synonymous with large contracts and lucrative payoffs, and they offer ample opportunities for patronage employment. But in reality, the formal sector private service companies have not shown any eagerness to extend infrastructure to the poor.

In the Zambian water sector, Donors have been allowed to assist install WSS infrastructure to improve service provision to the urban poor areas. In most cases there is a lack of coordination between the utilities, donors and local authorities in such ventures. Once commissioned, the facilities are operated by communities mostly as water trusts and are self regulatory despite water utilities being the licensed water operators in a particular city or province. This situation leads to mistrust and duplication of efforts (Seur and Kangwa, 2005).

2.3.2. Capacity building and community involvement constraint

Inadequate or inappropriate human resource capacity in both the utility and local authorities has contributed to low prioritisation and limited knowledge of the issues involved in service delivery to low-income areas. The primary challenge for improving these services lies in the hands of the local and municipal authorities. They can not solve this on their own but need effective partnerships with the poor, the NGOs and CBOs and the local private sector.

Therefore new innovative strategies and approaches in planning, implementation and management of the services are needed. Only then will the water and sanitation services may become effective and sustainable. In most cases inappropriate information channels are used to reach low-income communities. The development of effective strategies to sensitize the water consumers on key issues such as paying for water, hygiene awareness, reducing vandalism and misuse of facilities is uncommon.

2.4. Water Demand Management

The term WDM has been defined in several ways by different researchers and authors. Some of the definitions include the following:

WDM is defined as a program which is adopted to achieve effective management of the use of water resources in order to meet the general objectives of economic efficiency, environmental conservation, community and consumer satisfaction (Liu, 2002)

WDM has also been defined as a water resources management approach that involves the application of sector specific technical, economic, and social methods and incentives, to promote efficient, equitable and beneficial use of both water and financial resources (CSIR, 1998).

Dube and Van der Zaag (2003) also define WDM as an approach aimed at achieving desirable demands, desirable uses and it influences demand in order to use scarce resources efficiently and sustainable

WDM also involves the application of technical, behavioral, economic and institutional measures to promote efficient and equitable use and allocation of water (Mwendera *et al.*, 2003). The author also supported their definition by saying WDM an integral part of the planning and design of new water resources.

The DWAF (1999) defines WDM as the adaptation and implementation of a strategy (policies and initiatives) by a water institution to influence the water demand and usage of water in order to meet any of the following objectives: economic efficiency, social development, social equity, environmental protection, sustainability of water supply and services, and political acceptability.

A useful comparison on the philosophy of demand management was compared with the role of marketing in the commercial corporate environment (DWAF, 1999). In the past marketing in the commercial environment meant simply advertising. Currently marketing has a much wider meaning which involves understanding the clients and their needs, understanding the market forces and then deriving a strategy in order to set and achieve target sales, market share and profits.

The principles of demand management are very similar to that of marketing, where the water supply institutions should set water demand goals and targets by managing the distribution systems and consumer demands in order to achieve the objectives of economic efficiency, social development, social equity, affordability and sustainability. The water supply industry can gain a lot by adopting marketing principles to the demand management strategies.

This study will adopt all the definitions of WDM enlisted above to be relevant with a precaution that WDM should be sector specific, this means measures or strategies developed should be tailored to a specific water situation.

Water being a scarce resource requires to be managed in an efficient and sustainable manner to promote equity and environmental integrity (Gumbo, 2004). WDM considers other demand sided options such as minimising losses, influencing demands to more

desirable levels. Gumbo (2004) also states that WDM can offer some solutions to the urban poor in regions experiencing an unprecedented ballooning of informal settlements.

The water saving and demand management strategies applied around the world today can be grouped into four categories based on the approach employed: economic, institutional, technological and behavioural. In the urban sector, specific examples include: rising block rate tariffs, promotion of water-wise industries, water auditing, and water loss management, retrofitting with water-saving devices, leakage repairs, informative billing, water-wise gardening.

Besides all the mentioned interventions, another important aspect of water management is awareness raising, education and training. Changing user's perception towards water use and conservation can be a strong drive to WDM. There are many examples where advocacy and provision of alternative approaches to enhance the efficiency of water use has resulted in water saving. The research finding on the performance of eight cities in Southern Africa as cited by Gumbo (2004), show that cities that achieved reduction of UFW as a measure of success of WDM were those that incorporated awareness campaigns together with the other demand management interventions. This goes to show the importance of education and awareness to all stakeholders most especially the users when implementing WDM.

2.4.1. Factors for implementing WDM

The main factors which are motivating increasing numbers of water utilities to adopt WDM in water stressed or scarcity regions according to the IUCN (2004) will be mentioned in this study. These factors are: environmental, economic, equity and empowerment. The table 2-3 below lists down these factors:

Table 2-3: Factors driving the implementing WDM

1. Environmental push factors	• Current or future water scarcity, Droughts • Avoidance or postponement of the negative environmental impacts • Social and environmental impacts of dams and well fields
2. Economic factor	• Lower costs of WDM compared with new supply schemes • Possible savings on operations and maintenance costs • Increased competitiveness of enterprises that adopt WDM • Use of saved water to promote economic growth
3. Equity push factors	• Use of saved water to provide water to more people • Increased water security and risk aversion • Lower costs leading to improved affordability
4. Empowerment and growth push factors	• Building upon indigenous knowledge and resource management systems • Incentive for technology development and innovation • A means to meet water and sanitation policy goals • Opportunity for re-use and recycling

Source: IUCN (2004)

Some of the push factors in table 2-3 for implementation of WDM which are relevant the LWSC case briefly discussed.

Although, in Zambia, water resources are relatively "abundant" when compared to its neighbours particularly those to the south such as Botswana, Namibia and Zimbabwe. The management of these water resources is critical if equitable access and use by competing needs particularly the vulnerable poor, women and children are considered. In addition, there are significant variations across the country with a strong seasonal distribution leading to water deficits in specific localities (Nyambe *et al.*, 2002). Zambia has therefore seriously adopted and implementing WDM to manage her water resources properly.

In Lusaka city, the water demands for the City of Lusaka for the year 2000 were projected to be 390,157 cubic metres per day while the current production is 215,000 cubic metres per day both from the surface and ground water source. It is obvious that the current production levels cannot meet the water demand for both the present and the future. The average level of un-accounted for water now stands at about 56% and this comprises both physical and commercial losses. LWSC has therefore adopted WDM as an immediate measure to abate future water shortages that may arise due to ever increasing demands especially in the urban poor areas where over 60% of its population reside.

In Lusaka city, about 56% of the water that is produced is lost in the form of UFW while being supplied, yet LWSC was contemplating duplicating the 65 km pipeline from its Kafue Water plant which is the main source of surface water to meet the increasing water demands. The capital cost of duplication of the delivery pipe is prohibitive and LWSC could not afford to fund the project or later on finding a financier. Realising the cost involved in production of water while at the same time almost half of it is lost through UFW, LWSC decided to adopt metering and data base clean up to reduce both physical and commercial losses (LWSC, 2005).

These WDM measures were considered cheaper and more efficient options to the costly duplication of the transmission line. Through these efforts LWSC has increased its metering coverage which is contributing to efficient water use, customer data base is growing which is leading to increased revenue collection (LWSC, 2005).
This is one of the examples of where WDM solutions offer better financial benefits in the era of rapid rising demands for water.

LWSC also like many other utilities faces the huge challenge of providing WSS services to the largely un-served population. However, LWSC has responded positively to the challenges of service provision to low-income communities by addressing policy issues through establishing the peri-urban department and the formulation of the peri-urban policy. Through the policy WDM has been adopted and is being implemented to help address the poor service provision in the urban poor areas.

LWSC has a vision, which is in line with one of the MDG's. The utility is striving to provide water to all the residents within the jurisdiction of Lusaka city especially the urban poor. And so peri-urban areas have taken the center stage in the provision of WSS services, which is also in line with the Zambian government's policy of universal coverage.

The regulatory environment in which LWSC operates continues to change and is also contributing to the adoption of WDM. The Water Supply and Sanitation Act which was passed in 1997 established the NWASCO to regulate operations of WSS utilities in Zambia. NWASCO has developed guidelines within which CU's are expected to operate and abide to (NWASCO, 2004a). Through these guidelines the regulator has developed regulatory tools that it uses to monitor performance of CU's. Some of the regulatory tools are focused on WDM such as metering, reduction of UFW, service coverage, tariff setting, revenue collection efficiency etc. Operating licences of CU's are renewed based on performance against the set guidelines. With these regulatory conditions in mind, CU's such as LWSC are left with no choice but to adopt WDM as one of the measures to addressing service provision (LWSC, 2005).

2.4.2. Flow chart for addressing Water Demand Management

Figure 2-1 modified from McKenzie *et al*, (2002) provides a schematic overview of the various components of WDM in a water supply sector. The figure illustrates that WDM is a combination of measures which are tailored to the system in question and not simply a single measure. A proper WDM strategy will typically involve many different measures which are selected to suit a particular water supply system (McKenzie *et al*., 2002).

The WDM flow chart is also applicable to the case of LWSC except for the rural water use and waste water use. The utility is located in an urban environment therefore rural water use is not applicable. The LWSC despite being responsible for managing the waste water in the city has not put measures in place for effluent reuse. In the study the flow chart will be referred to in defining and explaining the WDM definitions and concepts.

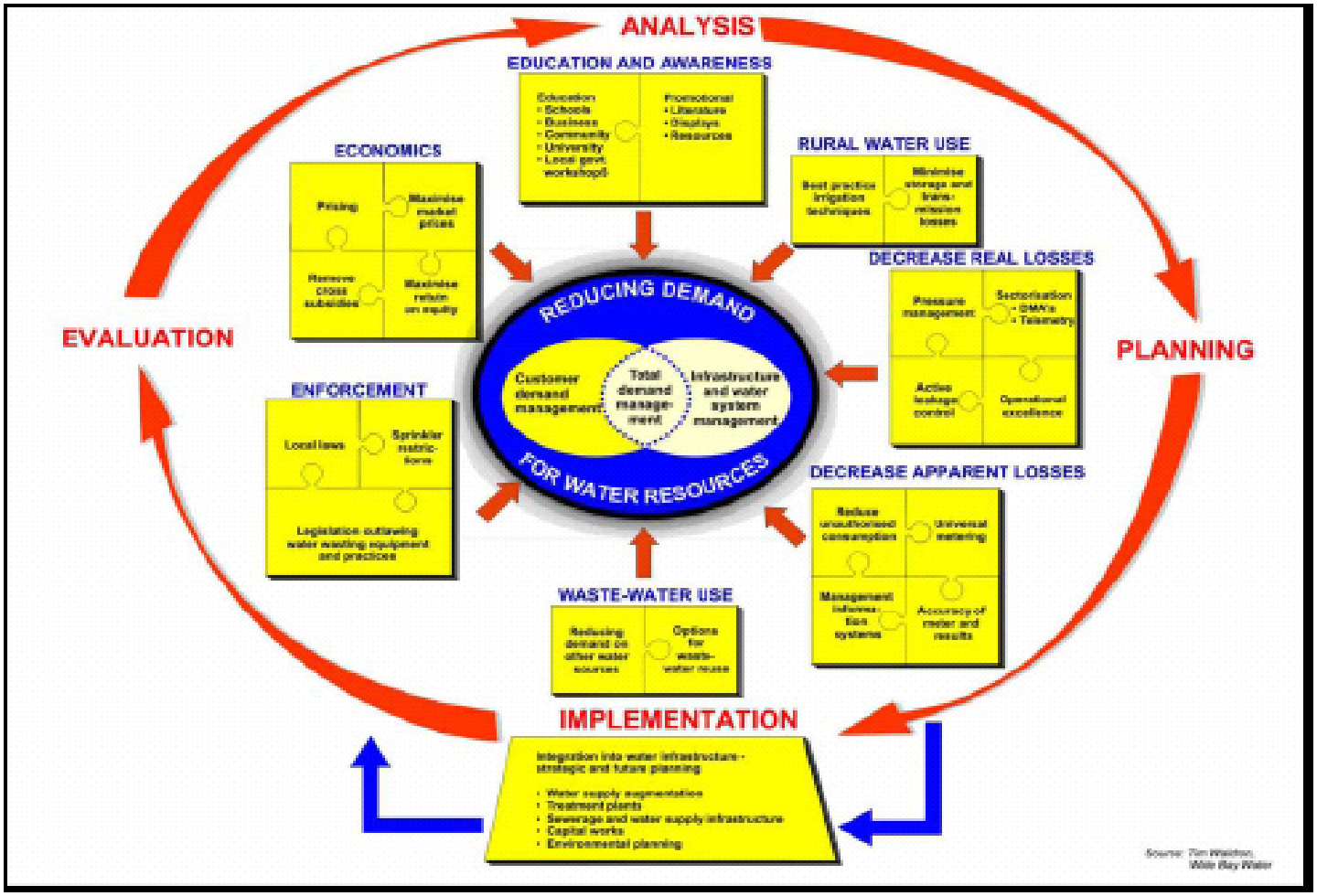

Figure 2-1: Framework for developing water demand management strategy

Source: McKenzie *et al* (2002)

2.4.3. Water demand management measures

According to Gumbo (2004), the two main measures through which WDM is applied are the structural and non structural measures. Referring to the flowchart in figure 2-1 the WDM measures are defined in the urban water context as follows:

2.4.3.1. Structural measures

These are WDM measures that could be applied within the water supply infrastructure to improve the efficiency. Notable examples pertaining to a domestic water supply from figure 2-1 are:

- **Decreasing real and apparent losses**

Real losses comprise leakage from transmission or distribution mains, leakage and overflow from utility storage and balance tanks and leakage in reticulation systems (especially service connections) up to the point of metering. Leakages arise from the poor state of water system or may also occur within customer properties. Leaks led to loss of water and can be costly to both the utility and the consumer. Water lost may also lead to denying water to the unserved.

- **Apparent losses**

These represent the unauthorized consumption i.e. theft or illegal use of water and technical or administrative inaccuracies associated with customer metering or billing. This can lead to loss of revenue as the water consumed is not accounted for. Wrong meter reading may also lead to wrong billing. Wrong billing or unjustified consumption will not attract a consumer's willing to pay.

According to Ntengwe (2004), UFW is the water that is lost due to leakages in a water system and that which is used by customers who are not captured in the billing data base. In this study UFW was considered as the total of the real and apparent water losses. UFW can be reduced through measures such as; leakage repairs, proper maintenance and pressure management, retrofitting i.e. replacing of non efficient water facilities with more water saving facilities, capturing unregistered customers, correct meter reading and billing.

2.4.3.2. Non structural measures

The non structural measures include the following:

- **Educational and awareness campaigns**

Educational and awareness campaigns are meant to influence or bring about a behavioural change in the water users towards water issues (Ntengwe, 2004). Provision of appropriate information to the consumers about WDM can make them appreciate more about issues of water and become more willing to pay or save water. Through these measures, water providers may solicit support of communities in preventing vandalism of water systems and minimise water losses.

- **Economic Measures**

Water pricing has been recognised as an important incentive measure for demand management to achieve the objective of efficiency and sustainability of scarce resources. Issues of water pricing are critical in a water system. Water pricing influences the way the service will be provided and its sustainability. Setting out of the right and correct

tariffs could influence the willingness and ability of consumers to pay. water pricing is an instrument to financial sustainability (Liu et al., 2003).

- **Enforcement**

Laws and regulations governing application of WDM have to be clearly set out and institutions responsible have to be put into place. For example in South Africa, the new water legislations, water services Act (1997) and the national water act (1998) provide the foundation for WDM development. (Sanderson, 2002) The legislation also addresses issues of equity, sustainability, efficient and effective water use focusing on the end user.

Similarly also in Zambia, the national water policy (1994) gives prominence to water resources management and is in direct support of WDM (Sanderson, 2002). Regulations set out clear guideline and roles of institutions responsible for WDM. The role of NWASCO and its ability to enforce regulations on water utilities proves crucial to the implementation of WDM. NWASCO employs regulatory instruments by

- Imposing service standards aimed at reducing UFW
- Obliges utilities to develop public awareness campaigns aimed at encouraging water conservations
- Demanding a staged universal metering of all consumption
- Approving tariffs that encourage water conservation.

While Gumbo (2004) classifies WDM measures into structural and non structural measures, the DWAF (1999) categories WDM measures into the following main groups:

- WDM measures applied in the water distribution and water supply functions
- WDM measures on the consumer or user end.

From the discussions, a conclusion can then be drawn that a WDM strategy is centred on water infrastructure systems management and customer demand management. It is clear that to implement a total WDM these two core components cannot be considered in isolation. Since the customer is a crucial component of the WDM cycle both as an end user and payer for the services, it is therefore important that their interests are taken into account when designing WDM strategies.

To compare the effects of WDM measures on changing water consumption patterns and payment in peri-urban areas, the measures that are on the customer or user end as recommended by the DWAF (1999) shown in table 2-4 below were selected and adopted in this study.

Table 2-4: Summary of the WDM measures by category

Demand management measures in the distribution and water supply functions	Demand management measures on customers / end use
• Regulations / Guidelines • Infrastructure optimisation • Town planning policies • Different levels of service • Loss minimisation, (i.e. reducing unaccounted for water) • Reuse and reclamation options • Metering • Pressure management • Dual distribution systems • Education, awareness, and training	• Metering • Increasing service coverage • Incentives • Leakage reduction or loss minimisation (domestic plumbing) • Retro-fitting (replace plumbing systems with efficient systems) • Water pricing • Efficient billing • Database clean up (capture of unregistered customers) • Disconnecting defaulting customers • Education and awareness campaign

Source: DWAF (1999)

Inorder to understand the WDM measures on the consumer or use end, brief explanations and definitions are given as follows:

- **Metering**

Metering refers to the installation of flow monitoring instruments in the water system to establish the volume of water harvested, treated, imported, exported, stored and consumed. Proper metering is a pre-requisite for the proper management of any water supply system. Metering in this study will refer to consumer's meters. Consumer meters are required if customers are being charged for the water used which is one of the key elements of any WDM strategy (McKenzie *et al*., 2002). If consumers are not charged in accordance with their use, there is little incentive to save water. Metering correct reading are essential inputs to an efficient billing which may also lead to improved water accountability and revenue collection.

- **Increasing Service Coverage**

In the context of WDM, increasing service coverage means ensuring that consumers have access to adequate and safe water supply at an affordable price. This approach is used discourage water consumers from illegally selling water to those that do not have access and those who cannot afford. Increasing access to water can also discourage illegal connections which will lead to high UFW. For example, in the peri urban areas of Lusaka, apart from construction more water points and extending the network to the un served, LWSC in George compound has opened up vending points as a cheap source of water for the poor that cannot afford to pay through the prepayment. This system will ensure access to water for all and discourage illegal selling of water to those that cannot afford or access water.

- **Incentives**

The Encarta English dictionary, defines incentive as something that encourages or motivates somebody to do something. In the context of WDM, incentives may be defined as tools or mechanisms through which consumers could be encouraged or motivated to save water, minimise losses or pay for water services. Notable examples include correct billing, payment of arrears in instalments or deferring payment of connection fees to encourage more people to get connected and minimise theft of water.

- **Leakage reduction or loss minimisation**

All water supply systems leak to some extent. Water leakages can be managed and in many instances reduced through various WDM or leakage management interventions. On the consumer side leakage management may involve fixing defective plumbing to minimize loss of water (McKenzie *et al.*, 2002). Metering if effectively implemented can also help consumers identify the water loss and devise measures to minimize it.

- **Retro-fitting**

This refers to replacement of inefficient non water saving plumbing systems with efficient systems that can save significant volumes of water. Notable examples of retrofit facilities are low volume taps, low flow shower heads, pressure reducers, low volume urinals etc. The overall benefit to these measures is that of water saving which can be translated in monetary terms as well as ensuring efficient use of water.

- **Water pricing**

The viability and success of water provision depends on returns from the sale of water. The underlying principle under which water utilities are established on, is that of full cost recovery (Nyambe *et al.*, 2002). In order to achieve this, tariff structures formulated should be ones that ensure equitable access to water to groups of different social status on one hand while guaranteeing cross subsidy from huge water consumers, on the other. The rising block tariff systems is one such tariffs that is not only fair but also encourage consumers to be efficient in the manner in which they use the water.

- **Efficient billing**

This is an activity that is also carried out under data base cleanup, to ensure the water bills that are generated are accurate and correct and according to the actual consumption. The focus of most water utilities is to ensure that consumers are billed according to consumption. For those on fixed or assessed consumption, utilities have to ensure that the assessment is as close to the actual consumption as possible. Correct metering reading and production of water bills on time is also an input to efficient billing.

- **Database clean up**

Database cleanups involves activities that lead to improvement of the billing efficiency such as capturing unregistered consumers, correct assessment of consumption in the case of unmetered, correct meter reading, verifying connections in the case of suspected illegal connection, disconnecting defaulting consumers, verification to ensure consumers are placed in the correct billing categories and production of correct bills.

- **Disconnecting defaulting customers**

In most water utilities, customers pay their water bills in arrears i.e. they first consume the water and then pay later. In the case of LWSC, the water bills generated on a monthly basis to show consumers the amount of water consumed and the cost also act as reminders to pay for water. Where customers do not come forth to pay after being

given notices to do so, the service is terminated through water disconnections. Water disconnections are also executed when properties are found to be wasting water through negligence such as unattended to leaks. This is done to minimise wastage of water and reduce UFW especially in unmetred areas.

- **Education and awareness campaign**

Education is a key component of any successful WDM policy and before the consumers can be educated it is necessary to ensure that the personnel working for the water utility are fully aware of WDM. Public awareness campaigns are very important in spreading the message of water conservation to consumers. Most water suppliers wishing to promote water conservation organise various activities designed to create awareness. The materials needed will vary from one area to another and from country to country depending on the level of service and the availability of the specific media to the consumer.

In summary, it is necessary to evaluate the consumer base thoroughly in order to establish the most appropriate means of spreading the water conservation message after which an appropriate strategy can be developed and implemented.

2.4.4. Constraints to the implementation of WDM

It is necessary to identify and acknowledge obstacles to WDM in order to develop actions within the WDM strategies to address them. The constraints to implementation of WDM in the Southern African region as identified by a team of researchers Mwendera *et al.,* 2003 and Mulwafu *et al.,* 2003 in a paper presentation to the phase II of the WDM program in Southern Africa will be discussed in this study but limited to domestic water sector.

2.4.4.1. Financial / economic constraints

Very little or no financial or human resources are usually made available for WDM implementation (Mwendera *et al.,* 2003). The focus in the water sector in the SADC region continues to be on water supply augmentation. In most cases when supply is outstretched by demands, more resources in terms of time, money and human continue to be spent in selecting and developing new water supply schemes without maximizing efficient usage from existing infrastructure. The lack of financial resources for the rehabilitation operations and maintenance of existing water systems results in high water losses. Lack of the understanding of the benefits to be achieved from WDM coupled with poor service delivery prompts stakeholders in the water sector to focus on water supply augmentation as an immediate solution (Mwendera. *et al.*, 2003). Adequate finances are a major pre-requisite to the effective implementation of WDM.

The lack of finances poses one of the biggest constraints to the implementation of WDM in Zambia. A number of programmes that promote WDM need huge amounts of money either in the upgrading of the water system or installation of essential WDM equipment like the water meters. For example in LWSC, where only 37% of the connections are metered and the bulk of the UFW is attributed to apparent losses, the lack of capital funds is a major constraint to the LWSC to carry out a comprehensive metering program to address the UFW (LWSC, 2005). In a city like Lusaka, where the water supply infrastructure is very old, an added budget of S$21 million is required to repair and upgrade the water infrastructures to meet the rising needs (LWSC, 2005).

2.4.4.2. Attitudes

Attitudes of consumers who demand cheap or free water hinders the application of WDM practices. Water is to a large extent considered to be a public good to which all people must have adequate access whether they can afford it or not. For this reason, water is supplied free of charge in rural areas and at subsidized prices to low-income households in urban areas. Historically, in Zambia, local authorities used to provide water as a free service. The newly formed water utilities has a mammoth task to change the behaviors and attitude of Zambians towards water and also to ensure that Zambians realize and appreciate the fact that water is finite and in fact is an economic good and must be treated as such.

2.4.4.3. Institutional and organisational constraints

Even if the objective of most water suppliers in urban areas is to achieve economic efficiency, however, pricing of water is subject to control by the governments especially in countries where the water sector is not autonomous (Mulwafu et al., 2003). In this case then water pricing cannot be used as an instrument for controlling demand. Lack of an institution or clear roles to monitor, support and enforce WDM can also be a hindering factor (Mwendera. *et al.*, 2003)

2.4.4.4. Policy and legal instruments to support WDM

Policy and legal instruments to support WDM practices can vary widely from country to country. Where policy is weak, there is often a lack of clarity as to who is responsible for WDM implementation, but there is even less clarity about who is responsible for monitoring water services institutions (WSIs), water usage, facilitating WDM implementation, and taking appropriate action when serious non-performance is discovered (Mwendera *et al.*, 2003). Through broad stakeholder debate and negotiations, facilitated by a person or persons with an in-depth practical knowledge of WDM implementation and surveillance, instruments need to be instituted to give clarity on how these weaknesses are to be overcome. New by-laws that include measures to encourage water use efficiency and discourage wasteful practices can be starting points.

2.4.4.5. Awareness raising and education:

Where there is little understanding of the need for WDM, and then there is also a lack of skills available to plan and implement it. The managing of change and setting up of appropriate institutions to manage WDM requires another set of skills especially in the poor areas of developing countries. In Malawi for example the general lack of awareness concerning the economic value of water, pricing, inefficient water use, water scarcity, as well as systems and procedures relating to water allocation and user rights made the implementation of WDM ineffective (Mulwafu *et al*., 2003).

Gumbo (2004), in a study of implementation of WDM in selected cities in Southern Africa mentioned that the cities of Windhoek, Bulawayo, and Hermanus achieved considerable success in WDM because of the investment in awareness campaigns and consumer education together with the other measures. Ntengwe (2004), also concluded from the study of consumer awareness of water sector issues on willingness to pay and cost recovery in Zambia, that there was a direct relationship between the level of awareness, willingness to pay and cost recovery.

2.5. Approach for evaluation

In the context WDM the approach adopted in this study was the customer demand management. The aim was to conduct a field survey on a sample of consumers in the selected peri urban areas of Lusaka and assess how different WDM measures have affected water consumption and payment patterns.

3. The Methodology

3.1. Introduction

This chapter discusses a combination of many techniques and approaches that were utilised in this study in an attempt to fulfil the objectives of the research. The study was carried out in three phases. The first phase involved review of literature and concepts related to WDM which has been outlined in chapter two of this report. The second phase involved development of tools for data collection. The third phase involved the field data collection in Lusaka city. The last phase involved analysis of the collected data and interpretation of the results obtained in order to answer the research questions.

The subsequent sub-sections of this chapter, gives detailed descriptions of how the main activities of this study were undertaken.

3.1.1. Research design

Since the main concern of this study was to determine the extent to which WDM influenced change in water consumption and payment. Conducting a social survey on water users in the study areas was judged as a necessary starting point to try and understand how WDM has brought about change in the behaviour of water consumers.

The type of research adopted in this study is referred to as cross–sectional research often called survey research. Cross sectional or survey research are studies generally carried out in a population at a point in time or over a short period to collect a body of quantitative and qualitative data in connection with various variables which can then be examined to detect patterns of association (Bryman, 2004).

According to Bryman (2004), in a survey research, data is collected predominantly by a questionnaire or by structured interviews on one or more cases where different variables can then be examined to detect patterns of association or cause and effects. In this study, a questionnaire was developed as the main tool for data collection. The questionnaire comprised of open and closed questions. The target group for this questionnaire was the water consumers at household level in the peri urban areas of Lusaka. Structured interview checklists were also developed and used to collect information from other stakeholders relevant to this study.

3.1.2. The questionnaire

Burgess (2001), states that the most crucial part of a good survey research concerns making sure that the questionnaire design addresses the needs of the research. A researcher needs to ensure that the questions asked are the right ones within the aims of the study. The design of the questionnaire for this study was based on the methods adapted from three authors; Burgess (2001), Clawford (1999) and Bryman (2004) in their publications on designing questionnaires for survey research.

The following steps were adopted in designing the survey questionnaire for this study:

1. Decide the information required.
2. Define the target respondents.
3. Choose the method(s) of reaching the target respondents.
4. Decide on question content.
5. Develop the question wording.
6. Put questions into a meaningful order and format. [;
7. Pre-test the questionnaire.

3.1.2.1. Deciding on the information required

The first step is to decide what one needs to know from the respondent in order to meet the research objectives. Bryman (2004), recommends the use of secondary data, as being helpful for the researcher to be aware of what similar work could have been done before or similar problems encountered, what factors may not have been examined, and how the present survey questionnaire can build on what has already been discovered. Development of the questionnaire for this study was guided by the research objectives and the literature reviewed related to the subject and publications by other researchers on similar studies

The variables that were adopted for evaluation in this research study were as follows:

- **Independent Variables**

The independent variables consisted of metering, payment (billing methods), tariff and awareness campaigns (sensitisation).

- **Dependable variable**

Dependent variables were water consumption and payment

3.1.2.2. Define the target respondents

At the outset, before a questionnaire is written, a researcher must define the population about which he/she wishes to generalise from the sample data to be collected and draw up the sampling frame. This process can assist the researcher to know what methods are to be used in reaching the respondents and also knowing at the onset which segments of the general population the study will cover.

In this study, the segment of the population was the water users at household level in peri urban areas and the sampling frame was limited to the areas where there was an improved water supply and where WDM have been implemented.

3.1.2.3. Choice of method (s) of reaching target respondents

The method of reaching the intended respondents is also recommended as an important part of the questionnaire design process. The method of contact can influence not only the questions the researcher is able to ask but also phrasing of questions. Choosing an appropriate method of reaching the respondents will have a positive impact on the

response rate so long as a researcher weighs both the advantages and disadvantages before hand. According to Clawford (1997), the main methods available in survey research are: personal interviews group or focus interviews, mailed questionnaires and telephone interviews. Clawford (1997), also supports the use of personal structured interviews in survey research due to the advantage it has on promoting standardisation of both asking and recording of answers and that it minimises error due to interviewer variability.

In this study, personal structured interviews using the questionnaire was adopted as the method to collect data considering the low literacy levels in the areas under study, duration of the survey and resources of having to translate the questionnaire to local a language.

3.1.2.4. Decide on question content

A question that is perceived to generate response or data that has no direct use in testing one or more of the hypotheses established during the research design should be minimised or removed in a questionnaire (Clawford, 1997). Redundant questions should only be included if they are perceived to be easy to answer, and/or are interesting, can greatly assist in gaining the respondent's involvement in the survey and help to establish a rapport. It is recommended to keep mostly questions that generate response or data relevant to the research study.

3.1.2.5. Develop the question wording

Survey questions can be classified into two main forms; i.e. closed and open-ended (Bryman, 2004). One of the significant considerations of researchers carrying out survey research is whether to ask a question in an open or closed format. There are also situations in which a questionnaire will need to incorporate both forms of question because some forms are more appropriate for seeking particular responses

Bryman (2004) refers to open questions as to ones where respondents are asked a question and can reply in any way they wish whereas in a closed question, respondents are presented with a set of fixed alternatives from which they have to choose an appropriate answer.

Both format of questions discussed as described in table 3.1 pose advantages and disadvantages to a survey researcher.

Table 3-1: Open and Closed Questions – advantages and disadvantages

Format of Question	Advantages	Disadvantages
Closed	• Easy method of respondent to indicate the answer • Respondents not relying on memory to answer questions • Ease to classify responses making analysis straightforward Ease of respondent to specify the answer categories most suitable for their purposes.	the respondent will not have an opportunity to give a different response to those suggested and can 'suggest' answers that respondents may not have considered before
Open	• Respondent gives answer in own words or meaning (no influence) • Can reveal issues which are most important or findings which were not originally anticipated in survey • Answers/opinions can be qualified	• Difficulty for respondents to 'articulate' responses • Data collected is in the form of verbatim comments coding it into manageable categories can be time consuming for analysis • Respondents will tend to answer open questions in different 'dimensions' • The researcher needs a prior knowledge of the subject in order to generate realistic/likely response options

The questionnaire for this study was designed to contain more closed questionnaires than open ones. This was for the purpose of stimulating the respondent to articulate answers or provides answers on a preferred dimension determined by the researcher. Open-ended questions were only used where there need to have very large number of possible different responses.

3.1.2.6. Putting questions into a meaningful order

Clawford (1997) recommends that questionnaires should begin with questions that are clear and not threatening to the respondent to answer in order to stimulate the respondent's interest to participate. He further recommends that there should be a logical order of questions where one leads easily and naturally to the next.

In this study, the questionnaire was designed in such a way that questions on the same topic were grouped together in a logical order for interviewers and respondents to easily follow.

3.1.2.7. Pre-testing the questionnaire

In order to ensure that the questionnaire functioned well as a research tool in this study, the following methods were employed:

Validity method: This referred to the suitability, layout appearance, and arrangement of the questionnaire and the extent to which the methods of measurement included all major elements relevant to the construct being measured.

Firstly, a review of questionnaires used by other researchers was done, by examining the questions used. Through this process the author, generated further ideas of how best to approach and improve the questionnaire for this study. Employing existing questions allows one to use questions that in a sense have been piloted before (Bryman, 2004).

For this study, the main questionnaires that were examined were on the following studies; 'Understanding urban residential water use in Beijing and Tiajing, China (Zhang and Brown, 2004), 'Consumer assessment for water supply and sanitation in Lusaka, a publication of MLGH and The World Bank' (GKW, 2005b) and The ability to pay for individual connection household survey report (DTF/LWSC, 2006)

The questionnaire was also pre tested on LWSC staff and on a researcher at the Central Statistics Office of Zambia (CSO). After incorporating the remarks, the questionnaire was also piloted on 25 randomly selected households in George compound before start of data collection. In this study the method of piloting the questionnaire used was that recommended by (Burgess, 2001), where piloting should not be carried out on population who are to be members of the full study as this may result in "questionnaire fatigue", meaning the respondent is less likely to respond the second time round.

The idea of piloting is to refine the questionnaire, to reveal any unanticipated problems with the questionnaire: i.e. any issues with question wording, instructions to skip questions etc. It also helps the researcher to assess if the respondents understand the questions and if questions were going to yield useful answers. The results obtained through pre-testing of the questionnaire led the adoption of structured personal interviews as opposed to self completion questionnaires.

3.2. Description of study Area

3.2.1. Country Profile

Zambia is one of the African counties located in Central Africa. It lies between longitudes 22 deg. East and 33 deg. 40 minutes East, and latitudes 8 deg. 12 minutes South and 18 deg. 5 minutes south. Zambia is a land-locked country occupying a total area of 752,614 square km, shares borders with eight countries as shown in figure 1.1 Zambia has a total population of about 10 million (CSO, 2003). Lusaka is the Capital and administrative centre of the republic of Zambia. The population of Lusaka is estimated at 2 million and about 65% live in the peri-urban areas (CSO, 2000).

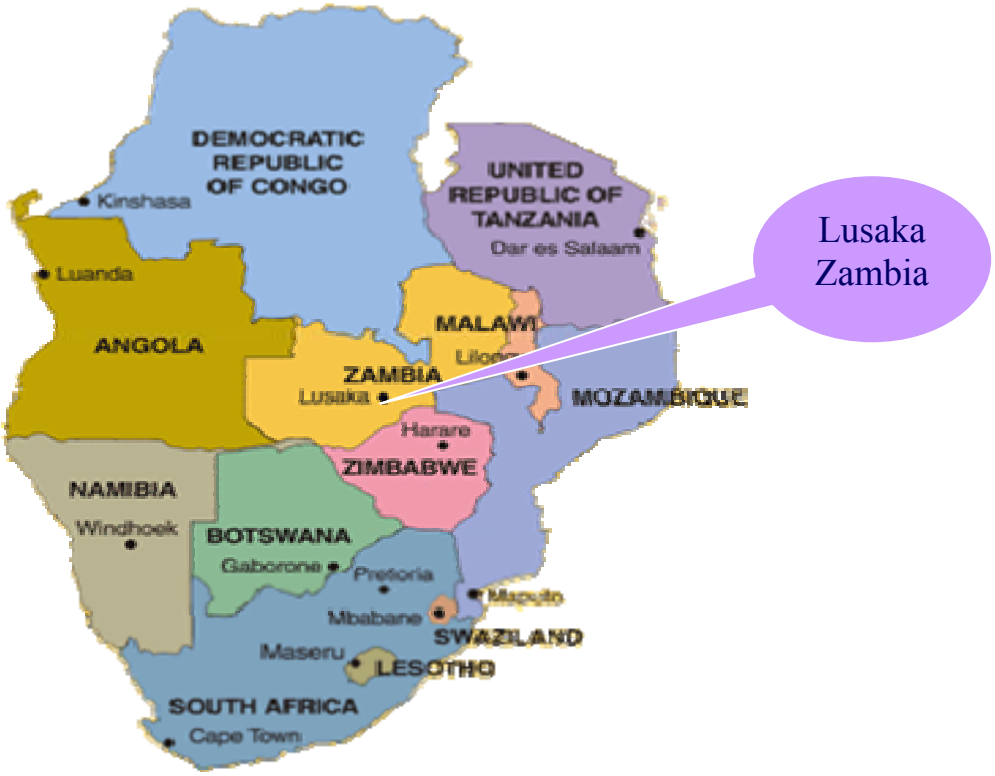

Figure 3-1: Map of the Southern Africa Development Community region showing Location of Lusaka in Zambia

Source: Modified from http://www.sadcreview.com/country_profiles/frprofiles.htm)

3.2.2. Overview of the Water and Sanitation Sector

The Water Supply and Sanitation sector in Zambia has been undergoing restructuring since early 1993 (MLGH, 2000). The water sector reforms are closely linked to the Public Service Reform Programme (PSRP) which aimed at the devolution of power from central government to local authorities as a basis for improving the efficiency and effectiveness of the public sector. The main objective of the water sector reform was to reorganize the water supply and sanitation sector so as to create new institutions that can provide cost effective, equitable and sustainable water supply and sanitation services in Zambia. The water sector reforms are as a result of the realization by policy makers, water sector professionals, donor agencies, and even consumers that the main constraint to water and sanitation service delivery in the country was weaknesses in the institutional, legal, and organizational framework of the sector (NWASCO, 2004b).

The first step in the implementation of the water sector reforms was the adoption of the National water policy principles. The policy principles are listed down in table 1-1 below:
Table 3-2: Water Supply Sector Principles

1) Separation of water resources management from water supply and sanitation. 2) Separation of regulatory and executive functions. 3) Devolution of authority [from central government] to local authorities and private enterprises. 4) Achievement of full cost recovery for the water supply and sanitation services through user charges in the long run. 5) Human resources development leading to more effective institutions. 6) The use of technologies more appropriate to local conditions. 7) Increased Government priority and budget spending to the sector

Source: NWASCO (2004)

The result of the Water Sector Reforms had been the development of a *National Water Policy (1994*) and the enactment of the requisite legislation, *The Water Supply and Sanitation Act No. 28 of 1997.*

The National Water Policy (1994) is aimed at promoting sustainable water resource development with a view to facilitating an equitable provision of adequate quantity and quality of water for all competing groups of users at acceptable costs and ensuring security of supply under varying conditions. The Policy recognises the need to establish a well-defined institutional structure that will achieve the intended policy objectives.

The Water Supply and Sanitation Act No. 28 of 1997 defines the institutional framework that would assure sustainable provision of water supply and sanitation services in the country. The Act seeks to promote provision of water supply and sanitation services in a commercially viable and sustainable manner and also gives responsibility for provision of water supply and sanitation to the Local Authorities.

3.2.3. Regulation of water supply and sanitation in Zambia

National Water and Sanitation Council (NWASCO) is the water supply and sanitation (WSS) regulatory body that was established under the WSS Act (1997) whose main functions are:

- To advise Government on Water supply and sanitation (WSS) matters.
- To advise local authorities on commercially viable institutional set ups for the provision of WSS services.
- To licence utilities and other service providers relating to the provision of WSS.
- To develop guidelines on WSS service provision, establishment of WSS utilities, the technical and financial management of WSS utilities and setting of WSS tariffs
- To establish and enforce standards for WSS service provision.
- To advise WSS utilities on procedures for handling complaints from consumers.
- To disseminate information to consumers on matters relating to WSS services.

3.2.4. Government's focus on service provision to urban poor areas

The Government of the Republic of Zambia (GRZ) 's focus on improving service provision for the urban poor addresses one of the most prominent needs in Zambia with regard to poverty eradication and to achieving the MDG's. Realising the importance of taking remedial measures to address this problem and taking into consideration the magnitude of the population being denied these basic needs, GRZ through NWASCO, under the WSS act no. 28 of 1997, established the Devolution Trust Fund (DTF) as an innovative basket funding instrument that pools funding from the GRZ as well as from other co-operating partners supporting GRZ in extending WSS service provision to the urban poor areas (DTF, 2006).

The DTF management reports to a board consisting of representatives from the Ministry Finance and National Planning (MoFNP), Ministry of Energy and Water Development (MEWD), Ministry of Local Government and Housing (MLGH), Ministry of Health (MoH) and the Water Watch Group (WWG), a consumer representative. This composition ensures a broad stakeholder participation in decision making at the DTF (DTF, 2006).

The Trust Fund was set-up to promote affordable water supply and sanitation services to the poor. Its aims are to maximise the amount of money going directly to the beneficiaries, ensure coherence of activities, transparency and accountability and maximising synergies from regulating and development efforts. The DTF reinforces the role of the commercial utilities (CU's) in extension and improvement of the service to the urban poor.

3.2.4.1. The DTF funding mechanism

DTF operates two funding portfolios called the General Fund (GF) and the Performance Enhancement Fund (PEF). The GF is to enable CU's to invest in appropriate low cost technologies in WSS for the urban poor areas and establish sustainable management systems while the PEF is aimed at enhancing the long term viability of the CU'S. The PEF are intended for measures that will either decrease costs or increase revenues such as addressing the WDM. The funds are given to CU's in the form of grants.

The CU's access funds from the DTF by first developing project proposals aimed at improving the WSS situation in the urban poor areas. With each successful proposal, the DTF signs a contract with the CU specifying the duties and obligations on both ends. Once funds are disbursed, DTF monitors the project progress and control the correct usage of the funds. Since commencing its operations in 2003, the DTF has been financing projects that will lead to achievement of the MDG's in the universal access to satisfactory WSS facilities for the urban poor in Zambia (DTF, 2006). Appendix 3-4 shows the DTF funded pilot projects in the CU's.

3.2.5. Water service provision in Zambia

The passing of the Water Supply and Sanitation Act (1997) has resulted in the formation of water utilities in the country to conduct the business of provision of water supply and sanitation services. Currently there are nine commercially licensed WSS utilities in Zambia (NWASCO, 2006). These are listed in table 1-3 below.

Table 3-3: Overview of commercial WSS utilities in Zambia

Commercial Utility	Abbreviation	Start of operation	No. of connections	No. of towns serviced	External Support *
Nkana WSC	NWSC	2000	73,656	7	ADB/DTF
Lusaka WSC	LWSC	1989	46,152	1	ADB
Kafubu WSC	KWSC	2000	36,250	3	DTF
Southern WSC	SWSC	2000	23,734	17	Germany
Mulonga WSC	MWSC	2000	20,341	3	DTF
Chambeshi WSC	CHWSC	2003	8,292	10	Ireland
Chipata WSC	CWSC	1992	5,266	1	Germany
North Western WSC	NWWSC	2000	4,426	7	Germany
Western WSC	WWSC	2000	6,616	6	DTF/Danida

Source: NWASCO (2006)

Overall access to safe water in Zambia is estimated at 67% of the population in the urban areas (inclusive of peri-urban) and 30% of the population in rural areas. This means that about 33% of the urban population are without access to clean portable water. There are a total of 372 peri urban areas in Zambia where majority of the urban poor live and only about 46% of the population have access to safe water (GKW, 2005a)

3.2.6. Water Supply in Lusaka

The study area, Lusaka is the capital and the biggest city in Zambia. It has a population of approximately 2 million people. The city covers an area of approximately 440 km^2. The LWSC is licensed utility responsible for the provision of water and sewerage services in Lusaka. LWSC was registered on 24th April 1988 as a private Company under the Companies Act of the Republic of Zambia and Lusaka City Council is the sole shareholder.

3.2.7. Water production in Lusaka

The average daily water production in Lusaka is 215 000 m^3 supplied from two sources; 43% surface water, from the Kafue river (65 km from Lusaka), and 57% groundwater from 72 boreholes in and around the Lusaka city area (LWSC, 2005). Water demands for the city of Lusaka are estimated at 390,000 m^3/day. This shows that the demands for water in Lusaka are far from being met. Most of the water distribution network was installed in the late fifties and early sixties and has now deteriorated leading to high water losses (LWSC, 2004a). Table 1-4 shows key indicators of water supply in Lusaka.

Table 3-4: Water production in Lusaka

Average daily water production (m^3/day)	Average daily water demands (m^3/day)	Service coverage (%)	hours of supply (hrs)	UFW (%)	Revenue Collection efficiency (%)
215,000	390,000	80	11	56	81

3.2.8. Billing and Collection

At present LWSC has 46,152 registered connections for water supply and 37% are metered. The indicated number of connections represent all categories of customers that LWSC services namely; industrial, commercial, institutions and domestic. The billing system is computerised.

Table 1- 5 shows the annual trends in customer base, billing, collections, collection efficiency and the UFW in Lusaka.

Table 3-5: Annual trends in billing and revenue collection in Lusaka

Year	2000	2001	2002	2003	2004	2005
Customers billed	30,845	31,018	33,791	36,263	38,831	45,872
Billing (Kwacha '000)	30,845	32,416	36,024	35,524	37,601	44,084
Collections (kwacha '000)	14,322	19,219	19,160	26,411	30,463	34,502
Collection efficiency (%)	46	59	53	74	81	78
Unaccounted for water (%)	-	58	59	56	54	54

The average monthly billing is K3.7 billion per month and the collection efficiency is estimated at 78% of the total billing. Bills are issued monthly and distributed to the customers manually. Payment is due two weeks after distribution of the bill.

LWSC applies the two types of tariffs for the domestic consumers, i.e. the rising block tariff for metered domestic consumers and the fixed charge tariff for the unmetered domestic customers. The rising block tariff that is applied on metered consumers is one where the first 6 m^3 have a low subsidised tariff (social band) and the next blocks have an increasing higher tariff. The rationale is to promote water saving practices within all households and to ensure that low income households can afford at least 30-35 litres/cap/day within the social band. The fixed charge is calculated according to the type of area or housing. Appendix 1-2, shows the current tariffs that LWSC is applying in Lusaka.

3.2.9. Peri urban water supply in Lusaka

3.2.9.1. Composition of peri-urban areas

Lusaka city alone has 33 peri-urban areas. They constitute a significant social group in the urban area with far reaching impacts in public health, politics, urban economy, labour relations and security. It is estimated that about 1.2 million people reside in the per-urban areas of Lusaka. Most of the peri-urban areas in Lusaka started as illegal

unplanned settlements and thereafter were regularised by the local authority into legal settlements (LCC, 2004) Most of these areas are densely populated and prone to high poverty. Basic services such as water supply, sanitation roads and drainages are in a poor state or non existent.

3.2.9.2. Other WSS service providers

The LWSC only provides water supply to 22 of the 33 peri urban areas. Water infrastructure in the other peri-urban compounds was installed by donor organisations such as the Japanese International Cooperation Agency (JICA), CARE international, DFID and the Irish Aid (World Bank, 2004). After construction, the water systems are handed to the communities to manage them as water schemes or water trusts. A water trust has a board with representation from LCC, LWSC, MLGH and local elected residents.

Over the last 12 years, a CARE project (CARE PROSPECT) installed or upgraded peri-urban systems in 10 compounds, five of which were handed over to LWSC. The remaining five are independent of LWSC and run as self-contained cost centres "Water Trusts", collecting revenue and managing it internally (Seur and Kangwa, 2005). It is estimated that the Water Trusts serve at least 20% of peri urban population in Lusaka while LWSC serves about 30%. LWSC's responsibility in the areas served by water trusts is only to offer technical advice. Even though water trusts are suppose to be regulated by LWSC being the utility licensed to provide WSS in Lusaka, this is not the case at the moment. Water trusts are currently self regulatory and set their own tariffs in consultation with the community.

3.2.9.3. Level of services in peri urban areas

The common level of service in peri urban areas of Lusaka is the public standpipes and yard connections with a small proportion of individual house connections (LWSC, 2004a). In some areas people are still using hand dug wells as a source of water. At present, there are 711 communal taps and 281 water kiosks in the peri urban areas of Lusaka. Appendix 1-2 contains a list of peri-urban areas in Lusaka, The pictures shown in figure 1-2 and 1-3 also shows examples of communal standpoints found in the peri urban areas in Lusaka. Figure 1-2 is a typical public standpipe while figure 1-3 is an improved communal standpipe (s) also known as an open kiosk. Kiosks are mostly metered and water is sold by prepayment method.

Figure 3-2: A communal standpipe in Kanyama township - Lusaka

Figure 3-3: An improved communal standpipe constructed by JICA in George in Lusaka

3.2.9.4. Billing methods

The following are the various revenue collection methods that are applied in the peri urban areas of Lusaka (LWSC, 2005c).

1. Communal standpipes and Kiosks
   - Monthly prepayment (scheme card) where a household is entitled to 6 m^3 of water per month
   - Daily payments (bucket sales) – paying on demand at a water point. This is the system considered by LWSC to be conducive for the poorest who cannot afford the prepayment.
2. Individual house connections
   - Fixed charge for un-metered connections (assessed consumption).
   - Billed consumption for metered house connections.

3.2.9.5. Revenue collection in peri urban areas

Figure 1-4 shows the trends in average annual revenue collection in the peri urban areas. From the chart indicates that there was a positive increase in revenue collection.

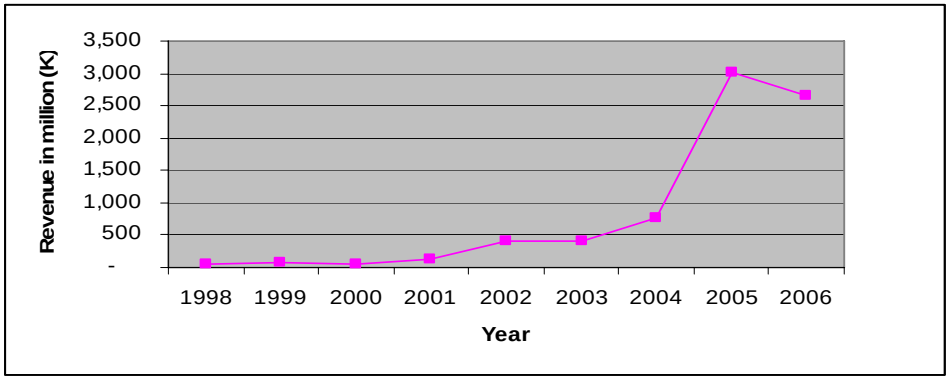

Figure 3-4: Trends in revenue collection in peri urban areas

Source: LWSC monthly reports for 2005 - 2006

3.3. Challenges in service provision to peri urban areas

The major challenges being faced in providing water to the peri urban areas according to LWSC (2005) are summarised:

3.3.1. Low revenue collection

The limited availability of finances affects the LWSC to improving services in the low income areas. There are severe problems with billing and revenue collection in the peri-urban areas, where LWSC supplies water. Water is essentially provided for free in many cases, and there is a lack of payment discipline. The social economic factors such as irregular incomes have further compounded the problem. The majority of consumers in peri urban areas are still unmetered. (LWSC, 2006b). In some areas, LWSC initially set up a system whereby water consumers pay their water fees to the Resident Development Committees (RDC's), but this was not successful and little revenue reached the company.

3.3.2. Inadequate community participation

Community participation in the delivery of water services in peri-urban areas is currently inadequate. This problem is more pronounced in the areas being supplied by the LWSC compared to the areas being run by CARE and JICA. CARE and JICA incorporated the concept of strong community participation, capacity building and community management in the water supply schemes they are involved in compared to LWSC (Banda, 1996). Communication between LWSC and low-income urban communities on a wide range of water related issues is not given sufficient attention. In many of the peri-urban areas, problems currently faced are largely due to a non psychological sense of ownership which has led to misuse of utility facilities e.g. vandalism, illegal connections and non-payment of bills.

3.3.3. Inappropriate policy and institutional arrangements

Service provision has been greatly affected by inappropriate institutional arrangements and unclear organisational mandates. Furthermore, there is also a lack of inter-agency coordination, particularly between Ministry of Local Government and Housing (MLGH), LWSC, Lusaka City Council (LCC) and other providers such as Donors have led to duplication of effort, contradictory actions or inconsistency in the approaches used. There is inadequate coordination between donors called by in GOVT to help finance WSS infrastructure in the urban poor areas and water utilities. Once donors pull out and water facilities are left in the hands of communities, its difficulty for water providers to offer technical advice on proper operations and maintenance to the community due to the mistrust. In most cases water utilities are only called in when the systems totally break down and fail to functions leading to duplication of efforts and loss of investment. The Kamanga water scheme in Lusaka is one of the examples of system failures due to lack of coordination.

3.3.4. Deplorable infrastructure

Most of the infrastructure in peri-urban areas is old and dilapidated resulting in numerous leakages in the system. This situation is as a result of lack of finances to maintain and develop new infrastructure. The problems of high leakages and illegal connections have largely contributed to the utility's high UFW in the peri urban areas (LWSC, 2006b). Most peri-urban areas receive intermittent supply and this leads to short opening hours of communal standpipes. This situation leads to long queues and waiting times, forcing communal tap users to buy water illegally from other sources.
The LWSC requires at least K50.6 Billion Kwacha[1] to re-capitalise the old water infrastructure in the peri urban areas (LWSC, 2005b).

3.3.5. Unplanned nature of communities

Most of the peri-urban areas in Lusaka started out as illegal unplanned settlements. They are overcrowded and lack the regular layout, access and way leaves for service lines. The overcrowding has also resulted in overloading of the services (LCC, 2000). The crucial challenge is meeting the growing demands for WSS in these crowded areas.

In the illegal peri-urban settlements LWSC is not currently servicing, the justification for lack of service is that settlement took place illegally or in a haphazard manner and is

[1] Bank of Zambia exchange rate €1 = K5,668 as at 30/03/07

not recognised. The lack of secure tenure or lack of compliance with building codes and standards makes any intervention in these areas problematic and risky. More critical however, is the concern amongst the Local authority that if pipes are installed in areas without legal status, their permanence may be seen as providing a stamp of approval or some degree of legitimacy to the residents.

3.4. Meeting the challenges of water to peri urban areas in Lusaka

The LWSC in its endeavour to carry out its obligation of providing water and sanitation services to the peri areas under the jurisdiction of the Lusaka City Council developed a peri urban policy. Through this policy, LWSC established a peri urban department in the year 2000 to specifically address WSS service provision in the peri urban areas (LWSC, 2005c).

The policy endeavoured to achieve the following;

- Improve the water supply service in the peri-urban areas to conform to the NWASCO service levels requirements.
- Improve the revenue collection in the peri-urban areas.
- Improve the provision of sanitation services in the peri-urban areas.
- Ensure that the service provision in the peri-urban is sustainable in the long term.
- To ensure that the company infrastructure in the peri-urban areas is well maintained and protected
- Promote involvement of the local communities and other stakeholders in the provision of sustainable and affordable WSS services to the urban poor

3.5. Water demand management in peri urban areas of Lusaka

The LWSC through its peri urban department has been implementing WDM in the peri urban areas since the year 2001 in order to address the following:

- Inadequate water supply,
- high unaccounted for water
- Capture the high unregistered customers
- Poor service levels
- Poor revenue collection

The LWSC has implemented WDM in seven of the twenty two peri urban areas where it supplies water namely: the George, Mtendere, Kalingalinga, Chawama, Kanyama, Garden and Chunga compounds.

For this study, only three peri urban areas namely; George, Kanyama and Mtendere were selected as case study. Description of the study areas and the WDM measures implemented each are outlined from section 3.5.1.

3.5.1. Selected case study areas

Three peri urban areas in Lusaka were selected for this study. The selection criterion was arrived at in consultation with the personnel working in the peri urban department of LWSC. The selection criterion was as follows:

- The area should have an improved water supply.
- The areas should be one where WDM has been implemented
- The main level of service should be either public standpipes, house connections, or a combination of both.

Table 3-6: Selected case study areas

Area name	Total Population	Total no. of households	Service provider	Level of service
George	179,012	29,835	Community water scheme	Communal Standpipes (80% metered)
Mtendere	59,121	9,854	LWSC	House connections (un metered)
Kanyama	82,629	13,772	LWSC	Standpipes and house connections. (metered + un-metered)

3.5.2. Determining the sample population

A sample in this study was defined according to Bryman (2004) as the segment of the population that is selected for investigation. Population was defined as the universe of units from which the sample is selected. In this study the sample population was the households which represented the population in peri urban areas.

A total sample size of 350 households was considered for this study. Taking into consideration the population and number of households in the study areas, the size of sample selected is shown in Table 3-4 below. Stratified random method of sampling was employed. The haphazardly built housing units and unclear walk routes and roads rendered housing typology not valid for determining sample populations in the study areas.
In George compound, the sampling frame used was the water supply zones since each zone consisted of communal standpipes which are used by consumers that live in that particular zone. Ten out of a total of twenty seven zones were selected as the sampling frame. In each of the 10 zones, 15 households using public standpipes were interviewed.

The Mtendere compound is divided into five sections (A to E) for local administrative purposes. Three sections namely A, B and C was selected as the sampling frame. A 100 households evenly distributed over the three areas were randomly interviewed i.e. selecting one household after every five houses.
In the New Kanyama area; the demarcation between the areas where public standpipes and house connections are located was used as the sampling frame with equal representation of each level of service. A total of 100 households, i.e. 52 using communal standpipes and 48 using house connections from each service area were randomly interviewed by selecting one household in every five houses.

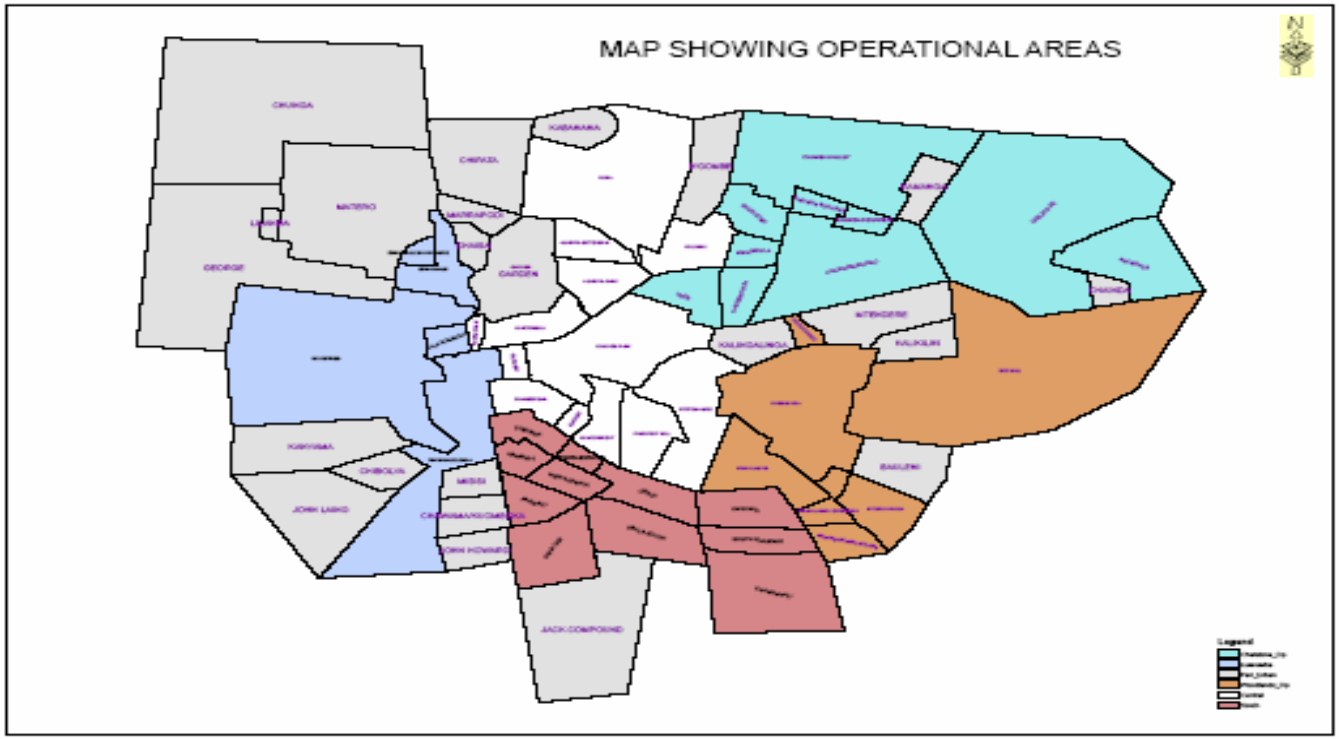

Figure:3-5: Operational areas of LWSC
Source : LWSC GIS database

Table 3-7: Sample distribution in case study areas

Area Name	Total Population	Total Households	Sample Size
George	179,012	29,835	150
Mtendere	59,121	9,854	100
Kanyama	82,629	13,772	100

3.5.3. George Compound

The George complex area is located on the northwest of Lusaka about 13 km from the main post. It has a population of 179,012 people. Like many peri urban areas, George compound is characterized by high population density and high poverty levels. The water supply scheme in George compound was financed through the Japanese Grant aid assistance solicited by the Government of Zambia to help alleviate the water problems and improve the poor hygienic conditions following a serious outbreak of cholera during the 1991-92 rain seasons. Cholera arose as a result water shortages and residents resorted to using shallow hand dug wells which were prone to contamination from pit latrines. The water scheme was implemented during the period 1993-2000 with a sole purpose to provide the residents with clean portable safe and affordable water of at least 35 litres per person per day. Along side the implementation of this project was the component of community involvement.

The water system in George is operated as an independent community water scheme. The water scheme bears its own costs, in terms of operations, maintenance, treatment chemicals, electricity and staff costs. All the personnel working in this scheme are recruited from within the community. LWSC being the legal owner of the project has full responsibilities of the assets and liabilities and seconds a manager to oversee the project.

3.5.3.1. The water supply situation

The George water scheme, for operational purposes is divided into eight (8) areas which are further sub-divided into twenty seven (27) zones. Each area has an independent water supply network supplied from an independent borehole and communal water facilities. The project is currently producing an average of 150,000 m^3/month of groundwater serving about 80% of the total population. Water is supplied to communal standpipes for 3-5 hrs per day.

Water is supplied mainly through communal facets and individual connections. There are 380 communal water faucets with an equal number of laundry faucets and 680 individual connections mostly serving institutions such as churches, commercial areas and some households. The communal taps are operated by tap attendants elected from within the zones in the community who are paid a 20% commission on the revenue collected. Each zone decides on opening time of public taps in consultation with LWSC.

Figure 3-6: Communal Standpipes in George Township

3.5.3.2. Billing and revenue

Two types of tariff categories exist; the pre-payment and the billed consumption. Communal tap users are on the pre-paid billing where each household purchases a scheme card at a cost of K6,600 per month which entitles them to fetch a maximum of 6kl per month an equivalent of 200 litres per day. Those with individual connections are billed according to consumption on a monthly basis. Consumers identified to be poor who cannot afford the prepayment are allowed to draw water at vending points at a cost of K100 per 20 litres of water.

80% of the communal and individual connections are metered and meters are read on a monthly basis. The total registered communal standpipe users is 18,088 households while the average monthly revenue collection was at K160 million (LWSC, 2006a)

3.5.3.3. WDM measures in George compound

The WDM measures that are being implemented in George area as follows

- **Metering:**

The policy of the George water scheme is to ensure that all water points are metered i.e. from the production boreholes up the points where customers draw their water. Currently 80% of the communal standpipes are metered. Meters are read on the monthly basis and reconciled with the sales to account for the water.

- **Prepayment system (scheme card)**

The prepayment systems have been compulsory implemented on all communal standpipes. The prepayment system was for the purpose of limiting consumption to $6m^3$ per household per month and also to improve revenue collection. As at December 2006 there were 18,800 registered households on the prepayment scheme compared to the 16,600 in the year 2003. Individual connections are billed according to consumption. Vending points have also been opened up for the poorest who cannot afford to the prepayment scheme to access the water at a cheaper rate.

- **Water loss management**

The George water scheme has a maintenance program of fixing all identifiable leaks within service level standards. Residents are encourages to report water leakages to the

authorities or through tap attendants. Locking devices are also fitted on the communal taps to minimise wastage or theft of water after tap is closed.

- **Awareness campaigns**

Awareness programs on WDM focussed on promoting payment for water, water saving, discourage vandalism of water facilities and minimising wastage at the taps. The campaigns are conducted in liaison with the community representatives (water committees). The campaigns are disseminated through community meetings and drama or public performances and announcements.

Performance indicators of WDM in George are summarised in the table 3-4 below:

Table 3-8: Performance of WDM in George compound

WDM measure	**Performance indicators**
Metering	80% metered communal standpipes by December 2006
UFW	Reduced UFW to about 15%
Registration of water consumers	18,880 registered customers in 2006 compared to 16,600 in 2003
Improved payments	Average monthly revenue increased from K588 million in 2003, K691 million in 2004 and K1,290 million in 2006.
Water loss management	Fixed 80 – 90 % of reported leakages
Awareness raising	Reduced vandalism, strengthened community involvement through water committees

Source: (LWSC, 2006b)

3.5.4. Mtendere Compound

Mtendere is a densely populated compound located on the eastern side of Lusaka city about 10 km from the main post office. It has a total population of 59,121 people consisting of 9,854 households (DTF/LWSC, 2006). The area was well planned and has a systematic layout of houses and roads.

3.5.4.1. Water supply situation

LWSC is the licensed service provider supplying piped water supply to Mtendere area. Water is supplied to Mtendere from the 7C pumping station in the surrounding Kalingalinga compound. The water supply situation in Mtendere is considered good and supplied for 10 hours daily. Average water production is 356 m^3/day while demand is estimated at about 840 m^3/day. The water demands in Mtendere are far from being met.

The level of service in Mtendere compound consist of individual house connections with a few communal standpipes located at public places such as markets and schools. All the water connections in Mtendere are not metered.

3.5.4.2. Billing and revenue

Since Mtendere area is unmetered, the LWSC applies the monthly fixed charge tariff. The monthly fixed charge is K34,800 per household per month. The monthly average billing for Mtendere is K35.2 million while collections stand at K22.9 million per month. Total number of connections is 1,358 (LWSC, 2006b)

3.5.4.3. WDM measures in Mtendere compound

The WDM measures that have been implemented in Mtendere are summarised in the table 3-5 below:

- **Metering**

Although metering is one of the measures planned, LWSC has not yet started installing meters in Mtendere. All the house connections are unmetered.

- **Data base cleanups**

This is being conducted through identification of illegal connections, registration of customers, validating of billing database according to customer types, timely production of monthly bills

- **Water loss management**

This is being done through prompt repair of leakages in the distribution network and disconnecting identified neglected leaking taps within customer premises.

- **Disconnecting defaulting customers**

Consumers that are in arrears are given notice to pay up and afterwards disconnections are carried out for the unpaid bills.

- **Awareness (sensitisation programs)**

Awareness programs are regularly carried out to promote payment for water, minimise wastage and encourage reporting of water problems and making payments at a new centre opened up within the community.

Table 3-9: performance of WDM measures in Mtendere

WDM measure	Performance indicator
Metering	On repair and installation of Bulk meters was done
UFW	Reduced from 64% to 56%
Registration of water consumers	1884 registered customers during 2004 – 2006
Efficient Billing	Average monthly revenue was K16.5 million in 2005 and increased to K25.6 million per in 2006[2]
Water loss management	70% of the major water leaks are resolved within the service hours
Awareness raising	Reduced vandalism, Increased revenue collection LWSC opened up of a pay point within the community to encourage payments

Source: (LWSC, 2006b)

[2] Bank of Zambia Exchange rate €1= K5,668 as at 30/03/07

3.5.5. Kanyama Compound

New Kanyama is a peri urban settlement located in the central part of Lusaka city with a population of 82,629 people and 13,772 households. The compound is comprised of two sections. One part started as an unplanned settlement called new Kanyama and the other area called Kanyama Site and Service is well planned with decent housing units. Like many peri urban areas, Kanyama is a compound that is characterized by high population density conditions with most of the population being in the low-income groups (DTF/LWSC, 2006).

3.5.5.1. Water supply situation

LWSC is responsible for the supply of water to Kanyama area. Water supply for this area is abstracted from boreholes which are operated on a 24 hours basis. The level of service in Kanyama consists of both individual and communal taps. Individual house connections are mainly in the site and service area while the area which started as unplanned settlement is serviced by communal standpipes. Water production is estimated at 4,392m^3/day while water demand for the area is estimated at 5,017m^3/ day. The area is prone to high water leakages in the network due to poor state of infrastructure, high prevalence of illegal connection, low payment for water, dilapidated and vandalised communal facilities and poor community participation.

In an effort to improve service provision to Kanyama, Lusaka water applied for funding from the DTF amounting to €30,000 under the PEF portfolio in 2005. The funds were meant for increasing service coverage, reducing UFW, improving infrastructure efficiency and strengthening utility capacity as well as the local community. At the time of survey, LWSC was executing the DTF funded project in the area.

3.5.5.2. Billing and revenue collection

Four types of tariff systems are applied in Kanyama area;

The monthly fixed charge for un metered house connections and billed consumption for metered house connections according to the LWSC tariffs attached in Appendix 1-2.

For the public stand pipes users; The pre-payment system where households buy scheme cards at K6,600 which entitles them to 6 m^3 of water per month and container method where consumers pay K100 per 20 litre container. This container method is meant to serve the poorer people who can't afford the prepayment and also to deter illegal vending. There are 650 registered domestic water connections and 13 public stand posts in Kanyama.

3.5.5.3. WDM measures in Kanyama compound

The WDM measures that were applied in Kanyama as part of the terms of reference for the on going DTF funded project:

- Network extension to connect more customers
- Replace dilapidated network and repair major leaks
- Construct 6 no. new closed kiosks
- Upgrade 13 no. communal taps into open kiosks
- Metering all water kiosks and individual water connections
- Capture unregistered customers

- Bill all customers; communal taps, and kiosks according to meter reading
- Capacity building of utility staff and local community representatives
- Sensitise consumers on:
    - Kiosk management system
    - Kiosk payment system (prepayment system)
    - Preparing customers for the meter based billing
    - Promoting payment for water
    - Promote sense of ownership to reduce vandalism

The project commenced in the first quarter of year 2006. the following were the improvements achieved as shown table 3-6:

Table 3-10: WDM measures in Kanyama

WDM measure	**Performance indicators**
Metering	400 house connections were metered to promote metered consumption
Construction of water Kiosks	6 open kiosks were under construction at time of survey
Registration of water consumers	550 individual connections were registered
Improved payments	Average monthly revenue increased from K6.3 million in 2005 to K8.1 million per month in 2006[3]
Water loss management	major water leaks and network upgrading were being resolved at time of survey
Awareness raising	Reduced vandalism, strengthened community involvement through water committees LWSC opened up of a pay point within the community to encourage payments

[3] Bank of Zambia exchange rate: €1 = K5,668 as at 30/03/07

3.6. Selected WDM measures for evaluation

From the list of WDM measures that are being applied in the three selected study areas, four key WDM measures were selected and adopted for assessment in this study, namely, metering, billing methods, tariff and awareness or sensitisation.

3.6.1. Metering

Metering was adopted based on the fact that LWSC has a policy of universal metering and metering was also being implemented in the study areas. Metering is also used as a regulatory tool by NWASCO to assess performance of water utilities. The aim was to determine how metering affected water consumption and payment for the water consumers using communal standpipes and those using house connections.

3.6.2. Billing methods

The policy of LWSC is to promote delivery of water to communal standpipe consumers in the peri urban areas through the kiosk system. Through this system, LWSC is promoting the prepayment method to control consumption and promote revenue collection. While for individual house connection, LWSC's policy is that of universal metering i.e. billed consumption for consumers with house connections. Four billing methods were selected: the prepayment and the container system for public standpipes and the fixed charge and bill systems for individual connections.

The selected WDM measures from the billing methods are the prepayment method for communal standpipes and the volumetric billed consumption for individual house connections. The container method and the fixed charge were only used for comparison purposes.

3.6.3. Tariff

Water pricing was adopted in this study based on the fact that pricing is an important no non structural incentive measure for demand management to achieve the objective of efficiency and sustainability of the scarce water resources Water pricing aims at achieving financial sustainability rather than an instrument for water allocation (Liu *et al.*, 2003). Only if financial costs are recovered will a water system be sustainable. Water utilities aim to make reasonable pricing to recover the cost and attain financial sustainability.

The aim was to assess if tariff increase affected water consumption for communal standpipes users. The assessment was limited to consumption since majority of the consumers were on prepayment. While individual house connections the aim was to assess how tariff increase affected payment since majority of the house connections are not metered.

3.6.4. Sensitisation

Sensitisation was selected on the basis that LWSC has adopted a customer focused communication strategy to reach out to the urban poor in promoting water saving, discouraging vandalism, encouraging community participation, and educating consumers on metering and promoting payment. The fact that LWSC has adopted awareness and education programs in the WDM programs makes it critical to be considered for evaluation and determine how it effected water consumption and payment.

3.6.5. Survey implementation

The field survey was conducted over a period of three months; November 2006 to January 2007. College graduate students were hired as interviewers and were trained on how to administer personal interviews using the questionnaire. Prior to actual data collection, familiarisations tour to study areas was conducted. A total of 350 households were interviewed using the questionnaire.

Questionnaires used in the survey were checked for completeness and then coded into systematically interpretable numeric formats using the SPSS for the statistical analysis. Coding data meant a simple and consistent way of representing each observation and making them easier to be entered into the software for further analysis. To do this, it is important to understand the different types of scales used to measure variables. For example, gender being a variable with only two categories i.e. male or female, 1 was assigned to male response and 2 to female response; the numeric values are the ones that were entered in the SPSS spreadsheets.
In order to minimise errors, the data sets were checked for missing data or entries which could have arisen due to respondent's failure to answer or interviewers accidentally omitting to record some responses. Trial run in SPSS statistical software was also executed prior to the data analysis to determine and correct any outliers or errors in the data.

Secondary data related to the study was also collected from LWSC, NWASCO, DTF, MLGH, LCC and the WWG by direct interviewing and self completion checklists. Other relevant information to the study was collected through reviewing reports and publications on WDM, LWSC reports, NWASCO regulatory tools and sector reports and GRZ policy documents.

3.6.6. Constraints in data collection

- Inaccuracies in determining representative samples; the irregular unplanned nature of the study areas made it difficult to accurately determine the sample population there was a possibility of errors being introduced in sampling due to some of the inevitable assumptions made in sampling under the prevailing conditions.
- English language barrier; difficulties were faced in interpreting some of the questionnaire questions verbally into common local languages for the respondents who could not understand English.
- Difficulty in accessing consistent data on WDM. There were inconsistencies and poor data management on WDM in the peri urban areas at LWSC. There were also no clear and consistent records on WDM performance assessments. In some instances, assumptions had to be made by reviewing numerous LWSC reports.
- Uncooperative respondents; In Mtendere and Kanyama areas some respondents were asking to be paid before being interviewed. This affected the sampling program as houses where respondents were not cooperative had to be abandoned.

4. Data Analysis and Results

4.1. Background

This chapter gives an outline of the analysis of the data that was collected during the field survey in Zambia. The statistical package for social sciences (SPSS) computer program was used to analyse the collected data in this research.

The following constitutes the approaches that were employed in analysing the data:

- Defining the variable types
- Univariate analysis
- Bivariate analysis
- Summary and discussion of the results

4.1.1. Variables

A variable is defined as a characteristic of interest that varies from one item to another and may take any specified set of values or attributes (Bryman, 2004). Quantitative variables take several forms or levels of measurement which affect the method of data analysis. Distinguishing the different types of variables is crucial in determining the methods of analysis.

Quantitative variables are mainly expressed in the form of nominal, ordinal, interval, or ratio (Bryman, 2004). Variables can further categorised into independent or dependent variables (Morgan and Griego, 1998). An independent variable is one that is considered to have a causal effect on the other (i.e. a dependent variable) while a dependent variable is one that is causally influenced by another variable (i.e. an independent variable). Dependent variables are expressed as ratings or scores in questionnaires.

Nominal variable are non numeric and have no inherent order. For purposes of data analysis, numbers are usually assigned to the attributes of a nominal variable as labels and must not be interpreted as conveying the order of the attribute. Persons, things, and events characterized by a nominal variable are not ranked or ordered by the variable.

An ordinal variable is non numeric and its attributes are ordered. Ordinal scales are seen in questions that call for ratings of quality (for example, very good, good, fair, poor, and very poor). For purpose of data analysis, numbers are assigned to the attributes, but the numbers are understood to indicate rank order and the "distance" between the numbers has no meaning.

The attributes of an interval variable are assumed to have equal intervals between the categories and are identical across a range of categories. An example of an interval/ratio variable in this study is the water payments or age of respondents or monthly incomes

In this study, variables were expressed in the form of the questions in the questionnaire. The values or attributes were the responses to the questions in the questionnaire which were expressed in numeric and non numeric forms. The independent variables were the selected WDM instruments that the water provider was applying in the study areas,

while the dependent variables were parameters which the instruments were to influence; in this case; water consumption and payment.

4.1.2. Variables for analysis from the questionnaire

Responses that were collected on questions in the questionnaire that were probing on water consumption and payment were utilised in the data analysis. The analysis was in two parts: i.e. one for respondents using communal standpipes and the other for respondents with individual house connections.

4.1.3. Univariate analysis

According to Bryman (2004), univariate analysis refers to the analysis of one variable at a time. In this study univariate analysis was executed in SPSS and data was presented and interpreted through frequency tables and frequency diagrams. Other outputs such as the mean, median, mode and standard deviation (sd), were also generated in SPSS to further interpret the data.

4.1.4. Bivariate analysis

Bivariate analysis is the analysis of two variables at a time in order to uncover whether the two are related (Bryman, 2004). Exploring the relationship between variables means searching for evidence that the variation in one variable coincides with variation in the other (Green and Salkind, 2003). A variety of techniques are available for examining these relationships but their use depends on the nature of the variables.

In this study, bivariate analysis was executed in SPSS by cross tabulating the independent and dependent variables under consideration. The results obtained in the contingency tables were then discussed in relation with information on collected on WDM in the study area.

Determination of the degree of the relationship between the variables and testing for statistical significance was out of scope of the study. Therefore the discussion and interpretation of results arising from this study will be based on surveyed areas only and not generalised to other peri urban areas.

4.2. Results and Discussion

This section provides the analysis of data that was collected from the field survey and processed in SPSS. The chapter will consist of the following; firstly, data on demographics and social economic status of the sample will be displayed which will include; sample sizes, gender, age, family size, income and literacy level. Secondly, water related data will be displayed i.e. water sources, distances to water points, supply hours, water collection methods, water use patterns and payments. In the third stage, the results arising from the analysis of the effects of the WDM measures on consumption and payment will be displayed. The last part of the chapter will involve determination of the most effective WDM measures arising from the results of the data analysis.

4.2.1. Demographics of sample

Table 4-1: Population and sample size in study areas

Study area	Population	No. of households	Sample size (households)
George Compound	179, 012	29,835	150
Mtendere Compound	59,121	9,853	100
Kanyama Compound	82,629	13,771	100
Total	320,762	53,359	350

Three peri urban areas, in Lusaka were selected for the study as shown in table 4-1. A total of 350 households participated in the study, consisting of 202 communal standpipe users and 148 using individual connections were interviewed in this survey.

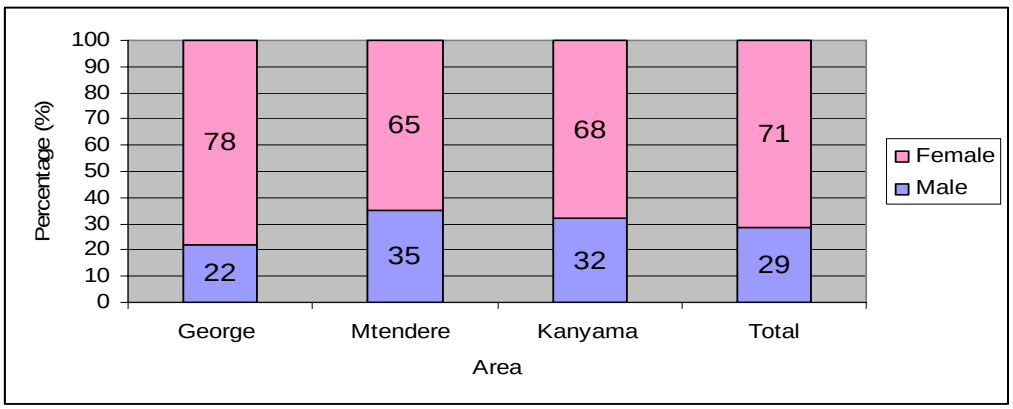

Figure 4-1: Gender in sample population per area

Based on the survey, 71% of the respondents were the female. Female respondents were the ones mostly found at the homes visited during the survey. Field observations also revealed that it was mostly the women or girl children that were seen fetching water at the water points.

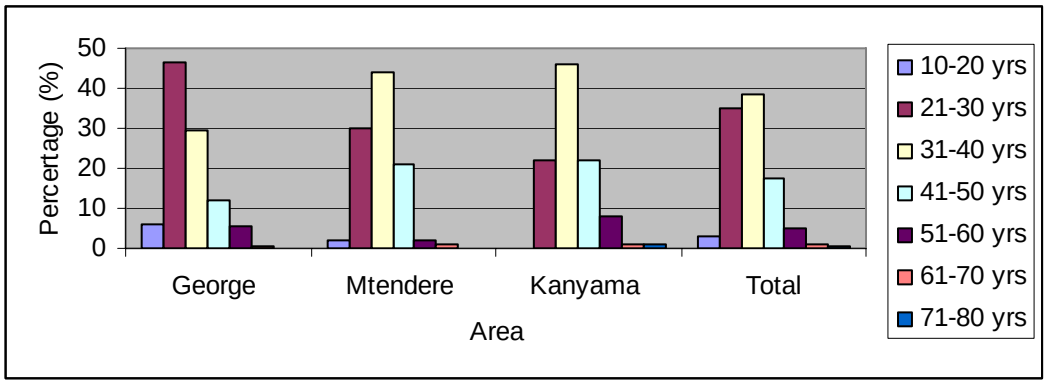

Figure 4-2: Age distribution in sample population

The average age in the sample population was in the range 31-40 yrs (figure 4-2). In George compound 47% of the respondents were in the age group 21-30 years and in Kanyama and Mtendere, 43% to 45% of the respondents were aged 31– 40 years old.

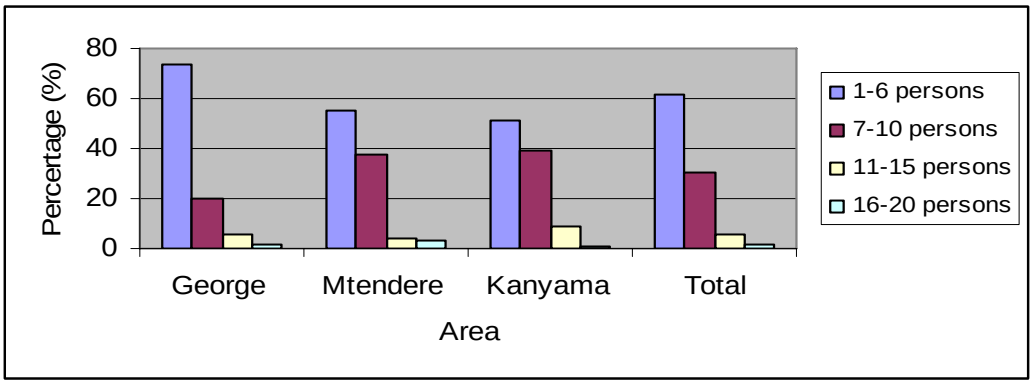

Figure 4-3: Family sizes in sample population

The mean family size of the respondents in the survey was 7-10 persons. The Central Statistics office (CSO) of Zambia (2000) estimated the average family size in the densely populated urban areas to be 6–8 persons per family.

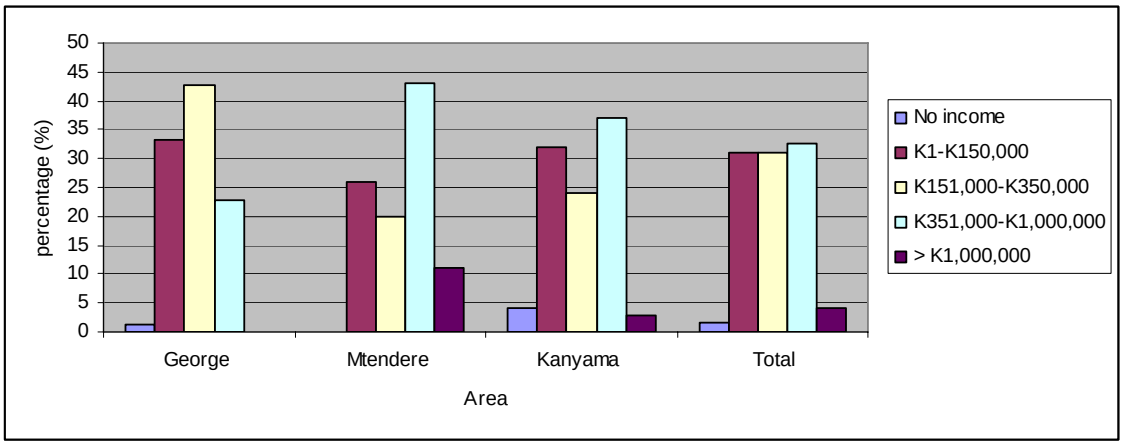

Figure 4-4: Household income per month in sample population

The average monthly income of the respondents (figure 4-4) was in the range K150,000 to K350,000 (€26 to €62). The CSO, January 2007 food basket for a family of six members was K699,253 (€123) and also for the same size of family to afford all the food and basic needs which include paying for utility bills, they needed to earn at least K1,133,995 (€200).

The CSO defines food basket is an average amount of money that a family of at least six persons can spend on the basic food needs in a month. CSO uses food basket as one of the indicators of poverty. From the results 60-70% of the respondents were earning income below the food basket, therefore were considered poor.

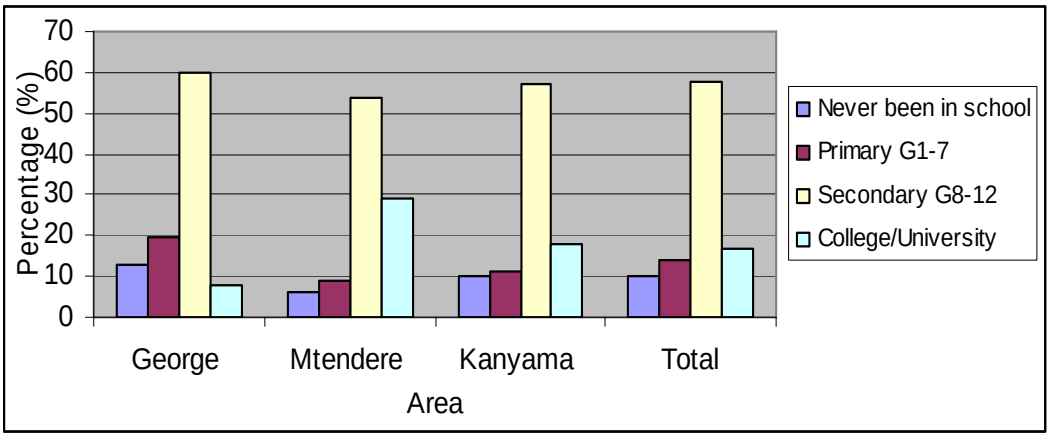

Figure 4-5: Literacy level of the respondent's head of household

Based on information presented in figure 4-5, about 50% of the heads of the households have attained a secondary school level of education while 10% have never attended school. Almost 60% of the heads of households in the sample have attained secondary school education.

4.2.2. Water related data in study areas

Figure 4-6, shows the previous water sources the respondents were using before resorting to their main current sources shown in figure 4-7. This information was collected to assess if there were improvements in the level of services in the study areas.

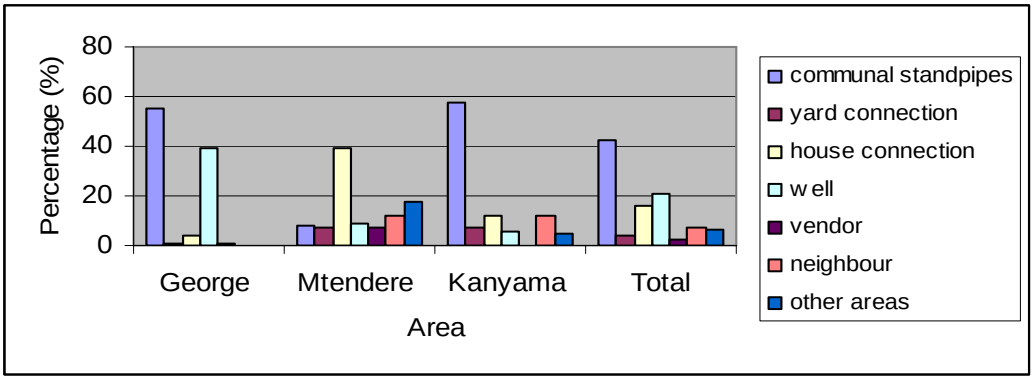

Figure 4-6 : Previous Water sources for the respondents

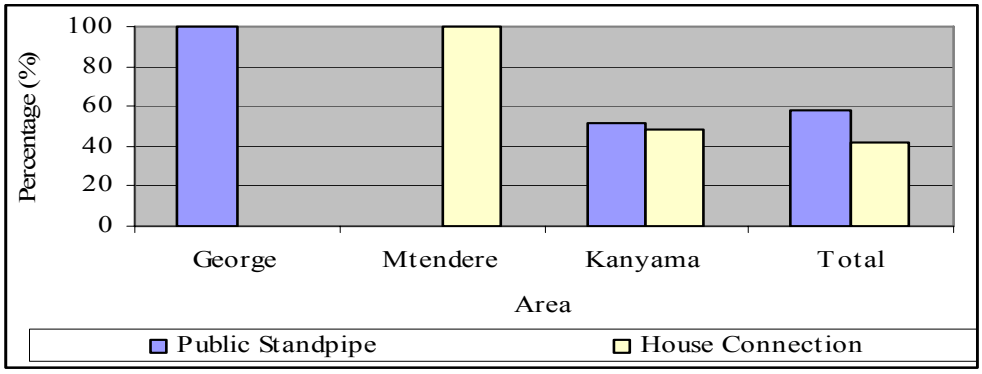

Figure 4-7: Sources of water in the study area

Figure 4-7, shows the sources of water in the study areas that the respondents were using. The sample size in terms of level of service was; 150 (100%) respondents in George used communal standpipes, of the 100 (100%) respondents in Kanyama 52% were using communal standpipes 48% on house connections and 100 (100%) respondents in Mtendere were using house connections. The total sample sizes in terms of level of service were 202 respondents using communal standpipes and 148 using house connections. Data analysis in the proceeding sections will be analysed in terms of levels of service i.e. communal standpipe and house connections.

Table 4-2: Reasons for choosing to use existing water sources in study areas

Reasons for using current water source	**count**	**Currently using Communal Standpipes**			**Currently using House connections**		**Total**
	%	George Compound	Kanyama Compound	Total	Mtendere Compound	Kanyama Compound	
Distance	no	35	30	65	39	72	111
	%	23.3%	57.7%	32.2%	81.3%	72.0%	75.0%
Cost	no	5	6	11	10	10	20
	%	3.3%	11.5%	5.4%	20.8%	10.0%	13.5%
Improved quality	no	87	16	103	10	26	36
	%	58.0%	30.8%	51.0%	20.8%	26.0%	24.3%
Good Pressure	no	4	7	11	6	11	17
	%	2.7%	13.5%	5.4%	12.5%	11.0%	11.5%

Table 4-2 is interpreted in relation to figure 4-6 and 4-7 above. In George area, 58% of the respondents considered water quality as a reason for using communal standpipes. If we compare figure 4-6 and figure 4-7 for George, we see that 40% who used shallow wells are now using tap water indication an improvement in the level of service. The past experiences with cholera outbreaks in George could be a reason why a high percentage of respondents now draw water from the public standpipes as opposed to the wells which are prone to contamination.

In Kanyama area, if we compare figure 4-6 and 4-7; the percentage of respondents using standpipes reduced while those using house connections increased and this could be a reason why over 72% mentioned distance as reason to using house connections in

Kanyama. Changing from public standpipes to house connection is considered an improvement in level of service.

In Mtendere, 81% of respondents rated distance as reason for using house connections. If we compare with the respondent's previous water sources for Mtendere in figure 4-6, we see that the number of respondents using house connections increased compared with the previous sources of water which were lower in terms of level of service.

Table 4-3: Distance to communal standpipes

Distance	Count and % within each category	Area		Total
		George Compound	Kanyama Compound	
Within 100m	Count	142	37	179
	% within - location	94.7%	71.2%	88.6%
>100m - 400m	Count	7	13	20
	% within - location	4.7%	25.0%	9.9%
More than 400m	Count	1	2	3
	% within - location	.7%	3.8%	1.5%
Total	Count	150	52	202
	% within - location	100.0%	100.0%	100.0%

Majority of respondents (Table 4-3) live within 100 m distance from the stand posts. The utility is constructs communal standpipes within 50 m to increase access to water. The DTF baseline study (2006) recommends a distance within 150 m. Accessibility to communal water points was higher in study areas.

Table 4-4: Supply hours for communal standpipes

Daily supply hrs	Count and % within each category	Area		Total
		George Compound	Kanyama Compound	
1 – 3 hours per day	Count	106	5	111
	% within- location	70.7%	9.6%	55.0%
3 – 5 hours per day	Count	41	5	46
	% within - location	27.3%	9.6%	22.8%
5 - 8 hours per day	Count	3	34	37
	% within - location	2.0%	65.4%	18.3%
8 - 24 hours per day	Count	0	8	8
	% within - location	.0%	15.4%	4.0%
Total	Count	150	52	202
	% within - location	100.0%	100.0%	100.0%

Table 4-4 show that 71% of the respondent's in George draw water from standpipes that are opened 1-3 hours per day, while in Kanyama 65% of the respondent's taps are opened for 3 - 8 hrs. The NWSCO (2006), estimated 11 hours as average supply hours in Lusaka. Actual supply hours differ area by area in Lusaka. According to LWSC, most peri urban areas receive intermittent supply of 5 to 8 hours (LWSC, 2006b). Supply hours in George were lower than the LWSC estimated hours.

Table 4-5: Supply hours for individual house connections

Daily supply hrs	Count and % within each category	location		Total
		Mtendere Compound	Kanyama Compound	
1- 3 hours per day	Count	7	3	10
	% within - location	7.0%	6.3%	6.8%
3 - 5 hours per day	Count	24	20	44
	% within - location	24.0%	41.7%	29.7%
5 - 8 hours per day	Count	21	2	23
	% within - location	21.0%	4.2%	15.5%
8 - 24 hours per day	Count	48	23	71
	% within - location	48.0%	47.9%	48.0%
Total	Count	100	48	148
	% within - location	100.0%	100.0%	100.0%

Table 4-5 show that 48% of respondents using house connections are receive water for 8 to 24 hrs. LWSC supplies water to Mtendere for 10 hrs per day and on 24 hrs basis to Kanyama area.

Table 4-6: Daily water use for households on communal standpipes

Area	N	Minimum (l/day)	Maximum (l/day)	Mode (l/day)	Mean (l/day)	Median (l/day)	Std. Deviation
George Compound	150	10	400	200	135.4	120	62.783
Kanyama Compound	52	10	200	120	114.6	110	53.375

The maximum daily water allocation per household using prepayment is 200 liters. The average amount consumed in the two study areas is below the daily allocation as shown in table 4-6.

Table 4-7: Water collection methods from communal taps

Methods of collection	Count and % within each category	Area		Total
		George Compound	Kanyama Compound	
20 liter containers	Count	144	50	194
	% within - location	96.0%	96.2%	96.0%
200 liter drums	Count	2	2	4
	% within - location	1.3%	3.8%	2.0%
Other Unspecified containers	Count	4	0	4
	% within - location	2.7%	.0%	2.0%
Total	Count	150	52	202
	% within - location	100.0%	100.0%	100.0%

The 20 liter plastic containers are a common method of carrying water in the urban poor areas of Lusaka. The observation made was that plastic containers are lighter, easy to carry even by children and are sold at an affordable price of K50. The 20 litre containers are used as a means for tap attendants to accurately determine volumes of water drawn.

Table 4-8: Monthly water payments for communal standpipe users

Area	No. of respondents	Minimum (K)	Maximum (K)	Mean (K)	Mode (K)	Std. Deviation
George Compound	150	600	27,000	6,821	6,000	2,366
Kanyama Compound	52	3,000	27,000	9,559	6,000 and 15,000	6,069

The tariff for public standpipe is K6,600 for $6m^3$ of water per month per household on prepayment and K50 per 20 litres for the container system. The average amount paid per household in George area is almost equivalent to the tariff while in Kanyama, the standard deviation is high due to variation in payments i.e. prepayment and container methods.

The cost per 20 litre container for the respondents on prepayment is K22 per 20 litres which is cheaper than those considered to be "poor' who pay the daily rate of K50 per 20 litre container of water. Even though the daily rate is meant for the poorest, it turns out to be more expensive for the same quantity of water as the prepayment in the long run.

Table 4-9 : Monthly water payments for house connection

Area	No. of respondents	Minimum (K)	Maximum (K)	Mean (K)	Std. Deviation
Mtendere Compound	100	2,000	50,000	29,917	11,642
Kanyama Compound	48	0	45,000	27,366	13,347

Variation in the amounts paid could arise due to the fact that some consumers are metered while others are not or possibly others are paying in installments or in arrears. Metered connections are charged on the actual volumes of water consumed while un-metered are on fixed charge (assessed consumption). The tariff for un-metered house connections in the low cost areas is K34,800 per month. [4]

[4] Bank of Zambia exchange rate: €1 = K5,668 as at 30/03/07

4.2.3. The effect of metering on consumption

This section gives an analysis of the effects of metering on consumption patterns of respondents that were using communal standpipes and those on individual house connections. The analysis is based on the outputs from the data processed in SPSS.

4.2.3.1. Metering status

Table 4-10: Is the communal standpipe metered?

Metered?		Count and %	Location		Total
			George Compound	Kanyama Compound	
is the communal standpipe metered	Yes	Count	62	12	74
		% within - location	41.3%	23.1%	36.6%
Total		Count	150	52	202
		% within - location	100.0%	100.0%	100.0%

Table 4-10 show that 74 (36.6%) respondents draw water from metered standpipes out of a total of 202 that are using communal standpipes. This consists of 62 respondents from George and 12 in Kanyama are using metered communal standpipes.

Table 4-11: Is the house connection metered?

Metered?		Count and % within	Location		Total
			Mtendere Compound	Kanyama Compound	
metered connection	Yes	Count	12	41	53
		% within - location	12.0%	85.4%	35.8%
Total		Count	100	48	148
		% within - location	100.0%	100.0%	100.0%

Table 4-11 show that 53 (35.8%) of the 148 respondents using individual house connections are metered, i.e. 12 respondents in Mtendere and 41 in Kanyama.

4.2.3.2. Consumption change due to metering

Table 4-12: Consumption change for metered - communal standpipe users

Consumption change		Count and percentage	Location		Total
			George Compound	Kanyama Compound	
how consumption changed due to metering	Reduced use	Count	33	8	41
		% within - location	53.2%	66.7%	55.4%
	Increased use	Count	7	0	7
		% within - location	11.3%	.0%	9.5%
	No change	Count	22	4	26
		% within - location	35.5%	33.3%	35.1%
Total		Count	62	12	74
		% within - location	100.0%	100.0%	100.0%

Is the communal standpipe metered = Yes

Table 4-12, show that metering was more effective on reducing consumption since majority (55.4%) of the 74 respondents who drew water from metered standpipes reduced their consumption. Those whose consumption did not change accounted for 35.1% and 9.5% increased consumption.

Results in table 4-12a below also show that despite the difference in size of sample, metering had more effect on influencing reduction in water consumption since for both prepayment and container method, majority of the respondents reduced their consumption.

To determine the variation in consumption due to effect of metering, a cross tabulation was done between the daily water use and consumption change due to meter shown in the Appendix 4-1 table 1. The analysis on effect of metering was limited to George area since sample size for Kanyama was not large enough for adequate interpretation. The result show that majority of the respondents that had reduced consumption were those consuming 150 -200l/day (high water consumers) while those consuming less water (50-100 l/day) were less likely to reduce consumption

Table 4-12a: how consumption changed due to metering * method of payment (a)

(Communal standpipes)

how consumption changed due to metering		Count and % in each category	method of payment for water		Total
			Per container	Scheme card	
how consumption changed due to metering	Reduced use	Count	6	35	41
		% within method of payment	54.5%	55.6%	55.4%
	Increased use	Count	0	7	7
		% within method of payment	.0%	11.1%	9.5%
	No change	Count	5	21	26
		% within method of payment	45.5%	33.3%	35.1%
Total		Count	11	63	74
		% within method of payment	100.0%	100.0%	100.0%

a - is the communal standpipe metered = Yes

Table 4-13: How consumption changed due to metering- house connection

Consumption change for metered users		Count and percentage	Location		Total
			Mtendere Compound	Kanyama Compound	
consumption changed due to metering	Reduced use	Count	5	31	36
		% within - location	41.7%	75.6%	67.9%
	Increased use	Count	0	4	4
		% within - location	.0%	9.8%	7.5%
	No change	Count	7	6	13
		% within - location	58.3%	14.6%	24.5%
Total		Count	12	41	53
		% within - location	100.0%	100.0%	100.0%

Metered connection = Yes

In table, 4-13, we observe that 67.9% of the total number of respondents with metered house connections reduced their consumption i.e. 75.6% in Kanyama and 41.7% in Mtendere. Similarly also 24.5% of the respondents did not change their consumption. i.e. 7 respondents in Mtendere and 6 in Kanyama.

Since Mtendere is considered un metered with a small sample size of metered respondents, the results were not used in the analysis except for comparison purpose.

In Kanyama area, since 85.4% of the respondents are metered (table 4-11) and also that 68.8 % are on the billed consumption (table 4-19), it is deduced that the majority of those that are metered could be reducing their consumption. To confirm this statement, the cross tabulation showing consumption change due to metering and method of payment in table 4-13a below, show that the majority of the respondents that reduced consumption were those on the billed consumption than the fixed charge. The result shows that metering has a more effect on influencing consumers on volumetric billing to reduce water consumption.

Table 4-13a: consumption changed due to metering * method of payment (a) (House connections)

consumption changed due to metering		Count and percentage	method of payment		Total
			Bill	Fixed charge	
consumption changed due to metering	Increased use	Count	2	2	4
		% within - method of payment	6.1%	10.0%	7.5%
	Reduced use	Count	26	10	36
		% within method of payment	78.8%	50.0%	67.9%
	No change	Count	5	8	13
		% within method of payment	15.2%	40.0%	24.5%
Total		Count	33	20	53
		% within method of payment	100.0%	100.0%	100.0%

a - metered connection = Yes

4.2.4. The effect of metering on payment

This section gives an analysis of the effects of metering on payment for respondents that were using communal standpipes and those on individual house connections from the study areas.

4.2.4.1. Payment change due to metering

Table 4-14: How payment changed due to metering

(**Metered standpipe users**)

Change in payment		**Count and percentage**	**Location**		**Total**
			George Compound	**Kanyama Compound**	
how payment changed due to metering	Started to pay more	Count	39	10	49
		% within - location	62.9%	83.3%	66.2%
	no change in payment	Count	17	1	18
		% within - location	27.4%	8.3%	24.3%
	Started to pay less	Count	6	1	7
		% within - location	9.7%	8.3%	9.5%
Total		Count	62	12	74
		% within - location	100.0%	100.0%	100.0%

Is the communal standpipe metered = Yes

The result in table 4-14 show that, out of the total of 74 respondents drawing water from metered standpipes, 66.2% started to pay more for water, i.e. 39 (62.9%) in George and 10 (83.3%) in Kanyama. Similarly also 24.3% of the 74 respondents did no change the way they paid for water and 9.5% started to pay less.

To confirm further if metering had an effect on payment a cross tabulation between the variables; how payment changed due to metering and monthly payment for water and the output is shown in the appendix 4-2 table 2. The result show that the 39 respondents in George that had started to pay more, 38 belonged to the group that was paying K6,600 for water per month i.e. the ones using prepayment system. Similarly also in Kanyama area, of the 10 respondents that are paying more for water, 6 (60%) were from the group that was paying >K3,000<K6,600 i.e. buying water by the container system (pay as you draw) and 3 from the group that paid >K10,000 for water.

The result of the cross tabulation of how payment changed due to metering and the method of payment for water shown in the table 4-14a below also show that majority of the respondents that increased payment as result of metering were those using the container method in Kanyama and scheme cards in George.
In George area, metering is expected not to have any effect on payment. This is so because in George 95.3% of the respondents are using the prepayment method and are entitled to 6 m^3/month and only pay K6,600 per month for water therefore would not be affected by metering. Metering communal standpipes apart from accounting for water produced against the sales can also help reduce wastage and control consumption since the tap attendant is held accountable for the loss; he will ensure that he disperses the right amounts of water according to the sales and within minimal allowable wastage.

Table 4-14a: how payment changed due to metering * method of payment (a)
(Communal standpipes)

how payment changed due to metering		Count & % within	Payment method		
			Per container	Scheme card	Total
how payment changed due to metering	Started to pay more	Count	8	41	49
		% within - method of payment	72.7%	65.1%	66.2%
	no change in payment	Count	2	16	18
		% within - method of payment	18.2%	25.4%	24.3%
	Started to pay less	Count	1	6	7
		% within - method of payment	9.1%	9.5%	9.5%
Total		Count	11	63	74
		% within - method of payment	100.0%	100.0%	100.0%

a SP - is the communal standpipe metered = Yes

Table 4-15: How payment changed due to metering

(Metered house connection users)

Change in payment		Count and percentage	Location		Total
			Mtendere Compound	Kanyama Compound	
payment change due to metering	Started to pay more	Count	7	20	27
		% within - location	58.3%	48.8%	50.9%
	No change in payment	Count	3	8	11
		% within - location	25.0%	19.5%	20.8%
	Started to pay less	Count	2	13	15
		% within - location	16.7%	31.7%	28.3%
Total		Count	12	41	53
		% within - location	100.0%	100.0%	100.0%

Metered connection = Yes

Result in table 4-15 show that out of the 53 respondents on metered house connections, 27 (50.9%) started to pay more for water, i.e. 7 (58%) in Mtendere and 13 (48.8%) in Kanyama. The total of those that did not change paying and those that started to pay less because of metering were 20.8% and 28.3% of the metered respondents.

The first indication from the results obtained show that metering has an effect on changing consumer behaviour towards payment as at least half of the respondents mentioned to start to pay more for water. Since metering is expected not to have any effect on the payment behaviour of the respondents on fixed charge type of billing, the discussion on effect of metering will only be based on the billed consumption respondents, i.e. for Kanyama area.

A cross tabulation between payment change due to metering and monthly payment for water (range) and method of payment for water attached in appendix 4-2 table 5 indicate that majority of the respondents on the billed method of payment, who were paying more, were the high payers (K30,000 - K40,000/month). For metered consumers,

payment is in relation to actual quantity of water consumed. Without considering other factors such as tariff, size of family or income we can somehow draw a conclusion that metering has no effect on changing payment behaviour of water consumers on billed consumption method of payment. This is so because payment is in relation with volume of water consumed.

4.2.5. The effect of method of payment on consumption

This section gives an analysis of the effects of methods of paying for water on changing the consumption pattern of respondents that were using communal standpipes and those on individual house connections in the study areas. The Prepayment system (scheme card) was considered as a WDM measure for communal standpipes and the billed consumption as a WDM measure for house connections. The aim was to compare how the two mentioned WDM measures affected consumption change. The effect on consumption of the prepayment was compared with that of the container method and billed consumption was compared to that of the fixed charge (assessed consumption).

4.2.5.1. Payment Methods

Table 4-16: Method of payment for water - communal standpipes (a)

method of payment		Count and percentage	Location		Total
			George Compound	Kanyama Compound	
method of payment for water	Per container	Count	7	41	48
		% within - location	4.7%	78.8%	23.8%
	Scheme card	Count	143	11	154
		% within - location	95.3%	21.2%	76.2%
Total		Count	150	52	202
		% within - location	100.0%	100.0%	100.0%

a pay for water = Yes

Table 4-16; show that in George 95% of the respondents use scheme cards (prepayment) to pay for water while the 4.7% are using the container system. Kanyama 79% of the respondents are using the container system, while 21% are on the scheme card system and 7.7% are on the fixed charge. Overall, 76% of the respondents are paying through the scheme methods and 23% are paying through the container system. LWSC is promoting the prepayment system as a WDM measure on communal standpipes to control consumption and promote payment in the peri urban areas.

Table 4-17: Method of payment for water - house connection

Payment method		Count and percentage	Location		Total
			Mtendere Compound	Kanyama Compound	
method of payment for water	Bill	Count	13	33	46
		% within - location	13.0%	68.8%	31.1%
	Fixed charge	Count	87	15	102
		% within - location	87.0%	31.3%	68.9%
Total		Count	100	48	148
		% within - location	100.0%	100.0%	100.0%

Table 4-17, show that majority of the respondents (87%) in Mtendere are on fixed monthly water charge, while in Kanyama the majority (68.8%) are using the bill system to pay for water. Fixed charge is applied on consumers that have unmetered house connections whereas the metered are charged according to consumption.

4.2.5.2. Consumption change due to method of payment

Table 4-18: Consumption change due to method of payment per area

(Communal standpipes)

method of payment for water				Location		Total
				George Compound	Kanyama Compound	
Per container	Consumption change due to payment method	Reduced consumption	Count	3	15	18
			% within location	42.9%	36.6%	37.5%
		Increased consumption	Count	2	4	6
			% within location	28.6%	9.8%	12.5%
		No change	Count	2	22	24
			% within location	28.6%	53.7%	50.0%
	Total		Count	7	41	48
			% within location	100.0%	100.0%	100.0%
Scheme card	consumption change due to payment method	Reduced consumption	Count	27	2	29
			% within location	18.9%	18.2%	18.8%
		Increased consumption	Count	4	0	4
			% within location	2.8%	.0%	2.6%
		No change	Count	112	9	121
			% within location	78.3%	81.8%	78.6%
	Total		Count	143	11	154
			% within location	100.0%	100.0%	100.0%

a pay for water = Yes

From table 4-18; we can conclude that majority of the respondents on the scheme card (prepayment) in both the two areas i.e. 78% in George and 89% in Kanyama did not change their consumption. The prepayment system in the two areas did promote reduction in consumption.

Since the sample, size for the respondents on container method in George was too small to warrant meaningful conclusions, they were not considered in the interpretation of the results. In Kanyama area, majority (54%) of the respondents using the container system did not change their consumption.

Even though the prepayment system is being implemented by LWSC as a WDM measure to control consumption, this study established that prepayment system had a lesser effect on reducing consumption as the majority of respondents on scheme cards did not change their consumption as shown in table 4-18 above. This observation somehow does not agree with the daily water use. The possibility of not reducing consumption for respondents using prepayment system is that, either they are insensitive to reducing consumption because they pay a fixed charge for fixed volume of water and even though they don't finish the monthly allocation; they are expected to pay for the following month's allocation. In addition if they consume more than the monthly allocation within one month, the excess water beyond the 6,000 litres allocation within the same month is billed at a higher tariff band than the social band making the water expensive. With these imposed conditions on prepayment system, it is somehow expected that the consumers will very unlikely to reduce consumption or consume more than the monthly allocation

Table 4-19: Consumption change due to method of payment

(**house connections**)

method of payment for water			**Count and % within**	**Location**		**Total**
				Mtendere Compound	**Kanyama Compound**	
Bill	consumption changed due to method of billing	Reduced	Count	2	18	20
			% within - location	15.4%	54.5%	43.5%
		No change	Count	11	15	26
			% within - location	84.6%	45.5%	56.5%
	Total		Count	13	33	46
			% within - location	100.0%	100.0%	100.0%
Fixed charge	consumption changed due to method of billing	Increased	Count	2	0	2
			% within - location	2.3%	.0%	2.0%
		Reduced	Count	10	5	15
			% within - location	11.5%	33.3%	14.7%
		No change	Count	75	10	85
			% within - location	86.2%	66.7%	83.3%
	Total		Count	87	15	102
			% within - location	100.0%	100.0%	100.0%

Table 4-19; indicate that bill system of payment was much more effective in reducing consumption for the metered consumers. From the table we observe that 54% of the 33 respondents in Kanyama on the volumetric bill system had reduced their consumption while in Mtendere (unmetered area) only 15% reduced the consumption.

If we compare consumption change for the billed consumption method and the fixed bill, we see from the table 4-19 in Kanyama where majority of respondents have metered

connections, the bill system had an effect on consumption change (reduction) than the fixed charge method. Billed consumers would be more sensitive to reducing consumption as the incentive for reducing consumption or minimising wastage will culminate into financial gain. From the study we conclude that the billed consumption can be an effective WDM measure to influence reduction in consumption.

4.2.6. The effect of tariff increase on consumption

This section provides an analysis of the effect of tariff increase on consumption for respondents using public standpipes only.

4.2.6.1. Consumption change due to tariff increase

Table 4-20: has tariff been increased?

(Communal standpipes)

Tariff changed?		Count and percentage	Location		Total
			George Compound	Kanyama Compound	
has tariff of water been increased	Yes	Count	132	38	170
		% within - location	88.0%	73.1%	84.2%
Total		Count	150	52	202
		% within - location	100.0%	100.0%	100.0%

From the table 4-20; The level of awareness on tariff increase is high i.e. 84.2% of the 202 respondents that are using communal taps are aware of the tariff increase. The LWSC last tariff increase was in June 2006. The tariffs being applied by the LWSC is attached in appendix 1-2

Table 4-21: How consumption changed due to tariff increase

(Communal standpipes)

Consumption change		Count and percentage	Location		Total
			George Compound	Kanyama Compound	
Consumption change due to tariff increase	Reduced consumption	Count	12	11	23
		% within - location	9.1%	28.9%	13.5%
	Increased consumption	Count	2	0	2
		% within - location	1.5%	.0%	1.2%
	No change	Count	118	27	145
		% within - location	89.4%	71.1%	85.3%
Total		Count	132	38	170
		% within - location	100.0%	100.0%	100.0%

Has tariff of water been increased = Yes

Table 4-21 shows that the increase in tariff did not have much effect on changing the respondent's consumption as 85.3% of respondents despite knowing about tariff increase did not change their consumption. In the George area where there is a prepayment system in place majority of the respondents (89%) did not change consumption due to tariff increase, while in Kanyama, only 28.9% of the 38 respondents reduced their water consumption and 71% did not change consumption.

The cross tabulation between change in consumption due to tariff increase and the payment methods shown in table 2 in appendix 4-3 also confirms that tariff increase did not have much effect on consumption for respondents on prepayment since majority (89%) did not alter their consumption while respondents using container method i.e. 34% reduced consumption and 66% did not change consumption.

In George, the tariff for communal standpipe is K6,600 and 95% of the respondents (table 4-16) are on the prepayment. The average payment by the George respondents per month was K6,821 which is almost equivalent to the tariff. In Kanyama area where there was prepayment and the container methods, the average monthly water payment per household was K9,559. The 28.9% decrease in consumption shown in table 4-21 could be attributed to respondent's who are using the container system who had reduced consumption due to tariff increase.

4.2.7. The effect of tariff increase on payment

This section provides an analysis of the results on the effect of tariff increase on payment for respondents using house connections only.

4.2.7.1. Payment change due to tariff increase

Table 4-22: has tariff been increased?

(House connections)

Tariff change		Count and percentage	Location		Total
			Mtendere Compound	Kanyama Compound	
has tariff been increased	Yes	Count	72	27	99
		% within - location	72.0%	56.3%	66.9%
Total		Count	100	48	148
		% within - location	100.0%	100.0%	100.0%

Tariff increase = yes

The results in table 4-22 shows that about 67% of the 148 respondents that have house connections are aware of the tariff increase i.e. 72 (72%) in Mtendere and 27 (56.3%) in Kanyama area.

Table 4-23: how tariff influenced payment for water

(House connections)

Payment change?		Count and percentage	Location		Total
			Mtendere Compound	Kanyama Compound	
how tariff influenced payment for water	Started to pay more	Count	21	17	38
		% within - location	29.2%	63.0%	38.4%
	Started to pay less	Count	17	6	23
		% within - location	23.6%	22.2%	23.2%
	No change in payment	Count	34	4	38
		% within - location	47.2%	14.8%	38.4%
Total		Count	72	27	99
		% within - location	100.0%	100.0%	100.0%

has tariff been increased = yes

In Kanyama area, 63% of the respondents had increased their payment as a result of tariff increase, whereas in Mtendere, only 29% increase was recorded (table 4-23). In Mtendere, almost half the number of respondents have reduced and increased payment while the about 47.2% have not changed their payment patterns. The fact that Mtendere is considered an unmetered area and residents pay a fixed charge regardless of whether they consume more or less.

When tariff is increased, consumers on billed consumption expected to increase their payments if they continue consuming the same amount of water. In Kanyama area the majority of the respondents that had increased their payments could be attributed to the metering as the excess water that respondents may have been consuming without paying is now being accounted for by the meter hence increased payment. Similarly also a reduction in payment may be due the fact that respondents maybe monitoring and controlling their consumption due to presence of the meter. The rising block tariff system which LWSC is applying can promote saving of water since the more water one consumes the more they pay therefore will begin to save water.

The cross tabulation between how tariff influenced payment for water and method of payment for water shown in table 4-24 below show that majority (48%) of the respondents on the billed started to pay more while for the majority of the respondents on fixed charge (41%) did no change their payment patterns. From these results we observe that tariff increase had a much more effect on respondents on the billed consumption than the respondents on fixed charge (unmetered).

Table 4-24: how tariff influenced payment for water * method of payment (a)

how tariff influenced payment for water			method of payment for water		
			Bill	Fixed charge	Total
how tariff influenced payment for water	Started to pay more	Count	13	25	38
		% within method of payment for water	48.1%	34.7%	38.4%
	Started to pay less	Count	6	17	23
		% within method of payment for water	22.2%	23.6%	23.2%
	No change in payment	Count	8	30	38
		% within method of payment for water	29.6%	41.7%	38.4%
Total		Count	27	72	99
		% within method of payment for water	100.0%	100.0%	100.0%

a has tariff of been increased = Yes

4.2.8. The effect of sensitisation on consumption

This section provides an analysis of the results on the levels of sensitisation or awareness and its effects on the respondent's water consumption and payment. The analysis is provided for both the respondents using communal standpipes and those using house connections. The analysis will be as follows: firstly, data on the level of sensitisation of the respondents will be displayed. This will be followed by the analysis of the effects of sensitisation on consumption and thereafter the analysis of the effect of sensitisation on payment.

4.2.8.1. Level of sensitisation

Table 4-25: Ever been water sensitised - communal standpipes

Ever been sensitised?	Count and percentage	Location		Total
		George Compound	Kanyama Compound	
ever been water sensitised Yes	Count	53	21	74
	% within location	35.3%	40.4%	36.6%
Total	Count	150	52	202
	% within location	100.0%	100.0%	100.0%

Results in table 4-25, show that the levels awareness on water issues of the respondents using communal standpipes in the study areas. Overall 74 (36%) respondents have received awareness on water out of a total of 202, i.e. 53 respondents in George and 21 respondents in Kanyama. The sensitisation campaigns are commonly disseminated through community meetings, drama performances and public announcements. In the case of George the water committee which represents the consumers is the channel of sensitisation since they are the ones that also elect tap attendants.

Table 4-26: Ever been water sensitised - house connections

Ever been sensitised?	Count and percentage	L ocation		Total
		Mtendere Compound	Kanyama Compound	
ever been water sensitised Yes	Count	43	22	65
	% within - location	43.0%	45.8%	43.9%
Total	Count	100	48	148
	% within - location	100.0%	100.0%	100.0%

Results in table 4-26, show that a total of 65 (44%) out of 148 respondents using individual house connections have been sensitised. Of this group 43 were in Mtendere area while 22 respondents were from the Kanyama area.

4.2.8.2. Consumption change due to sensitisation

Table 4-27: How consumption changed due to sensitisation

(Communal standpipes)

Consumption changed?		Count and percentage	Location		Total
			George Compound	Kanyama Compound	
how consumption changed due to sensitisation	Reduced use	Count	11	2	13
		% within - location	20.8%	9.5%	17.6%
	No change	Count	42	19	61
		% within - location	79.2%	90.5%	82.4%
Total		Count	53	21	74
		% within - location	100.0%	100.0%	100.0%

ever been water sensitised = Yes

The low response rate result in table 4-27, show that the sensitisation in both cases did not promote any drastic reduction in consumption as majority (82.4%) of the 74 respondents who were sensitised did not change their consumption and only 17% reduced their water consumption.

Table 4-28: How consumption changed due to sensitisation * method of payment (a)

(Communal standpipes)

Consumption changed?			method of payment for water		Total
			Per container	Scheme card	
how consumption changed due to sensitisation	Reduced	Count	1	12	13
		% within method of payment for water	5.3%	21.8%	17.6%
	No change	Count	18	43	61
		% within method of payment for water	94.7%	78.2%	82.4%
Total		Count	19	55	74
		% within method of payment for water	100.0%	100.0%	100.0%

a - ever been water sensitised = Yes

Table 4:28 also shows that sensitisation did not have much effect for both the respondents who used the container method of drawing water and for those on prepayment system. Majority of the respondents did not change their consumption i.e. 95% using the container method and 78% using the prepayment method.

Table 4-29: How consumption changed due to sensitisation

(House connections)

Consumption change?		Count and % in each category	Location: Mtendere Compound	Location: Kanyama Compound	Total
how consumption changed due to sensitisation	Increased	Count	1	0	1
		% within - location	2.3%	.0%	1.5%
	Reduced	Count	9	17	26
		% within - location	20.9%	77.3%	40.0%
	No change	Count	33	5	38
		% within - location	76.7%	22.7%	58.5%
Total		Count	43	22	65
		% within - location	100.0%	100.0%	100.0%

a. Ever been water sensitised = Yes

Table 4-29; majority (76.7 %) of the respondents that are sensitised in Mtendere area have not changed their water consumption. The fact that 88% of the respondents Mtendere are not metered (table 4-11) explains why the majority of the respondents did not reduce consumption. Un-metered consumers will not hind to the call to save water because no matter how much water is consumed they still pay the same amount (fixed charge). In Kanyama area, majority of the respondents 77.3% have reduced their water consumption as shown in table 4-29. The fact that 85% (table 4-11) of the respondents have metered connections could be the reason why the majority have reduced consumption.

Results in table 4-30 below also confirm that respondents on the volumetric billing are likely to reduce consumption than those on fixed charge.

Table 4-30: how consumption changed due to sensitisation * method of payment (a)

(House connections)

consumption changed			method of payment: Bill	method of payment: Fixed charge	Total
how consumption changed due to sensitisation	Increased	Count	0	1	1
		% within method of payment	.0%	2.2%	1.5%
	Reduced	Count	13	13	26
		% within method of payment	65.0%	28.9%	40.0%
	No change	Count	7	31	38
		% within- method of payment	35.0%	68.9%	58.5%
Total		Count	20	45	65
		% within method of payment	100.0%	100.0%	100.0%

a ever been water sensitised = Yes

4.2.9. The effect of sensitisation on payment

This section provides an analysis of the results on the effects of sensitisation on payment for both respondents using communal standpipes and those using house connections.

4.2.10. Payment change due to sensitisation

Table 4-31: How payment for water changed due to sensitisation

(Communal Standpipe)

Payment change?		Count and percentage	Location		Total
			George Compound	Kanyama Compound	
how payment for water changed due to sensitisation	Started to pay more	Count	48	17	65
		% within - location	90.6%	81.0%	87.8%
	No change in payment	Count	0	1	1
		% within - location	.0%	4.8%	1.4%
	Started to pay less	Count	5	3	8
		% within - location	9.4%	14.3%	10.8%
Total		Count	53	21	74
		% within - location	100.0%	100.0%	100.0%

ever been water sensitised = Yes

Results of table 4-31 above and table 4-31a below show that the influence of sensitisation on promoting payment was very high. In table 4-31 above, out of the 74 respondents that are sensitised, 48 (90.6%) in George area and 17 (81%) in Kanyama area, started to pay more for water

In George area, the community representatives (water committee) works hand in hand with the water provider on various water related issues and the water committee is also responsible for electing the tap attendants to control opening of communal standpipes.

In Kanyama area, the DTF funded service improvement program could somehow explain the impact on positive payment behavior. Awareness and educational campaigns were adopted by LWSC in the ongoing DTF service improvement in Kanyama.

Table 4-31a how payment changed due to sensitisation * method of payment (a)

(Communal standpipes)

Payment change?		Count and percentage	method of payment for water		Total
			Per container	Scheme card	
how payment for water changed due to sensitisation	started to pay more	Count	15	50	65
		% within - method of payment	78.9%	90.9%	87.8%
	no change in payment	Count	1	0	1
		% within - method of payment	5.3%	.0%	1.4%
	started to pay less	Count	3	5	8
		% within - method of payment	15.8%	9.1%	10.8%
Total		Count	19	55	74
		% within - method of payment	100.0%	100.0%	100.0%

a - ever been water sensitised = Yes

Table 4-32: How payment for water changed due to sensitisation

(House connections)

Payment change		Count and percentage	Location: Mtendere Compound	Location: Kanyama Compound	Total
how payment for water changed due to sensitisation	started to pay more	Count	35	19	54
		% within - location	81.4%	86.4%	83.1%
	No change in payment	Count	3	2	5
		% within - location	7.0%	9.1%	7.7%
	started to pay less	Count	5	1	6
		% within - location	11.6%	4.5%	9.2%
Total		Count	43	22	65
		% within - location	100.0%	100.0%	100.0%

ever been water sensitised = Yes

Results of table 4-32 above and table 4-32a below show that sensitisation had a major impact on influencing the respondent's to paying for water. From the table 4-32, 81% of the respondents in Mtendere area and 86% of the Kanyama that are sensitised on water had started to pay more for water. Since in both cases respondents were already paying for water, started to pay more will be interpreted as increase in the amounts paid or increased frequency of payment or positive attitude towards payment.

Awareness campaigns had been conducted by the LWSC in the Mtendere despite the area having no meters. The programs were aimed at minimising wastage disconnecting taps found leaking within customer yards, registering, warning defaulters to pay.

Table 4-32a: how payment changed due to sensitisation * method of payment (a)
(House connections)

Payment change?		Count and percentage	method of payment for water: Bill	method of payment for water: Fixed charge	Total
how payment for water changed due to sensitisation	started to pay more	Count	16	38	54
		% within method of payment for water	80.0%	84.4%	83.1%
	No change in payment	Count	2	3	5
		% within method of payment for water	10.0%	6.7%	7.7%
	started to pay less	Count	2	4	6
		% within method of payment for water	10.0%	8.9%	9.2%
Total		Count	20	45	65
		% within method of payment for water	100.0%	100.0%	100.0%

a ALL - ever been water sensitised = Yes

In Kanyama area, the LWSC has adopted awareness campaigns as a one of the main component of the on going DTF funded service improvement. Focus of the awareness programs was on Kiosk management, prepayment, meter based billing, promoting payment for water and on reducing vandalism of water infrastructure. The awareness raised could have contributed to the positive payment behavior.

4.3. Summary of the results on the effects of WDM measures

This section first summarises the results obtained from the data analysis on the assessment of the effects of the selected WDM measures on consumption and payment and then concludes by determining the most effective WDM measure that influenced reduction in water consumption and also the most effective WDM for promoting better payment from the survey. The results arising from the data analysis in the form of response rates are first summarised in tabular form as shown in table 4-33 for communal standpipes and table 3-34 for individual house connections.
From the table 3-33 and table 3-34, the response rates indicate the percentage of the total number of respondents that had responded to a particular attribute or variable that was assessed.

4.3.1. Discussion of results for communal standpipes users

From the results in table 4-33, for communal standpipe users, we summarise the results as follows:

Metering had a much more effect on consumption for consumers drawing water by container method and those on the scheme card method, since from our overall result majority of the respondents i.e. 55% said metering led to reduction in their water consumption. In the case of payment, metering also had more influence on payment since according to our survey majority of the respondents i.e. 66% mentioned having started to pay more for water.

As for the payment methods, we see from the results in the table 3-33 that despite the prepayment method of billing being promoted as a WDM measure to control consumption, in our survey we established that it did not have much effect on influencing consumption since majority of respondents on this method of billing said prepayment method doe not change their consumption patterns.

Tariff increase, despite being implemented as a WDM our survey revealed it did have much impact on influencing consumption on communal standpipe consumers since majority of the respondents using both the prepayment system and the container method stated that increase in price didn't have an effect on their consumption.

As for sensitisation, from the result in table 4-33 we see that sensitisation was more effective in promoting payment than consumption for communal standpipe users. The overall result showed that majority of the respondents i.e. 88% mentioned having started to pay more for water and while only 18% of the respondents had reduced consumption as a result of sensitisation.

4.3.2. Discussion of the results for individual house connections

From the results in table 4-34, for respondents who were on individual house connections, the results are summarised as follows:

Metering was an effective WDM measure for consumption for the respondents using metered individual house connections, since from our survey established that majority of the respondents i.e. 68% said metering led to reduction in their water consumption. In

the case of payment, metering also had an influence in promoting better payment since about half the number of respondents i.e. 51% mentioned having started to pay more.

On pricing policy, the observation made from the result is that pricing policy in the form of tariff increase as a WDM measure had somehow an influence on affecting payment for the consumers on billed consumption than those on fixed. Majority of the respondents from our survey on billed consumption i.e. 48 % indicated having started to pay more for water than those on fixed charge. However the overall result show that tariff increase did not have much influence on promoting better payment.

In the case of payment methods, we see from the results in the table 4-34 that despite the billed (volumetric) consumption method of billing being promoted as a WDM measure to control consumption for consumers using house connections, in our survey we established that less than half i.e. 44% of the respondents on billed consumption reduced their consumption. If we compare with those on fixed charge, we can comment therefore that billed consumption respondents likely to reduce their consumption.

As for sensitisation, from the result in table 4-34 we see that sensitisation in overall terms was more effective in promoting better payment than reducing consumption for both consumers on the billed and the fixed charge. However in the case of influencing consumption, majority of the respondents i.e. 65% mentioned having reduced their consumption than those on fixed charge. As expected consumers that are billed by actual volume have an incentive to save water since the financial gain in terms of saving is clearly felt unlike those on fixed.

4.3.3. Determination of the most effective WDM measures

To determine the most effective WDM measure, a comparison was made of the response rates obtained on each of the four WDM instruments on influencing water consumption (reduction) and similarly a comparison of the response rates obtained for each of the four WDM measures on promoting payment for water. The WDM measure that had the highest response rate from the survey on reducing consumption was considered the most effective WDM measure for water consumption and the WDM measure that had the highest response rate from the survey on promoting payment was considered as the most effective WDM measure for influencing payment. Table 4-33 and table 4-34 below, shows the WDM measures (independent variables) and the response rates obtained on each of the dependent variables i.e. consumption and payment for the respondents that used communal standpipes and those that used individual house connections in the survey.

Table 4-33: Determination of most effective WDM measure for communal standpipes

Effect of WDM measure on dependent Variables (%)		WDM Instrument - (Independent Variable)											
		Metering			Payment method			Tariff increase			Sensitisation		
		Container	Scheme card	Overall result	Container	Scheme card	Overall result	Container	Scheme card	Overall result	Container	Scheme card	Overall result
Effect on consumption	Reduced	54	56	**55**	18	39	**23**	34	9	**14**	5	22	**18**
	Increased	0	11	10	3	13	5	0	2	1	0	0	0
	No change	46	33	35	79	48	72	66	89	85	95	82	82
Effect on payment	Started to pay more	73	65	**66**	n/a	n/a	n/a	n/a	n/a	n/a	79	91	**88**
	No change	18	25	24	n/a	n/a	n/a	n/a	n/a	n/a	5	0	1
	Started to pay less	9.1	9.5	10	n/a	n/a	n/a	n/a	n/a	n/a	16	9	11

Note: n/a = non applicable meaning no assessment was carried on the particular dependent variable

Table 4-34: Determination of most effective WDM measure for house connections

Effect of WDM measure on dependent Variables (%)		WDM Instrument - (Independent Variable)									
		Metering	Payment method			Tariff increase			Sensitisation		
			Billed	Fixed	Overall result	Billed	Fixed	Overall result	Billed	Fixed	Overall result
Effect on consumption	Reduced	**68**	44	15	**24**	n/a	n/a	n/a	65	29	**40**
	Increased	8	0	2	1	n/a	n/a	n/a	0	2	2
	No change	24	57	83	75	n/a	n/a	n/a	35	69	59
Effect on payment	Started to pay more	**51**	n/a	n/a	n/a	48	35	**38**	80	84	**83**
	No change	21	n/a	n/a	n/a	30	42	38	10	7	8
	Started to pay less	28	n/a	n/a	n/a	22	24	23	10	9	9

Note: n/a – non applicable meaning no assessment was carried on the particular dependent variable

4.3.4. Most effective WDM measures for communal standpipes

From the results in table 4-33, metering was established to be the most effective WDM measure on changing consumer behaviour towards water consumption since it had the highest response rate (55%) on reducing water consumption than the other WDM measures that were evaluated on communal standpipe users in the survey.

From the table 4-33 we also observe that the most effective WDM measure for promoting payment established from our survey was sensitisation. From the table 4-33 we observed that the sensitisation had the highest response rate (88%) compared to that of the other WDM measures on the variable 'started to pay more for water' in the case of communal standpipe users from the survey.

4.3.5. Most effective WDM measures for house connections

From the results in table 4-34, we observe that for the respondents that were using house connections in the survey, the most effective WDM measure for influencing consumption, was metering, since the response rate was higher (68%) on reduction of water consumption compared to that of the other three WDM measures that were considered.

The results in Table 4-34 indicate also that sensitisation was the most effective WDM measure for promoting payment for water amongst consumers using house connection from the survey since it had the highest response rate (83%) compared to that of the other three WDM measures on the variable 'started to pay more for water'.

4.3.6. Discussion of the results on the most effective WDM measures

The results presented above raise important points on the different WDM measures that LWSC has implemented in the peri urban areas and how the measures are influencing consumer behaviour towards water consumptions and payment. Only preliminary conclusions are made based on the survey. Conclusive statements or generalisation of the findings to all the peri urban areas can only be made after a more comprehensive study that will involve statistical testing.

From the study, it was established that for both communal standpipes and individual house connections in the surveyed areas, metering was the most effective WDM measure for influencing water consumption and sensitisation was the most effective WDM measure for promoting payment.

The result on metering agree with the researcher Mazungu and Machiridza (2005) who recommended metering an as a pre-requisite for the proper management of any water supply system. Consumer meters are required if customers are to be charged for the exact amount of water used which is one of the key elements of a WDM strategy. When consumer points are metered water providers will be able to know levels and patterns of consumption and be able to collect the revenue from consumers according to quantity consumed. Metering is one of the key regulatory instruments which NWASCO uses to assess performance of water utilities towards efficient service provision in Zambia. Through this directive water utilities are mandated to meter all consumer points.

The LWSC has adopted a policy of universal metering where all communal water points and all individual house connections should be metered (LWSC, 2005c). When metered, a consumer will pay according to the water that they use, which gives them a financial incentive to save water. Through metering LWSC is able to have an accurate assessment of the water production, consumption and account for the losses.

In the peri urban areas, LWSC is metering the communal stand posts and frequently reads the meters and reconciles with the sales. Metering is implemented along side the prepayment system, which is used to control consumption per household and promote payment. Through metering, LWSC accounts for the water losses and institute measures to address such losses. Metering communal facilities also brings a level of responsibility to tap attendants or kiosk operators to ensure that water wastage at the tap is minimised and only the exact volumes of water according to payment is dispersed. With proper controls, metering can minimise pilferage or illegal selling of water at the tap.

In the case of individual connections, LWSC aims to meter all individual house connections and bill consumers according to consumption. Metered consumers will have the financial incentive to control or minimise consumption. This was also evident from the study that majority of the respondents that had reduced consumption due to metering were those that were on metered consumption according to the data analysis in section 4.2.3.2. For example in the Mtendere area, where metering coverage was low the majority of the respondents indicated having not changed their water consumption whereas in the case of Kanyama area which was 85% metered, majority of the respondents indicated having reduced their consumption.

From our finding, we can comment that metering is an effective means of charging for water, and is fair in that customers only pay for what they use. Paying for the volume of water used will provide a financial incentive for customers to undertake water efficiency measures. The overwhelming response on reduction of consumption due to metering depicted by the respondents in this study indicates that metering will play an important role for customers in peri urban areas to contribute to efficient household water use. The saving realised from metering could over time either defer or avert the need for new expensive water sources or help alleviate the water shortages which are a common feature in these areas.

The study also establishes that even though metering was found to be the most effective WDM measure in controlling water consumption for house connections, all the other WDM measures somehow relate to each other. For example, metering will be more effective if consumers are on billed consumption type of billing, the tariff system should also be one that will encourage water saving e.g. the rising block tariff and some level of awareness will make a consumer realise the need to save water.

In the research study, sensitisation having been established as the most effective WDM measure for promoting payment for both communal standpipes and individual house connections agrees with the research findings reviewed in this study that that awareness is an important component of any WDM intervention to bring about change in the behavioural patterns of the water consumers Gumbo (2004). Gumbo (2004) stated that changing water user's perception towards water use and payment is a strong drive to WDM. Ntengwe (2004) also reiterated that water consumers would only heed to calls to pay increased prices or usage of water below the basic use if there are well informed and have the understanding on various water issues and their implication.

WDM efforts must be endorsed and owned by the communities that use water. In this context, water utilities must create and facilitate the enabling environment for consumers to make decisions and take action to use water in a more efficient, equitable and sustainable way. Water providers therefore need to devise effective strategies of communicating to the different consumer groups. Awareness and education is very essential to all WDM measures tailored to the consumer or end user.

The LWSC through its policy on improvement of service provision to the peri urban areas recognises the need for community participation and awareness raising. LWSC has developed various forms of media for reaching out to the peri urban areas. Through this participation, LWSC facilitates dialogue with the communities and enhances communication on the need to pay for water services, need to save water, prevent and report illegal connections, report leakages, prevent or report on any vandalism on the water infrastructure, engage tap attendants to man taps and ensure that only paid up users are allowed to draw water (LWSC, 2005c).

In the George area, LWSC's close collaboration with the water committee, an elected representative of the community on water related matters has proved to be a success in winning the support of residents. From the inception of the George water project, the community has been involved in project planning, implementation and operation. Community mobilisation is done by the water committee of the George resident development. Access to communal taps is controlled by the tap attendants that are elected by water committee. The tap attendants ensure that taps are opened at agreed times, tap surroundings are cleaned and only paid up residents draw water and ensure minimised wastage at the taps. In return tap attendants are paid a commission of the revenue generated which act as an incentive.

It is through this type of community mobilisation, awareness raising and education that the prepayment systems which is part of WDM measures implemented, use of portable water from communal taps as opposed to the contaminated shallow wells and minimised vandalism of water infrastructure that has made George a successful community water project that has embraced WDM to improve service provision to the urban poor. Through these interventions customer base has grown and revenue collection has improved (LWSC, 2006a).

5. Conclusion and recommendations

This chapter deals with the conclusions drawn from the data analysis and discussion. The conclusion will look at how the objectives of the research have been met. The recommendations arise from gaps that were established in the process of conducting the research which need further study or improvement.

5.1. Conclusion

Conclusions arising from the research study that are relevant to the peri-urban areas are as follows:

The study established that LWSC has a policy on WSS service provision to the urban poor and its through this policy that WDM is implemented in the peri urban areas. From the survey, we learnt that through implementation of WDM in the selected peri urban areas that were surveyed, LWSC has achieved some success in areas such as metering, reducing UFW, increasing customer base and revenue collection.

The study also established that the regular monitoring of performance of water utilities by the NWASCO through regulatory tools and guidelines on WDM such as UFW, metering, service coverage, supply hours, and collection efficiencies has mandated the LWSC to develop innovative and sustainable strategies such as WDM towards service provision to the urban poor.

The study also identified the WDM measures that are being implemented in the peri urban areas of Lusaka that were aimed at influencing water consumption and promoting better payment. The identified WDM measures were grouped into four categories i.e. metering, payment (billing) methods, pricing policy, and awareness (sensitisation) campaigns.

From our survey results on the assessment of the effects of WDM measures on water consumption and payment patterns in the peri urban areas summarised in form of response rates in tables 4-33 and 4-34, suggest that there is potential for WDM to be utilised as a tool to influence consumer behaviour towards more efficient water use and better payment. From these results, it was also established that that WDM measured differed in the manner in which they influenced consumption and payment for the different consumer types and levels of service.

The study also established that metering was a very effective WDM measure to influence consumption (i.e. reduction in consumption) for both the communal standpipes users and individual house connections users, while sensitisation (awareness) was also a more effective WDM measure for promoting better payment for water in the peri urban areas.

Even though WDM measures are interlinked, measures selected for one system will not necessarily be applicable for the other. Because of the differences in water supply systems and consumer types in the peri urban areas, water providers need to understand these different setups in order to develop WDM measures that are appropriate.

5.2. Recommendation

Recommendations arising from the research study that are relevant to the peri urban settlements are as follows:

The need for LWSC to meter all consumer water points in the peri urban areas in order to accurately assess the water produced against what is consumed and come up with accurate UFW is highly recommended. Through these measures, LWSC can accurately account for the water losses and devise sustainable strategies to address it. UFW figures based on assessed consumption in the absence of meters are not credible.

LWSC should improve its data management and performance assessment of the WDM measures implemented in the peri urban areas. The monthly reporting systems are not consistent and have a lot of missing data. Poor data management and performance assessment will lead to incorrect reporting and will hinder the purpose of WDM.

There is need to build capacity in the personnel working in the peri urban department that are directly involved in implementation of WDM, on the whole cycle of WDM in urban poor areas. Urban poor areas present unique socio and economic challenges compared to the other conventional areas. Understanding their characteristics could be a good starting point to application of sustainable WDM. Awareness raising within the communities should also be enhanced through increased community involvement in WDM programs.

There is need to promote research into understanding the applicability of WDM in the urban poor areas in Zambia and the benefits to be derived from it. NWASCO and the CU's should solicit for support in this undertaking. Through research, knowledge on WDM can generated which will inform decision makers, planners and local management institutions, politicians and the communities on the need for WDM to improving service provision to the urban poor.

6. References

Aiga, H., and Umenai, T. (2002) Impact of improvement of water supply on household economy in a squatter area of Manila. *Social Science and Medicine*, **55**(2002), 627-641.

Akbar, H. M. D., Minnery, J. R., Horen, B. v., and Smith, P. (2007) Community water supply for the urban poor in developing countries: The case of Dhaka, Bangladesh. *Habitat International*, **31**(2007), 24-35.

Banda, T. I. (1996) *Integrating Commercialisation and Community Participation in Peri urban areas: The Lusaka Challenge* Lusaka Water and Sewerage Company, Lusaka, Zambia.

Bryman, A. (2004) *Social Research Methods* Oxford University Press Inc.,New York, Second Edition.

Burgess, D. T. (2001) *A General Introduction to Design of Questionnaires for Survey Research*. University of Leeds. [Online] http://www.leeds.ac.uk/iss/documentation/top/to2.pdf [date: 21 February 2007]

Clawford, I. (1997) Marketing Research and Information Systems. . Food and Agriculture Organisation of the United Nations, Rome, 1997

CSIR (1998) *Water Demand Management: South African Country Study*. Council for Scientific and Industrial Research (CSIR), RSA.

CSO (2000) Zambia Census of Population and Housing 2000 L. Z. Central Statistics Office, ed.

CSO (2003) *2000 Census of population and housing* CSO, Lusaka, Zambia.

Deelstra, T. (2005) *Causes and effects of Urbanisation Lecture notes Handout*, UNESCO IHE, Delft, Netherlands,

DTF (2006) *Reaching the water and sanitation needs of the urban poor*. Devolution Trust Fund, Zambia.

DTF/LWSC (2006) *Ability to pay for individual connection, Household Survey Report, New Kanyama Site and Service, Lusaka*.

DWAF (1999) Water Conservation and Demand Management National Strategy Framework. Department of water Affairs and Forestry, RSA

GKW (2005a) *Baseline study on Water Supply and Sanitation for Peri-urban and Low cost areas in Zambia*. National Water and Sanitation Council & Devolution Trust Fund, Lusaka, Zambia.

GKW, C. (2005b) *Consumer Assessment for Water Supply and Sanitation in Lusaka*. Ministry of local Government and Housing - Zambia and The World Bank

Green, S. B., and Salkind, N. J. (2003) *Using SPSS for Windows and Macintosh Analysing and Understanding Data*, Person Education, Inc.Upper Saddle River, New Jersey Third Edition.

Gumbo, B. (2004) The status of water demand management in selected cities of Southern Africa. *Physic and Chemistry of the Earth 29(2004)*, 1225 - 1231.

Gumbo, B., Foster.L, and Artzen.J (2005) Capacity Buiding in Water Demand Management as a key component for attaining water Millenium Development Goals. *Physics and Chemistry of the Earth*, **30**(2005), 984-992.

Kampata, J., Mondoka, A., and Shisala, S. (2002) Application of water demand management in rural areas of Zambia, Research study

Kyessi, A. G. (2005) Community based urban water management in fringe neighbourhoods: the case study of Dar es Salaam, Tanzania. *Habitat International*, **29**(2005), 1-25.
LCC (2000) Lusaka Integrated Development Plan. Lusaka, LCC (CD-ROM). Lusaka City Council
LCC (2004) *Lusaka District Situation Analysis*. Lusaka City Council, Lusaka, Zambia.
Liu, J. (2002) *Water Demand Management in Urban Areas: A case study of Weinan City in China*, UNESCO-IHE,, Delft, The Netherlands.
Liu, J., Savenije, H. H. G., and Xu, J. (2003) Water as an economic good and water tariff design
Comparison between IBT-con and IRT-cap. *Physic and Chemistry of the Earth*, **28**, 209-217.
LWSC (2004a) *Annual Report*. Lusaka Water and Sewerage Company, Lusaka, Zambia.
LWSC (2005) *Business Plan 2006 - 2010*. Lusaka Water and Sewerage Company Ltd, Lusaka, Zambia.
LWSC (2005b) *Investment costs for selected peri-urban areas*. Lusaka Water & Sewerage Company Lusaka, Zambia (Internal report).
LWSC (2005c) *Peri-urban reviewed policy document*. LWSC, Lusaka, Zambia (Internal report).
LWSC (2006a) *George Water Supply Project, Quartely Report (July-August 2006)*. Lusaka Water and Sewerage Company.
LWSC (2006b) *Peri Urban Monthly August 2006 Report* Lusaka Water and Sewearge Company.
Mayumbelo, K. (2006) *Cost analysis for application of ECOSAN in peri urban areas to achieve MDGs - case study of Lusaka, Zambia*, MSC Thesis, Delft Netherlands.
McKenzie, R., Wegelin, W., Meyer, N., and Buckle, H. (2002) *Water Demand Management Cook-Book*, UN Habitat, Rand Water, WRP,
MLGH (2000) Peri-Urban Water Supply and Sanitation Strategy Ministry of Local Government and Housing-Zambia
Morgan, G. A., and Griego, O. V. (1998) *Easy use and interpretation of SPSS for Windows*
Answering Research Questions with Statistics, Lawrence Erlbaum Associates, NJ, USA,
Mulwafu, W., Chipeta, C., Chavula, G., Ferguson, A., Nkhoma, B. G., and Chilima, G. (2003) Water demand management in Malawi: Problems and prospects for its implementation. *Physic and Chemistry of the Earth*, **28 (2003)**, 787-796.
Mwendera, E. J., Hazelton, D., Nkhuwa, D., Robinson, P., Tjijenda, K., and Chavula, G. (2003) Overcoming constraints to the implementation of water demand management in Southern Africa. *Physic and Chemistry of the Earth* **28**, 761-778.
Mwendera, J., Hazelton, D., Nkhuwa, D., Robinson, P., Tjijenda, K., and Chavula, G. (2003) Overcoming constraints to the implementation of water demand management in Southern Africa. *Physic and Chemistry of the Earth* **28 (2003)**, 761-778.
Ntengwe, F. W. (2004) The impact of consumer awareness of the water sector issues on willingness to pay and cost recovery. *Physic and Chemistry of the Earth*, **29**, 1301-1308.
NWASCO (2004a) Regulatory tools and Legislation.
NWASCO (2004b) Water Sector Reform in Zambia, Lusaka, Zambia.
NWASCO (2006) *Urban and Peri-Urban Water Supply and Sanitation Sector Report 2005 / 2006*. National Water Supply and Sanitation Council of Zambia.

Nyambe, I. A., Mwasambili, R., Mate, L., Lungu, C., Kambole, M., and Maseka, C. (2002) *Water Demand Management in Zambia: Towards promotion and adoption*. IUCN South Africa Country Office, Pretoria, South Africa.

Sanderson, K. (2002) Water demand management programme for Southern Africa Phase II. *Proceedings of the Water demand management regional workshop*
Johannesburg, South Africa.

Schuringa, M. W. (1999) Innovative ways of finding water for cities. *International Syposium on efficient water use in Urban area*, Kobe, Japan.

Seur, H., and Kangwa, D. (2005) *Adapting Regulations to the Needs of the Poor, Building Partnership for Development in Water Supply and Sanitation*. Lusaka.

Sharma, S. (2006) *Decentralised water supply and sanitation: Lecture notes UNESCO IHE*, Delft, Netherlands

Tho, V. N. (2005) Livelihood strategies for the urban poor in the peri urban interface of Ho Chi Minh city, Vietnam. Hue University of Agriculture and Forestry, research cooperation project for sustainable rural development.

WHO/UNICEF (2000) Global Water Supply and Sanitation Assessment, 2000 Report.

Woldemeskel, B. B. (2006) Evaluation of water supply systems in selected urban areas of Addis Ababa Ethiopia. MSC Thesis UNESCO IHE.

WUP (2003) Better water and sanitation for the urban poor. Good practice from sub Saharan Africa.

Zhang, H., and Brown, D. (2004) Understanding urban residential water use in Beijing and Tianjin, China. *HABITAT International* **29** (2005), 469-491.

7. Appendices

Appendix 1-1

LWSC Water Tariffs

	APPROVED TARIFFS		
1. Domestic customers	**2006**	**2005**	**2002**
Metered			
Consumption block (m^3)	(K/m^3)	(K/m^3)	(K/m^3)
0 to 6	1,000	600	400
6 to 30	1,200	750	480
30 to 100	1,500	900	600
100 to 170	1,900	1,700	1,500
170 plus	2,200	1,900	1,650
Un-metered			
Customer category	(K/month)	(K/month)	(K/month)
Low cost households (Assumed consumption $30m^3$)	34,800	21,600	12,900
Medium cost households (Assumed consumption $50m^3$)	72,300	44,100	23,160
High cost households (Assumed consumption $120m^3$)	172,800	115,600	91,580
2. Communal standpipes (Assumed consumption $6m^3$)	6,000	3,000	2,500
3. Kiosk (George) (Assumed consumption $6m^3$)	6,000	5,000	3,000
4. Industrial & Commercial customers			
1.0 Metered	(K/m^3)	(K/m^3)	(K/m^3)
0 -30 m^3	1,500	800	680
30 -170 m^3	2,500	1,800	1,500
> 170 m^3	2,800	2,000	1,650
2.0 Un-Metered	(K/month)	(K/month)	(K/month)
Assessed 0 – 30 m^3	54,000		
Assessed 30 – 170 m^3	180,000		
Assessed > 170 m^3	384,400		
5. Sewer Charge			
Domestic	30% of water bill	30% of water bill	50% of water bill
Commercial/Industrial	45% of water bill	45% of water bill	80% of water bill
Sanitation Charge	In addition to the above tariff every customer pays a monthly sanitation levy irrespective of whether they have sewer connections Sanitation levy is for improvement of sanitation in urban poor areas. Charges per month are as follows: K800 for communal standpipe users K1,000 individual house connections K1,200 for Industrial/commercial customers		

Source: LWSC Approved 2006 Tariffs

APPENDIX 1-2: Peri-Urban areas of Lusaka: showing population, number of households, water providers and service levels

no.	Name of peri- urban	Legal status	Population	# of households	Water Provider	Level of service	# of communal stand posts	# of house connections	Ave. daily supply hrs
1	Bauleni	Legalised	26,142	4357	LWSC	HC and PT	16	257	24
2	Chainda	Legalised	11,379	1897	LWSC	HC and PT	16	50	16
3	Chawama/kuku	Legalised	52,679	8780	LWSC	PT & HC	197	1995	17
4	Chazanga	Legalised	37,524	6254	LWSC	HC,& Kiosks	19	48	
5	Chibolya	unknown	31,498	5250	LWSC	PT	26	14	17
6	John howard	Legalised	24,322	4054	LWSC	PT	0	968	24
7	John Laing	unknown	81,634	13606	LWSC	HC & Kiosks	10	13	10
8	Jack compound	Legalised	12,966	2161	LWSC	HC& Kiosks	27	263	12
9	Garden	Legalised	64,397	10733	LWSC	HC & PT	20	1281	10
10	Kabanana	Legalised	23,525	3921	LWSC	HC	0	1554	14
11	Kalikiliki	Legalised	21,165	3528	LWSC	HC and PT	20	72	
12	Kalingalinga	Legalised	28,686	4781	LWSC	HC and PT	97	654	17
13	Kamanga	Legalised	7,512	2650	LWSC	PT and HC	36	250	14
14	**Kanyama New**	**Legalised**	**82,629**	**13772**	**LWSC**	**HC& Kiosks**	**28**	**356**	**17**
15	Koumboka	Legalised	4,404	734	LWSC	PT			
16	Mandevu	Legalised	17,427	2905	LWSC	HC & Kiosks	0	3094	12
17	Marrapondi	Legalised	17,608	2935	LWSC	PT	0	3100	12
18	Msisi	unlegalised	30,045	5008	LWSC	PT and HC	39	60	24
19	**Mtendere**	**Legalised**	**59,121**	**9854**	**LWSC**	**HC**	**0**	**1358**	**10**
20	Chunga	Legalised	21,299	3550	LWSC	HC & PT	4	2639	12
21	**George**	**Legalised**	**179,012**	**29835**	**Community**	**PT and HC**	**393**	**685**	**1 to 5**
22	Chaisa	Legalised	32,512	5419	water trust	HC& Kiosks	39	82	12
23	Chipata	Legalised	84,979	14163	water trust	PT	50	19	17
24	Freedom	Legalised	10,232	1705	water trust	PT and HC	8	18	
25	Kanyama old	Legalised	116,069	19345	water trust	HC & Kiosks	102	110	8
26	Linda	Legalised	18,868	3145	Community(RDC)	PT and HC	14	85	12
27	Ngo'mbe	Legalised	64,928	10821	water trust	HC and PT	20	14	6

Legend: PT – communal standpipe, HC = house connection

Source: DTF Baseline study 2006 and LWSC Peri urban monthly reports for 2006

APPENDIX 1-3

Summary of performance for the eight cities

Indicator	Bulawayo	Mutare	Maputo	Windhoek	Lusaka	Jo'burg	Hermanus[b]	Maseru
Managing institution	Municipal	Municipal	Private	Municipal	Private	Private	Municipal	Parastatal
Population served (1000s)	1000	200	1700	250	1100	3500	32	170
% urban population with formal status	95	80	60	95	40	75	99	80
Volume supplied (m^3/day)	100,000	60,000	120,000	48,000	210,000	1 100,000	9000	29,000
Per capita gross figure (l/capday)	100	300	70	190	95	310	280	140
Annual yield from sources (mm^3)	47.5	42.0	54.0	22.2	–	–	3.3	1.8
Average rainfall (mm/annum)	460	900	800	360	900	710	760	780
Altitude (m)	1420	1550	300	1600	1300	1200	50	1700
Level of service[c] % reticulated	99	86	45	97	40	90	100	79
% stand-posts and other	1	14	55	3	60	10	0	21
Number of connections	106,000	23,000	80,000	38,000	34,800	617,000	12,400	32,000
% of metered connections	90	70	45	88	32	70	100	70
Length of distribution network (km)	2100	660	840	1300	2300	9500	290	480
WDM strategy	Yes (1998)	None	None	Yes (1994)	None	Yes (2001)	Yes (1996)	None
WDM policy	None	None	None	Yes	None	Yes	Yes	None
WDM legislation	None	None	None	None	None	Yes	Yes	None
WDM education and awareness programme	Yes	None	None	Yes	None	Yes	Yes	None
Major customer complaints	Billing	Bursts and Billing	Inadequate supply	Bursts and Billing	Inadequate supply	Billing	Billing	Inadequate supply
Dedicated WDM section	Yes	None	None	Yes	None	Yes	Yes	None
Total number of employees in water section	450	115	–	70	490	3500	25	455
Number of employees/population served	1:2200	1:1700	–	1:3600	1:2400	1:1000	1:1300	1:400
Number of employees/1000 connections	4	5	–	2	14	6	2	14
Recycling, reclamation and reuse	Yes	Yes	Yes	Yes	Yes	Yes	No	No
% Level of UAW	20	52	65	18	58	30	19	31
% Domestic consumption	55	70	80	74	80	75	95	40
Block tariff system	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Average cost of water (US$/$m^3$)	0.30	0.22	0.40	0.65	0.14	0.25	0.38	0.38
Is essential volume free or at reduced tariff?	Yes	Yes	No	Yes	Yes	Free	Free	Yes
Revenue generated[d](millions per annum)	Z$600	Z$40	–	N$45	ZK35 000	R2000	R14	M28
Financing of WDM as a % of water account	Yes (1%)	None	None	Yes (1%)	None	Yes	Yes (0.5%)	None

[a] Data from various sources (refer to Table 1).

[b] The population of Hermanus oscillates between 30,000 and 70,000 due to seasonal influx of holiday makers.

[c] Level of service is defined as (1) reticulated: household water. connections that can have taps within the house or within a private plot of land, or (2) stand posts and other: public water points, including public standpipes, water kiosks or vendors, boreholes with hand pumps, protected dug wells, protected springs, rainwater collection, or other locally defined technologies.

[d] The exchange rates of national currencies at the time of reporting are as follows: 1US$ = Z$60 = N$10 = ZK4000 = R10 = M10 for the Zimbabwean dollar, Namibian dollar, Zambian

Source: Gumbo (2004)

APPENDIX 3-1

Key Persons Interviewed

Name	Institution	Position
1. Mr G Ndongwe	Lusaka Water and Sewerage Company	Managing Director
2. Mr. K. Mayumbelo	Lusaka Water and Sewerage Company	Peri Urban Manager
3. Mrs. BC Chibwe	Lusaka Water and Sewerage Company	Community Development Officer
4. Mr. V Mujelemani	Lusaka Water and Sewerage Company	Engineer Peri Urban
5. Mr L. Mwape	George water Supply Project	Manager
6. Mr. K. Chitumbo	National Water Supply and Sanitation Council	Snr Technical Inspector
7. Mr. Sam Gonga	Devolution Trust Fund	Manager
8. Mr D Singanga	Ministry of Local Government and Housing	Head Peri urban Unit
9. Mr. Mukuka	Water watch Group (Consumer representative)	Coordinator
10. Gregory Kambaila	Central Statistics of Zambia	Researcher

APPENDIX 3-2

Questionnaire for assessing the effects of water demand management on water consumption and payment in the Peri urban areas of Lusaka:

November 2006

Instructions for the interviewer:

- Introduce yourself and explain in detail the purpose of your visit.
- Make your respondents aware that all the information that they will provide will be treated with utmost care and confidentiality
- Do not read out to your respondents, the alternative answers that have been formulated, but give them the opportunity to come up with their own ideas and when they do, just tick the corresponding answer in the questionnaire. Only read out the alternative answers to your respondents if they face problems answering the questions.
- You can write NA (=Non Applicable) when you get an answer which cannot be classified or which is not comprehensive.

Part A.: General information

Name of interviewer: _____ Date: of Survey_____
Name of Peri Urban: _____
Household no.: _____ Household Address: _____
Gender: □ Male □ Female
Age:

Part: A1: Household- Socioeconomic Data (All types of users)

1. How many people live in your household?
   [Respondent should state total number of people including small children]

2. Can you tell me the source of income in your family?
   [1] Business [2] Rentals
   [3] Wage employment [9] Other: specify

3. How much income do you earn or make in the family per month (ZMK)?
   [Respondent to state the amount and period earned)
   [1] Below K150,000 [2] K150,000 – K350,000
   [3] K350,000 – K 1 Million [4] Over K1 Million

4. What is the highest level of educational attained by the head of the household?
   [1] Never attended school [2] Primary G1- G7
   [3] Secondary G8 – G12 [4] College or University

Part: B: Water sources, (All types of Users)

1. What was your main source of water before the one you are currently using?
   [1] Public stand pipe [2] Yard connection
   [3] House connection [9] Other: Specify

2. What is your main source of water supply that you are using?
   [1] Public stand pipe **Proceed to Part B1**
   [2] House connection **Proceed to Part B2**

3. Why did you choose to get water from this source?
   [Respondent can give more than one reason. Tick each answer]

Tick	Reasons (specify)	Tick	Reasons
1	Distance	4	Good pressure
2	Cost	5	Only source
3	Quality		

Part B1: Households using public standpipes

1. How far away is the water point where you are drawing your water now?
   [1] Within 100m [2] 100 to 400m [3] More than 400m

2. Has the distance to the water point changed your consumption of water?
   [1] Yes: If yes go to Q3 [2] No: if no go to Q4

3. How has your water consumption mentioned in Q2 changed?
   [1] Reduced [2] Increased [3] Not changed [4] Don't know

4. How many hours is water available at this source?
   [1] Per day __ hrs [2] In a week___Days

5. How do you draw water from the source you are currently using?
   [1] Container [2] Drum [9] Other: Specify
6. Is the point at which you draw your water metered?
   [1] Yes Go to Q7 [2] No Go to 10

7. How has metering affected your usage of water?
   [1] Reduced [2] Increased [9] No change

8. How has metering of the water point affected your payment for water?
   [1] Started Paying more [2] no change in payment [3] started to pay less

9. How much water does your household use each day?_____ litres
   [Respondent can also specify amount consumed by no. of container used]
10. What do you use this water for?
   [1] Cooking [2] Drinking [3] Bathing
   [4] Laundry
11. Do you pay for the water you use?
   [1] Yes Go to Q12 [2] No Go to Q16

12. Why should you pay for water?
   [1] To avoid interruptions [2] To enable provider to supply [3] Services to improve

13. To whom do you pay your water to?
   [1]Resident development committee (RDC) [2] NGO [3] Water trusts [4] LWSC

14. How do you pay for the water?
   [1] Bill [2] Per container [3] Scheme card [4] Fixed charge

15. How has this method of payment mentioned in Q 18 affected your consumption?
   [1] Reduced consumption [2] Increased consumption [9] No change

16. How much do you pay for water?
   [1] Daily K_____ [2] Weekly K_____ [3] Monthly K_____

17. Has there been any increase in the price of the water you are using?
   [1] Yes Go to Q18 [2] No Go to Q20

18. What improvements did you observe in the water supply after the price increase?
    [1]Pressure improved [2] Supply hours increased [3] More stand pipes
    [4] No improvement

19. How has the change in the price of water influenced your usage of water?
    [1] Reduced consumption [2] Increased consumption [9] No change

20. Among the various uses of water in your home, where have you changed your consumption?]
Tick corresponding answers

Water use	Increased	Reduced	No change
[1] Cooking			
[2] Laundry			
[3] Drinking			
[4] Cleaning the house			
[5] Bathing			

21. Would you be willing to pay for improved water services?
    [1] Yes Go to Q22 [2] No Go to Part C

22. Which water supply services should be improved for you to continue paying?
    [1]Pressure [2] supply time [3] reduce interruptions
    [4]More standpipes [5] house connection [6] Low price
    [7] Improve billing [9] Other (Specify)

PROCEED TO SECTION C

Part: B2: Households using individual house connections

1. Compared to your previous source of water, how do you rate the new source?
   [1] Improved [2] Not improved [9] no change

2. How many hours is water available at this source?
   [1] Per day __ hrs [2] Per Week___Days

3. What do you use this water for?
   [1] Cooking [2] Laundry [3] Drinking [4] Cleaning the house
   [5] Gardening [6] Bathing [9] Other

4. Among the various uses of water in your home, where have you changed your consumption?

Water use	Increased	Reduced	No change
[1] Cooking			
[2] Laundry			
[3] Drinking			
[4] Cleaning the house			
[5] Bathing			

5. Is your water connection metered?
   [1] Yes Go to Q7 [2] No Go to Q112

6. When was the meter installed?_____

7. How often does the water provider read the meter?
   [1]Daily [2] Weekly [3] Monthly [4] Never read

8. Has the installation of the water meter affected the amount of water you use?
   [1] Increased use [2] Reduced use [3] Not changed

10. How has the installation of the meter affected your payment for water?
    [1] Started to pay more [2] no change in payment [3] started to pay less

11. If usage of water has changed state why this has changed?
    [1] I monitor my usage [2] Only use what I need
    [3] Control cost [9] Don't know

12. Are there any water-saving measures practiced in the household?
    [1] Yes Go to Q113 [2] No Go to Q14
13. What are the water-saving measures practised in your household?

Water use	Reduced	Increased	No change
Bathing			
washing			
Cooking			
Drinking			

14. Do you pay for the water you use?
    [1] Yes Go to Q15 [2] No Go to Q22

15. Why should you pay for water?
    [1] To avoid interruptions [2] To enable provider to supply [3] Services to improve [
    9] Other Specify

16. To whom do you pay for your water?
    [1]Resident development committee (RDC) [2] NGO [3] Water trusts
    [4] Lusaka Water and Sewerage [9] Other (Specify)

17. How do you pay for the water?
    [1] Monthly bill [2] Per container [3] Scheme card
    [4] Fixed charge [5] Fixed charge [9] Other: Specify

18. How much do you pay for water?
    [1] Daily K_____ [2] Weekly K_____ [3] Monthly K_____

19. How often do you receive the bill or scheme card?
    [1] Weekly [2] Monthly [3] Daily [9] Other

20. How has this method of billing mentioned in Q 20, affected your consumption?
    [1] Increased [2] Reduced [1] Not changed

21. If consumption has changed mention reasons why consumption has changed?
    [1] Price [2] Use what I need [3] Save water
    [4] I receive bill on time Other (specify)

22. Has there been any change in the price of water you are using?
    [1] Yes [2] No
23. What improvements did you observe after increase in the price of water?
    [1]More water at taps [2] Pressure improved [3] Supply hours increased
    [4]More houses connected [51] No improvements [9] Other

24. Has the change in the price of water influenced your payment for water?
    [1] Started to pay more [2] started to pay less [3] no change in payment

25. What reason apart from price that had prompted you to change the way you use the water now?
    [1] Distance [2] Quality [3] Availability [4] More taps
    [5] Water shortages [9] Other (Specify)
26. What reason apart from price that had prompted you to change the way you pay for water now?
    [1] Distance [2] Quality [3] Availability [4] More taps
    [5] Water shortages [9] Other (Specify)

27. Would you be willing to pay for an improved water services?
    [1] Yes [2] No [9] Other
28. Would you be willing to pay a higher price for an improved water supply?
    [1] Yes [2] No [9] Other

29. Which water supply services should be improved for you to continue paying?
    [1]Pressure [2] supply time [3] reduce interruptions
    [4]More standpipes [5] house connection [6] Justify price
    [7] Improve billing [9] Other (Specify)

PROCEED TO SECTION C

Part C: Awareness programs (To be answered by all households)

1. Have you ever received any sensitisation program?
   [1] Yes Go to Q2 [2] No Go to Q6

1. If you have received any sensitisation, what kind of sensitisation was this?

Sensitisation program	Yes	No
[1] Save water		
[2] Vandalism		
[3] Price increase		
[4] Reporting faults		
[5] Reporting leakages		
[6] Metering		
[7] Water disconnection		
[8]Water connection charges		

2. Who carried out the sensitisation programs mentioned in Q2?
   [1] Water utility [2] Community representatives (RDC)
   [3] Municipality [4] Community based NGO

3. Has the sensitisation programs influenced the way you use the water?
   [1]Increased [2] Reduced [3] No Change [

4. Has the sensitisation programs influenced your payment for water?
   [1] Started to pay more [2] no change in payment [3] stopped pay less

5. Which water services would you want the water provider to inform you?
   [Rate this on a scale of 1 to 3 i.e 3 = Very important, 2 = Important and 1= Not Important]

Service level	Not important	Important	Very important
Water interruptions	1	2	3
Water prices	1	2	3
Water saving	1	2	3
Leakage repairs	1	2	3
Connection charges	1	2	3
Meter installation	1	2	3
Pay and fault reporting centers	1	2	3
Improvement plans	1	2	3
Billing breakdown	1	2	3

6. How would you rate the quality of water services now compared to the past on a scale of 1 to 5 i.e 1= poorer, 2 = no change, 3 = slight improvement, 4 = very improved

Service level	Poorer	no change	Slightly improved	improved
Water availability	1	2	3	4
Water interruptions (stoppages)	1	2	3	4
Pressure	1	2	3	4
Leakage (plumbing) repairs	1	2	3	4
Attendance to leakages	1	2	3	4
New house connections	1	2	3	4
More public standpipes	1	2	3	4
Identifying illegal connections	1	2	3	4
Billing	1	2	3	4
Water pricing	1	2	3	4
metering	1	2	3	4

APPENDIX 3-3

Interview questions for other stake holders. The interviews were conducted with open-ended questions and the ones given below were used as start up questions.

Organization	**Guide Questions**
LWSC	**Part: A: Water supply and coverage** 1. What is the total water production for the city of Lusaka 2. What is the total water demands for the city of Lusaka 3. What is the overall population coverage 4. What is the overall unaccounted for water in Lusaka **Part B : Peri- urban water supply strategy** 1. List the organization's strategic plans towards provision of water to peri urban areas 2. What are the challenges that LWSC faces in providing water to peri urban areas 3. State the total number of peri urban areas where LWSC provides water 4. What is the overall population coverage in peri urban areas? 5. Total water production to peri urban areas in Lusaka 6. What is the total water demands for peri urban areas 7. Mention other institutions responsible for water supply to peri urban areas? **Part C: WDM measures in peri urban areas** 1. When did the organization start implementing WDM in peri urban areas? 2. Mention the main factors that led to implementing WDM in peri urban areas 3. List the names of peri urban areas where the LWSC has implemented WDM 4. State the indicators for measuring performance of WDM measures. 5. Mention the constraints LWSC is facing in implementing WDM in peri urban areas? 6. What is the organisation's water pricing policy? 7. What is the tariff structure based on? 8. What is the type of tariff structure is LWSC using for peri urban areas. 9. In what way is the tariff promoting WDM in peri urban areas? 10. Is the revenue collected in peri urban areas able to meet the cost of service provision? 11. Does the tariff or pricing policy promote water saving in peri urban areas? Has water pricing contributed to change in consumption patterns in peri urban areas? 12. Does LWSC achieve full costs recovery for operations and maintenance from the revenue collected in peri urban areas? 13. Does LWSC have a metering policy in place? If so provide a copy of the policy; 14. Mention how metering has contributed to saving of water in peri urban areas? 15. State how metering changed the consumption patterns in peri urban areas? Provide evidence where possible. 16. State how metering contributed to promotion of payment for water? Provide evidence where possible. 17. What are the various ways through which LWSC is addressing water losses? 18. Are consumers involved in managing water losses? if so mention how? 19. What are the incentives that encourage water consumers to conserve water? 20. Mention the awareness campaigns that LWSC has been carrying out in peri urban areas. 21. What has been the effects of these awareness programs on changing consumers behaviour towards water payment and consumption
NWASCO	1. What are the underlying policies that promotes provision of WSS to peri urban areas 2. What are the underlying policies or regulations for implementing WDM in peri urban areas 3. Mention how WDM is regulated and enforced in water utilities 4. What are the incentives for utilities to implement WDM in peri urban areas? 5. Can WDM be an effective tool to control water consumption in peri urban areas?

Organization	**Guide Questions**
	Can WDM be an effective tool to promote equity for water in peri urban areas 6. What are your views on WDM application s in peri urban areas Comments on performance of LWSC towards service provision in the peri urban 7. Can WDM be an effective tool to promote equity for water in peri urban areas 8. What are your views on WDM application s in peri urban areas 9. Comments on performance of LWSC towards service provision in the peri urban areas
DTF	1. What are the DTF underlying policies that promotes provision of WSS to peri urban areas 2. What role does DTF play in provision of WSS in urban poor areas 3. What role does DTF play in promoting WDM in urban poor areas 4. Can WDM be an effective tool to control consumption of water in peri urban areas? 5. Can WDM be an effective tool to promote payment for water in peri urban areas? 6. what are your comments on DTF interaction with LWSC towards service provision to peri urban areas
LCC	*1.* What are the municipal strategies and policies on water provision to peri urban areas of Lusaka? 2. What role does LCC play in provision of water to the urban poor areas 3. How does LCC peri urban unit interact with LWSC towards service provision to peri urban areas 4. To what extent can LCC promote WDM in peri urban areas? 5. How does LCC peri urban unit interact with LWSC towards service provision to peri urban areas 6. To what extent can LCC promote WDM in peri urban areas?
MLGH	1. What role does MLGH peri urban unit play in provision of WSS to urban poor areas 2. Mention the Government Policy on WSS in peri-urban areas 3. Mention the Government Policies on water conservation or WDM 4. Mention the Government Policy on Funding WSS to urban poor
WATER WATCH GROUP (WWG)	1. What are your main roles in water service provision in peri urban areas 2. Do you think CBO or WWG have a key role to play in peri urban areas 3. How does CBO or WWG deal with water complaints in their areas 4. What in your opinion on the current water situation in your area and what are the challenges to addressing the problems? 5. Are you aware of any water improvement in your area by the provider? Mention and explain 6. Can WDM be an effective tool to control consumption of water in peri urban areas? 7. Can WDM be an effective tool to promote payment for water in peri urban areas? 8. Comments on performance of LWSC towards service provision to Peri urban areas

Appendix 3-4

Table 1: DTF Funded Projects in the CU's

Location	Period	Amount (€)[5]	Donor	Target Population	outputs
Itimpi Water supply: Kitwe	2003/2004	54,000	GTZ	7,500	5 kiosks built & network repairs, & capacity building
Maiteneke water supply Chingola	2003/2004	52,750	GTZ	8,000	6 kiosks built & network extension, capacity building
Kawama, Kitwe	2004/2005	24,218	DCI	3,500	3 kiosks built & water supply line,
Kwanzi Water supply, Ndola	2004/2005	72,000	DANIDA	42,500	19 kiosks built & network extension & capacity building
Mongu Water Supply	2004/2005	72,100	DANIDA	28,000	16 kiosks built & network extension & capacity building
Baseline study on WSS in peri and low cost areas of Zambia	2004/2005	735,840	KfW DANIDA	All peri urban, low cost areas & all CU's	Creation of WSS data for all peri urban areas in Zambia investment requirements
Kawama water supply Chililabombwe	2005/2006	48,000	DANIDA	16,000	8 kiosks built & rehabilitation & network extension & capacity building
Chipulukusu water supply, Ndola	2005/2006	47,230	DANIDA	18,000	8 kiosks built, rehabilitation of network, extension & capacity building
Kanyama water supply, Lusaka	2006/2007	30,000			Kiosks being built, network repair, capacity building

Source: DTF (2006)

[5] Bank of Zambia exchange rate €1 = K5,668 as at 30/03/07

APPENDIX 4-1

Table 1: Daily water use range * how consumption changed due to metering (a)

location				how consumption changed due to metering			Total
				Reduced use	Increased use	No change	
George Compound	daily water use range	0-50 litres	Count	2	0	0	2
			% within how consumption changed due to metering	6.1%	.0%	.0%	3.2%
		>50-100 litres	Count	11	3	11	25
			% within - how consumption changed due to metering	33.3%	42.9%	50.0%	40.3%
		>100-150 litres	Count	3	1	5	9
			% within - how consumption changed due to metering	9.1%	14.3%	22.7%	14.5%
		>150-200 litres	Count	15	1	5	21
			%within how consumption changed due to metering	45.5%	14.3%	22.7%	33.9%
		>200 litres	Count	2	2	1	5
			% within - how consumption changed due to metering	6.1%	28.6%	4.5%	8.1%
Total			Count	33	7	22	62
			%within how consumption changed due to metering	100.0%	100.0%	100.0%	100.0%
Kanyama Compound	SP - daily water use range	>50-100 litres	Count	4		2	6
			% within - how consumption changed due to metering	66.7%		33.3%	50.0%
		>100-150 litres	Count	0		3	3
			%within how consumption changed due to metering	.0%		50.0%	25.0%
		>150-200 litres	Count	2		1	3
			% within - how consumption changed due to metering	33.3%		16.7%	25.0%
Total			Count	6		6	12
			% within - how consumption changed due to metering	100.0%		100.0%	100.0%

a - is the communal standpipe metered = Yes

Appendix 4-2

Table 1: How payment changed due to metering *monthly payment for water range * location (a)

(Communal standpipe)

How payment changed				monthly payment for water range					Total
				>3,000 <6600 (K)	=6,600 (K)	>6,600 <10,000 (K)	=10,000 <15,000 (K)	15,000 - 24,000 (K)	
George Compound	how payment changed due to metering	Started to pay more	Count		38			1	39
			% within monthly payment for water range		63.3%			50.0%	62.9%
		no change in payment	Count		16			1	17
			% within - monthly payment for water range		26.7%			50.0%	27.4%
		Started to pay less	Count		6			0	6
			% within - monthly payment for water range		10.0%			.0%	9.7%
Total			Count		60			2	62
			% within - monthly payment for water range		100.0%			100.0%	100.0%
Kanyama Compound	how payment changed due to metering	Started to pay more	Count	6		1	2	1	10
			% within - monthly payment for water range	100.0%		50.0%	100.0%	50.0%	83.3%
		no change in payment	Count	0		0	0	1	1
			% within - monthly payment for water range	.0%		.0%	.0%	50.0%	8.3%
		Started to pay less	Count	0		1	0	0	1
			% within - monthly payment for water range	.0%		50.0%	.0%	.0%	8.3%
Total			Count	6		2	2	2	12
			% within - monthly payment for water range	100.0%		100.0%	100.0%	100.0%	100.0%

a - is the communal standpipe metered = Yes

Table 2: How payment changed due to metering * method of payment for water * location cross tabulation (a) **(Communal standpipes)**

location	How payment changed?		Count and % within	Payment method		Total
				Per container	Scheme card	
George Compound	how payment changed due to metering	Started to pay more	Count	0	39	39
			% within - method of payment for water	.0%	63.9%	62.9%
		no change in payment	Count	1	16	17
			% within - method of payment for water	100.0%	26.2%	27.4%
		Started to pay less	Count	0	6	6
			% within - method of payment for water	.0%	9.8%	9.7%
Total			Count	1	61	62
			% within - method of payment for water	100.0%	100.0%	100.0%
Kanyama Compound	how payment changed due to metering	Started to pay more	Count	8	2	10
			% within - method of payment for water	80.0%	100.0%	83.3%
		no change in payment	Count	1	0	1
			% within - method of payment for water	10.0%	.0%	8.3%
		Started to pay less	Count	1	0	1
			% within - method of payment for water	10.0%	.0%	8.3%
Total			Count	10	2	12
			% within - method of payment for water	100.0%	100.0%	100.0%

a is the communal standpipe metered = Yes

Table 3: Daily water use range * method of payment for water (a)
(Communal standpipes)

			method of payment		Total
			Per container	Scheme card	
daily water use range	0-50 litres	Count	0	2	2
		% within method of payment for water	.0%	3.3%	3.2%
	>50-100 litres	Count	0	25	25
		% within method of payment for water	.0%	41.0%	40.3%
	>100-150 litres	Count	1	8	9
		% within method of payment for water	100.0%	13.1%	14.5%
	>150-200 litres	Count	0	21	21
		% within method of payment for water	.0%	34.4%	33.9%
	>200 litres	Count	0	5	5
		% within method of payment for water	.0%	8.2%	8.1%
Total		Count	1	61	62
		% within method of payment for water	100.0%	100.0%	100.0%

a - location = George Compound, SP - is the communal standpipe metered = Yes

Table 5: payment change due to metering * monthly payment for water (range) * method of payment for water (a)
(House connections)

method of payment for water	Payment changed due to meter?		Count and % w within	monthly payment for water (range)					Total
				0-10,000 (K)	>10,000 - 20,000 (K)	>20,000 - 30,000 (K)	>30,000 - 40,000 (K)	>40,000 (K)	
Bill	payment change due to metering	Started to pay more	Count	1	0	3	8	1	13
			% within monthly payment for water (range)	25.0%	.0%	37.5%	53.3%	100.0%	41.9%
		No change in payment	Count	1	0	3	4	0	8
			% within monthly payment for water (range)	25.0%	.0%	37.5%	26.7%	.0%	25.8%
		Started to pay less	Count	2	3	2	3	0	10
			% within monthly payment for water (range)	50.0%	100.0%	25.0%	20.0%	.0%	32.3%
	Total		Count	4	3	8	15	1	31
			% within monthly payment for water (range)	100.0%	100.0%	100.0%	100.0%	100.0%	100.0%
Fixed charge	payment change due to metering	Started to pay more	Count	1		3	2	1	7
			% within monthly payment for water (range)	100.0%		100.0%	40.0%	100.0%	70.0%
		Started to pay less	Count	0		0	3	0	3
			% within monthly payment for water (range)	.0%		.0%	60.0%	.0%	30.0%
	Total		Count	1		3	5	1	10
			% within monthly payment for water (range)	100.0%		100.0%	100.0%	100.0%	100.0%

a metered connection = Yes, location = Kanyama Compound

Table 6: payment change due to metering * method of payment (a)
(house connection)

payment change due to metering		Count and % within	method of payment		Total
			Bill	Fixed charge	
payment change due to metering	Started to pay more	Count	14	13	27
		% within - method of payment for water	42.4%	65.0%	50.9%
	No change in payment	Count	9	2	11
		% within - method of payment for water	27.3%	10.0%	20.8%
	Started to pay less	Count	10	5	15
		% within - method of payment for water	30.3%	25.0%	28.3%
Total		Count	33	20	53
		% within - method of payment for water	100.0%	100.0%	100.0%

a - metered connection = Yes

Appendix 4-3

Table 1: Monthly payment for water (range) * location Cross tabulation
House connections

			location		
			Mtendere Compound	Kanyama Compound	Total
monthly payment for water (range)	0-10,000 (K)	Count	11	7	18
		% within - location	11.0%	14.6%	12.2%
	>10,000 - 20,000 (K)	Count	9	4	13
		% within - location	9.0%	8.3%	8.8%
	>20,000 - 30,000 (K)	Count	20	12	32
		% within - location	20.0%	25.0%	21.6%
	>30,000 - 40,000 (K)	Count	53	23	76
		% within - location	53.0%	47.9%	51.4%
	>40,000 (K)	Count	7	2	9
		% within - location	7.0%	4.2%	6.1%
Total		Count	100	48	148
		% within - location	100.0%	100.0%	100.0%

Table 2: consumption changed due to method of billing * method of payment for water
(a)(House connections)

			method of payment for water		
			Bill	Fixed charge	Total
consumption changed due to method of billing	Increased	Count	0	2	2
		% within method of payment for water	.0%	2.0%	1.4%
	Reduced	Count	20	15	35
		% within method of payment for water	43.5%	14.7%	23.6%
	No change	Count	26	85	111
		% within method of payment for water	56.5%	83.3%	75.0%
Total		Count	46	102	148
		% within method of payment for water	100.0%	100.0%	100.0%

a pay for water = Yes

Table 3: consumption change due to tariff increase * location * method of payment for water cross tabulation (a)

method of payment for water	Consumption change			Location		Total
				George Compound	Kanyama Compound	
Per container	consumption change due to tariff increase	Reduced consumption	Count		10	10
			% within location		34.5%	34.5%
		No change	Count		19	19
			% within location		65.5%	65.5%
	Total		Count		29	29
			% within location		100.0%	100.0%
Scheme card	consumption change due to tariff increase	Reduced consumption	Count	12	1	13
			% within location	9.1%	11.1%	9.2%
		Increased consumption	Count	2	0	2
			% within location	1.5%	.0%	1.4%
		No change	Count	118	8	126
			% within location	89.4%	88.9%	89.4%
	Total		Count	132	9	141
			% within location	100.0%	100.0%	100.0%

a has tariff of water been increased = Yes

Table 4: how tariff influenced payment for water * location * method of payment (a)

method of payment for water	how tariff influenced payment for water			location		Total
				Mtendere Compound	Kanyama Compound	
Bill	how tariff influenced payment for water	Started to pay more	Count	3	10	13
			% within location	27.3%	62.5%	48.1%
		Started to pay less	Count	1	5	6
			% within - location	9.1%	31.3%	22.2%
		No change in payment	Count	7	1	8
			% within - location	63.6%	6.3%	29.6%
		Total	Count	11	16	27
			% within - location	100.0%	100.0%	100.0%
Fixed charge	how tariff influenced payment for water	Started to pay more	Count	18	7	25
			% within - location	29.5%	63.6%	34.7%
		Started to pay less	Count	16	1	17
			% within - location	26.2%	9.1%	23.6%
		No change in payment	Count	27	3	30
			% within - location	44.3%	27.3%	41.7%
		Total	Count	61	11	72
			% within - location	100.0%	100.0%	100.0%

a - has tariff of been increased = Yes

Appendix 4-4

Table 4: Types of sensitisation programs for communal standpipes

			location		
			George Compound	Kanyama Compound	Total
sensitised on water saving	Water saving	Count	33	15	48
		% within location	62.3%	71.4%	64.9%
	Stop vandalism	Count	34	18	52
		% within location	64.2%	85.7%	70.3%
Total	Tariff change	Count	28	6	34
		% within location	52.8%	28.6%	45.9%
	Reporting faults	Count	15	10	25
		% within location	28.3%	47.6%	33.8%
	Report leakages	Count	3	5	8
		% within location	5.7%	23.8%	10.8%
	Metering	Count	2	8	10
		% within location	3.8%	38.1%	13.5%
	Disconnections	Count	3	10	13
		% within location	5.7%	47.6%	17.6%
	Connection charges	Count	5	4	9
		% within location	9.4%	19.0%	12.2%

a ever been water sensitised = Yes