UNIVERSITY OF ZIMBABWE

An Assessment of the Quality of Water Services in Low-income areas of Malawi- A case study of Mtandile-Mtsiliza in the City of Lilongwe, Malawi.

By

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Department of Civil Engineering

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ABSTRACT

Water supply utilities in Africa are finding it increasingly difficult to provide adequate services to the needy areas: their core business operations are often stagnant, compounded by an increase in peri-urban and poor settlements. Studies have revealed that by 2015, urbanization in Sub-Saharan Africa will have progressed from about 3.2% to about 5.2% in a year. There are 16 low-income areas in Lilongwe city in Malawi and these low income areas are home to almost 70% of the population of Lilongwe City which is estimated at 450,000. Drinking water in these areas is provided by Lilongwe Water Board through communal kiosks. This study therefore aimed at determining the quality of water services in one of the low income areas of Mtandile-Mtsiliza in Lilongwe. The study also investigated willingness and ability of the communities in these low-income areas to pay for current and improved water services and also to investigate if service quality influences their decision on willingness to pay for improved water services. Questionnaires, focus group discussions, interviews with key personnel and field observations were the main study tools used to collect data. The indicators of quality of service considered were reliability, accessibility, sufficiency of water quantity, customer perceptions to service quality and affordability of the water services.

The results show that compared to internationally accepted standards, the indicators of service quality are met to varying degrees. It was found out that compared to international standards, the service was unreliable with 88.7% of the respondents getting water for no more than 6 hours while the internationally accepted standard is 24hrs. The average walking distance to a water point was found to be 682m as opposed to the generally accepted 200m. On average consumers in the area can afford paying for water as they water costs take only 3.4% of their monthly income which is below the threshold of 5% which is recommended by WHO and the World Bank. It was also found out that consumers are willing to pay more for improved services than for current services. The mean amount that the consumers were willing to pay for current service was found to be MK232.76. On average the consumers were also willing to pay MK374.14 for improved services and were willing to pay MK1, 864.66 for connection fees. The study also found out that households' decision on willingness to pay for improved was influenced by their perception to the current service.

It was concluded that compared to internationally accepted standards, the quality of service in Mtandile-Mtsiliza is low with the consumers also perceiving the service to be low. It was also concluded from the study that willingness to pay is influenced by the perceived service quality with the under-served willing to pay more for improved services compared to the current service. It is recommended that to improve the quality of service and hence consumer perception to service, the utility company should maintain all broken down kiosks and also reduce, subsidise or allow payment in instalments of the connection fee to enable consumers have individual connections.

Keywords: Service Quality, willingness and affordability to pay, service reliability.

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Most of all, thanks be to God the Almighty for the strength, wisdom, good health and everything through out my studies.

Masters class of 2007, you were something else, I cherish the company and moments.

DECLARATION

I ………………………………………………. Hereby declare to the Registrar of Examinations at the University of Zimbabwe, that the work contained in this thesis is the result of the author's original work. With the exception of such quotations or references that have been attributed to their authors or sources and that all photographs, sketches, maps, plans, graphs and pictograms were made by me except where it is acknowledged that someone is the author. It is submitted for the Masters Degree in Integrated Water Resources Management (IWRM), Department of Civil Engineering in the University of Zimbabwe, Harare. To the best of my knowledge, it has never been submitted before, for any degree or award in any University.

Dated This ……………… day of …………………….in the year ……………………..

Signed by:

Author: ……………………………………..
Lazarus Botomani Phiri

DEDICATION

This work is dedicated to my late mother Mrs Botomani-Phiri. Through your sickness your showed me a brave face and gave me encouragement that we can surmount any kind of task and pressure before us, …………………… just anything. May God keep you in eternal peace.

The work is also dedicated to my fiancée Mphatso Modester Selemani, for her unwavering support and strength during the long periods of my absence. You were always a shining light to my soul. May God bless you my dearest.

ACRONOMS

CVM	Contingent valuation Method
FGD	Focus Group Discussion
LWB	Lilongwe Water Board
MK	Malawi Kwacha
MSB	Malawi Bureau of Standards
NSO	National Statistical Office
NTU	Nephelometric Turbidity Units
US$	United States Dollar
WB	World Bank
WHO	World Health Organisation
WTP	Willingness To Pay

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1 INTRODUCTION

Access to safe water supply has been one of the top priorities in developing countries over the past three to four decades, and billions of dollars have been invested in pursuit of the goal of "universal service" (Gulyani et al., 2005). According to studies by Water Utility Partnership (WUP) 2003 and Gulyani et al. (2005), public utilities in developing countries often serve only a fraction of the urban population, with the vast majority relying on alternate sources. Micro studies in urban areas such as Port-au-Prince (Haiti), Jakarta (Indonesia), and Onitsha (Nigeria) show that the urban poor are disproportionately connected to the public utility, often relying on vending systems, buying water by the bucket at very high unit prices, and hence consuming very little water (Whittington, 1996). Poor households often pay vendors several times the unit price paid by connected non-poor households to the utility, and they use only a fraction of the amount of water used by the connected users. Studies carried out by Whittington et al in 1991 in Onitsha, Nigeria for example, shows that the water vending system collects 24 times per capita as much revenue as the public utility during the dry season (Whittington et al 2003).

Water utilities in Africa find it increasingly difficult to provide adequate services to the needy areas: their core business operations are often stagnant, compounded by a dramatic rise in peri-urban and poor settlements (WSP, 2003). By 2015, it is estimated that urbanization in Sub-Saharan Africa will have progressed from about 3.2% to about 5.2% (World Bank, 2003; Africa Environmental Outlook, 2004). The urban population will have grown from about 215 million to about 400 million (an increase of 86%). If current trends prevail, it is assumed that the large majority of these urban dwellers will be living in poverty in unplanned or informal settlements without access to safe water and hygienic sanitation (WSP, 2003).

Water supply to low-income areas in Malawi poses a lot of challenges to water utilities. It is inappropriate to sink wells or drill boreholes in urban and semi-urban neighbourhoods as conditions of overcrowding and poor waste disposal can lead to groundwater contamination (WaterAid, 2005). Hence water kiosks and community stand pipes present ways of delivering safe drinking water to these low-income areas (LWB, 2005).

In the past, City Assemblies in Malawi, who are the landlords of the cities, did not promote the supply of water to unplanned or informal settlements with permanent water infrastructure (Water Aid, 2005). Instead they encouraged supplying water to such settlements with communal points and kiosks. In Lilongwe City there are about 412,000 people who are partly or not served in 16 low-income areas (LWB, 2005). Even for the served areas, the kiosks are deemed not to adequately serve the communities. While informal settlements are still rapidly increasing due to high urbanization rate estimated at 4.7% per annum, some are growing thereby increasing the areas not served with water and sanitation services (WaterAid, 2005; NSO, 2004).

1.1 Problem statement

According to WaterAid (2005) low-income areas are sprouting and giving a challenge to utility companies to improve water services. This is essential in meeting the Millennium Development Goals especially Goal 7 of reducing by half the number of people without access to portable and clean water. This study then seeks to assess just how much the urban poor are served in the low-income areas. Are the consumers willing to pay for the improved services? How much are they willing to pay for the improved services? Are their decisions on willingness to pay affected by their perception to the current service? How can service in the area be improved?

1.2 Objectives

The main objective of the study is to assess the quality of water services in low-income areas of Malawi as compared to generally accepted standards and investigate its influence on willingness to pay for water services.

The specific objectives of the study are:

- To determine the reliability, accessibility and sufficiency of water services in low-income areas.
- To assess the consumer perception towards the service they get.
- To investigate the consumers' willingness and affordability to pay for current and improved services.
- To investigate if service quality influence consumers' willingness to pay for improved services.

2 LITERATURE REVIEW

2.1 General Overview

Recent reports emphasize that the world "is facing a serious water crisis" and that water access and service delivery in the developing world need to be improved dramatically and urgently, especially if gains in the fight against poverty, hunger, and disease are to be made (United Nations 2003, Gulyani et al., 2005). World leaders not only agree that water is an important part of the core development agenda but have also committed to ambitious targets for expanding access to water services (UN, undated) . At the United Nations (UN) Millennium Summit in 2000 and subsequently at the Johannesburg Earth Summit in 2002, world leaders agreed to a set of time-bound and measurable development targets—widely known as the Millennium Development Goals for 2015—which include a commitment "to halve the proportion of people without access to safe drinking water" (UN, 2003). Literature clearly shows that public utilities in developing countries often serve only a fraction of the urban population (Whittington et al., 1994; WSP, 2003; World Bank, 1993 and Gulyani et al, 2003), with the vast majority mainly the urban poor relying on alternative sources. Studies in urban areas such as Port-au-Prince (Haiti), Jakarta (Indonesia), and Onitsha (Nigeria) show also that the urban poor are disproportionately under-served—poor households are almost never directly connected to the public utility, rely on vending systems, buy water by the bucket at very high unit prices, and hence consume very little water (Whittington et al., 1991, 1997., World Bank 1996,). Poor households often pay vendors several times the unit price paid by connected non-poor households to the utility, and they use only a fraction of the amount of water used by the connected (Whittington et al., 1991). In Onitsha, for example, the water vending system collects 24 times as much revenue as the public utility during the dry season (Whittington et al., 1991).

Whittington et al. (1993) suggest that the widely used public practice of keeping domestic water tariffs low is not working. According to the World Bank (1993), the practice has resulted in massive and poorly targeted subsidization of service that has helped the rich but not the poor, has hurt the financial viability of utilities, and has led to deterioration in service quality, and consequently to low willingness to pay by users—most communities are now caught in a low price, low-quality equilibrium. To break out of this low-level equilibrium, World Bank contend, governments need to adopt a "demand-driven approach" in which utilities "deliver services that people want and for which they are willing to pay" (World Bank, 1991). There are two key ideas underlying the demand-driven approach (Gulyani, 2001). First, utilities can and should charge full costs for water and use the revenues to improve service —that is, utilities should aim to move from a low-price, low-quality service for all households to a high-price, high-quality service for those who are willing to pay for it. Second, to do so, planners in utility companies need to understand and respond to demand—quantity, price, and preferred service types and options—in every community they intend to serve because demand is highly location-specific.

2.1.1 Water services in the urban poor

Africa has the lowest water supply and sanitation coverage of any region in the world (WHO, 2000). More than 1 in 3 Africans residing in peri-urban areas currently lack access to adequate services and facilities. In the year 2000, coverage levels for water supply and sanitation in Africa were 62% and 60% respectively (WSP, 2003). Africa is also urbanizing faster than any other region with urbanization rate in Africa between 3.2 to 5.2% per annum as compared to other continents with a maximum of 3% per annum (WSP, 2003). Between 1990 and 2025, the total urban population is expected to grow from 300 to 700 million; and by 2020, it was expected that over 50% of the population in African countries will reside in urban areas (World Bank, 2003). For those organizations and individuals responsible for water service delivery in urban areas, a key challenge will be keeping up with the rapid pace of urban population growth (WSP, 2003).

According to WHO (2000), in order to meet the recently established millennium development goal number seven of ‘halving the un-served population by 2015’; urban Africa will require an 80% increase in the numbers of people served. According to WHO (2000), meeting this goal would require, on average, about 6,000 to 8,000 new connections every day. Political commitment to these goals, backed by resources and action, is essential if the Millennium Development Goal number seven is to be achieved. (WSP, 2003). Given that a large fraction of the urban population growth is occurring in communities that are poor and settlements that are informal and unplanned, the task of providing water to the un-served is becoming increasingly difficult and challenging. These informal settlements (often known as slums, low-income areas and informal settlements) now house between 40% and 70% of the urban population and range from high density, squalid inner city tenements to spontaneous, informal settlements lacking legal recognition (WUP, 2003). Some are more than fifty years old and others are the result of recent urban expansion. Bearing in mind that conditions differ between countries and cities, almost half of urban Africans – about 300 million people – will be living in slums by 2020 unless current approaches to urban development change radically (WHO, 2000).

Cross (2003) argues that regardless of their location and legal status, low-income settlements have several characteristics in common. Their residents often lack access to adequate and affordable basic water supply and sanitation services, lack adequate housing and have limited or no access to other infrastructure and services such as solid waste, storm water drainage, street lighting, roads and footpaths. Improving services in these areas is a practical challenge because of their haphazard layout, their lack of high density and/or difficult geographical and environmental conditions (WHO, 2000). Despite the size and significance of these informal settlements in relation to the total urban population, utilities often play a limited role in serving the households that reside there (WUP, 2003). While most utilities in Africa have made efforts to provide a basic level of water service through public standpipes, these services are often unreliable, inaccessible and/or oversubscribed and as a result many low-income households choose to pay a higher price for water purchased through vendors or private water kiosks (WUP, 2003). Given the magnitude and scale of the problem, improving water supply and sanitation service delivery to low-income communities is a priority for most governments and utilities.

Referring to studies undertaken by Whittington, 1996, many independent providers indicated that policy and legislation explicitly prevents them from providing water and sanitation services to low-income customers. This is particularly marked in situations where the poor occupy illegal and hazardous land or reside in unplanned areas.

2.2 Water Availability and Reliability

Previous studies carried out by Water and Sanitation Programme of water use in Kibera (Kenya), report that households tend to rely on one source to meet most of their water needs, but reliance on additional sources has increased (WSP, 1998). In the study, households reported that their primary source accounts, on average, for 66 percent of their total water use. At the same time, as many as 42 percent of the households reported that they rely on two or more sources to meet their water needs. As one would expect, the non-poor households get a higher percentage of their total water needs from the primary source than poor households do. Households need to use multiple sources because their primary source is not fully reliable and does not provide the level of service that they require (WUP, 2005).

One indicator of the water availability and reliability of service of a system is the proportion of households that rely exclusively on that system to meet their water needs. In studies by WUP (2005) it was found that 76 percent of households with private piped connections, 61 percent of those with yard connections, 62 percent of those that rely on alternative sources, and 52 percent of those using kiosks get their water exclusively from their primary source. The report further argues that in relative terms, then, the piped connection provides better service than that from a yard connection and that from all other sources combined. However, neither the “gap” between the private and yard connections nor that between the yard tap and alternative sources is was large as one might expect (WUP, 2005).

Another indicator of water availability and reliability is the number of hours that water is available from a given system (Billing et al., 1999). A proper and reliable water supply system should be able to supply water to its consumers for 24hours a day. In Kenya, 36 percent of the households with private connections, 36 percent of those relying on kiosks, and 47 percent of those with yard taps report that water is available for less than 8 hours per day (WUP, 2005). Only about one-third of households that have private connections usually get water for more than 16 hours a day. Taken together, limited water availability and the highly curtailed hours of service offer one explanation for why overall water use, by the poor, has fallen and is at surprisingly low levels. In addition to cutting water use, households cope with the intermittent water supply by storing water (Whittington et al, 1991).

2.2.1 Quantity of water versus distance

Many studies have been undertaken to try and quantify water use and demand in relation to distance from the drinking water source (WUP, 2003, World Bank, 1996). Most studies have indicated that an inverse relationship exists between travel distance and consumption. As the distance to the drinking water decreases domestic water use increases markedly. However, there is a threshold distance at which the basic water use will not decrease. One study done by Baba in southern Africa concluded that, although per capita water use drops rapidly once there is not a water connection on the property, water use varies little between households around 100 m from a standpipe and the ones where the water source is several kilometers away (Baba A.F., 1996). This concept is shown in Figure 2.2-1.

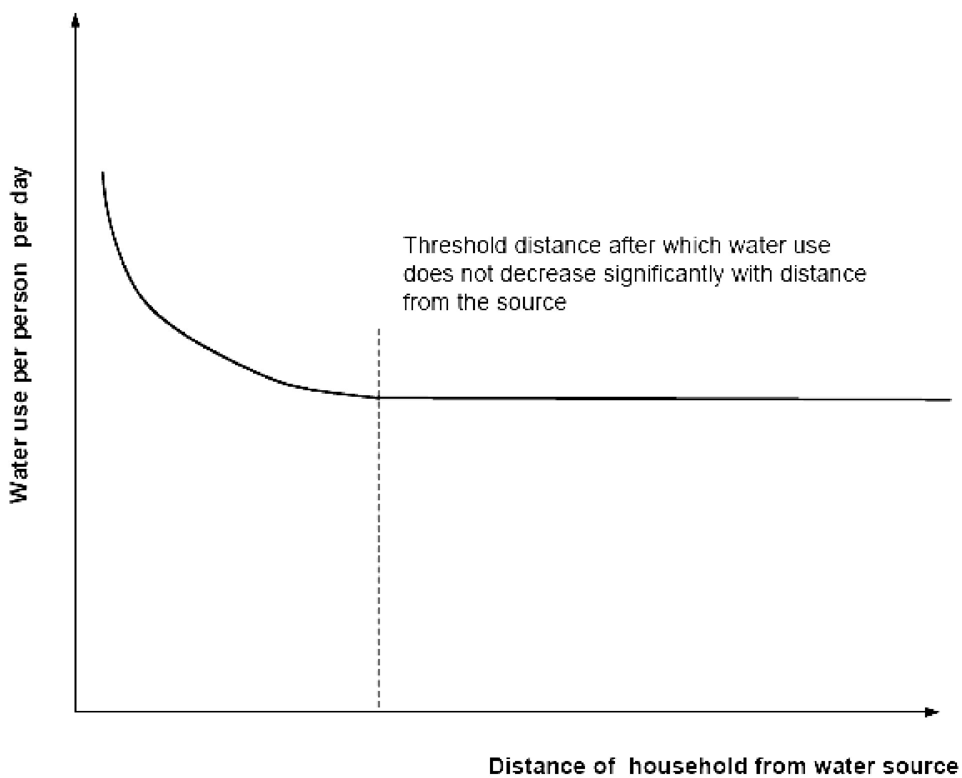


Figure 2.2-1 : Water use versus distance from source (Adopted from Baba. A. F., 1996)

2.2.2 Strategies for serving the urban poor

Many water utilities provide some limited options such as house connections and standpipes or water kiosks, but the scope for introducing more options to improve customer satisfaction is considerable. A key aspect of improving customer services is developing different service options that can be used to address the demands of consumers in different market segments. These options should be technically feasible and financially viable. The service option should also be priced taking into account peoples' willingness to pay and it should be environmentally feasible (Wedgewood, 2001).Box 1 below gives the water service options that can be used by utilities to supply water in low income areas.

Box 1: Options available in supplying water to the urban poor (Adopted from Wedgewood, 2001)

- Individual house connections with various pressure regimes and frequency of water supply. There may be a variety of means of connecting to the water mains, for example by conventional buried pipe, possibly metered, or through informal connections to an individual manifold or meter some distance from the dwelling.

- Individual yard connections at various pressure regimes and frequency of supply, where water is obtained from a tap outside the house. The house is unlikely to have internal plumbing.

- Shared group connections with a few households or a 'street' sharing one connection at various pressure regimes and frequency of supply in order to minimize connection charges and any fixed standing charges. Alternatively one household with a yard connection may sell on water to neighbours.

- Bulk supply connections where the utility sells water through a bulk meter at special rates to a community or private contractor, possibly with on-site storage capacity, for selling on through a private distribution net-work to household connections or even to water kiosks

- Water kiosks, essentially communal/public water points, technically similar to stand posts where people buy water. A water kiosk may be sheltered (with a structure) or open and may include storage and/or bathing facilities. A utility, a private operator or a community group may manage the water kiosk and sell water at a predetermined price per container, although different payment methods may be adopted.

- Stand posts, communal/public points where water is collected by many people. Stand posts, as opposed to kiosks, are usually unmanned and there is no direct charge for the water provided (particularly in South Asia).

- Supply by vendors. Vendors may transport water in various ways such as using bicycles, handcarts, animal-pulled carts and motorized delivery vehicles (trucks) to deliver water to consumers.

Water kiosks, essentially communal/public water points, where people buy water. A water kiosk may be sheltered (with a structure) or open and may include storage and/or bathing facilities. A utility, a private operator or a community group may manage the water kiosk and sell water at a predetermined price per container, although different payment methods may be adopted (WSP, 2003).

Many water sector experts note that well-managed kiosks are an appropriate and financially sustainable solution for providing water to poor households (Whittington et al, 1991, Collignon and Vézina, 2000., WUP, 2003). These experts argue that private connections are often inaccessible to the poor. First, for those within reach of the network, connection costs tend to be unaffordable. Second, the poor often cannot pay lump-sum bills monthly or quarterly, especially because their income tends to be irregular. The result is high disconnection rates or large arrears or both, and both the utility and poor consumers are left worse off. In addition, many poor households may live in areas that are inaccessible (for legal or technical reasons) to utilities, or they may be tenants—renting rooms—and not have a choice in service level. For these households, alternatives to the utility may include small-scale private service providers and self-provisioning.

Where access to a private or yard connection is limited, kiosks or public standpipes may be an appropriate option for the poor. WUP (2003) argues that kiosks are the best supply option to the urban poor because of the following reasons:

- Kiosks allow users to buy in quantities and at times that they can pay;
- Kiosks entail lower capital costs per household served, compared with private and yard connections (allowing, among other things, coverage rates to be increased significantly and faster and presumably lowering the unit cost to the user)
- Permit (better) cost recovery by the utilities because the kiosk operators ensure that the users pay for the water.

In other words, kiosks provide a flexible, desirable, and good service to the poor by allowing them to purchase in (small) quantities, as and when they have money (as opposed, for example, to a lump-sum monthly bill that is due on a fixed date each month). The poor get a service that they can afford, and the utility recovers most of the costs of providing such a service. Further, given that almost all of the customers of kiosks tend to be poor, any subsidies directed to the kiosk system are better targeted.

However, if not managed well, this approach does not work well. In a study carried by the World Bank in three urban centres in Kenya, water kiosks are neither providing the quality of service desired by users nor achieving the utilities' objective of subsidizing costs to poor households (WUP, 2003*)*. From the price analysis, it was discovered that kiosk owners charge, on average, a price that is 18 times higher than the subsidized prices at which they receive water from the utility. That is, the utility provides a subsidy on every unit of water it supplies to kiosks, but this does not reach users, the majority of whom are indeed poor.

2.3 Consumer perception

Water should be free of tastes and odours that would be objectionable to the majority of consumers (WUP, 2003). In assessing the quality of drinking-water, consumers rely principally upon their senses. Microbial, chemical and physical water constituents may affect the appearance, odour or taste of the water and the consumer will evaluate the quality and acceptability of the water on the basis of these criteria (WHO, 2004). According to Gulyani et al, 2003, although some substances in water may have no direct health effects, water that is highly turbid, is highly coloured or has an objectionable taste or odour may be regarded by consumers as unsafe and may be rejected. In extreme cases, consumers may avoid aesthetically unacceptable but otherwise safe drinking-water in favour of more pleasant but potentially unsafe sources (WHO, 2004). WUP therefore urges that it is wise to be aware of consumer perceptions and to take into account both health related guidelines and aesthetic criteria when assessing drinking-water supplies and developing regulations and standards. Changes in the normal appearance, odour or taste of a drinking-water supply may signal changes in the quality of the raw water source or deficiencies in the treatment process and should be investigated (WUP, 2003).

2.4 Willingness to pay

The term willingness to pay describes the consumer's preferences in relation to changes in water services and prices. The willingness to pay is the expected payment a user is willing to pay for a given service/product or a given change in service level or product attributes. (Lopaying, 2004; CWS, 2006). When improvements are introduced, willingness to pay reflects the level of increase in payment that leaves the consumer indifferent as to the situation before and after the change. Likewise, the willingness to pay to avoid a deterioration of the situation represents the compensation in payment which will be necessary to leave the consumer indifferent. Studies by Whittington (1994) adds that willingness to pay for water and wastewater services is determined by a large number of factors including, but not limited to, the public perception of the quality of water services and the existence of alternative sources of water that are available to the consumers.

Whittington’s 1991 describe a study from Onitsha, Nigeria, which illustrates how levels of payment for water equate to the financing of urban water supply infrastructure development. Roy (2004) believes that governments of developing countries increasingly seek methods of cost recovery to improve public utility service provision. They do so by attempting to assess the amount consumers would contribute to the costs of such service provision. Briscoe (1997) suggests that attention to the rural area should be pursued as an additional source of state revenue. However, as Whittington (1993) states little is known about household behaviour in securing water for domestic purposes and how much they will be paid for improved services.

Major development agencies such as the World Bank and WHO promote the pricing of water as a means for public water utilities to manage the allocation of existing water supplies more effectively (World Bank, 1993). The WB therefore supports the economic concept of willingness to pay for water. The Bank's approach to estimating levels of Willingness to pay is by application of the 5% rule. This rule commonly assumes that there is an elastic demand for the purchase of water with a cost of less than 5% of a household's income and an inelastic demand where the cost exceeds 5% of the household's income. Winpenny (1994) criticizes such a broad approach to assessing levels of WTP not least because it does not allow for the varying values of water through space and time. Rogerson (1996) agrees with Winpenny by stating that development agencies tend to overestimate the amount individuals are willing to pay whilst government agencies tend to underestimate. Consequently, Rogerson (1996) advocates further research, but at the household level in order to assess levels of WTP more accurately. Rogerson (1996) continues to argue that such inaccurate pricing levels for water often result in the failure of many water supply projects. USAID is aware that the situation is compounded by project failure as it is misinterpreted by water planners and public officials as an indication that the price is set too high rather than an indication of unmet demand and dissatisfaction (USAID, 1996).

2.4.1 Contingent Valuation Method in soliciting WTP

Willingness to pay is commonly determined by using the Contingent Valuation Method (CVM). Contingent Valuation Method is a survey-based stated preference methodology that provides respondents the opportunity to make an economic decision concerning the relevant non-market good. Values for the good are then inferred from the induced economic decision. In CV individual respondents are asked hypothetical questions about how much they would be willing to pay to access a resource or goods (Carson et al., 2001). This method has been used widely in estimating hypothetical goods or services and has received widespread attention in economic literature (Cameron, 1987; Whittington, 1992; World Bank, 1999; Kurukulasuriya and Mendelsohn, 2001).

The households mean Willingness to Pay (WTP) is the variable of interest that is calculated from the CV method. To calculate the mean WTP, the sample average is the best (FAO, 2000). However, this requires that data be following normal distribution (FAO, 2000). Unfortunately, in many CV studies - including this one - the WTP distribution is not normal. In these circumstances, then, the maximum likelihood estimate (MLE) of mean WTP is more statistically efficient (FAO, 2000). Nevertheless, to use the MLE method requires that WTP distribution be specified. However, some researchers have developed ways to estimate mean WTP without the constraint of a given distribution (Giraud et al., 2001; Haab & McConnel, 1997; Creel & Loomis, 1997; Creel, 1995, Kristrom, 1990; Turnbull, 1976). Besides, Giraud et al, (2001) argue that there is no single clearly superior method to compute WTP estimates from discrete response, which means that, variations notwithstanding, several of the methodologies that have been used will give a reasonable WTP estimate. In this study a sample mean WTP is calculated from all respondents who have expressed their willingness to pay and revealed their value for the water services. The internal validity of the WTP can be checked by regressing WTP on quality of service, vector of responses by individual households, and alternative quality of good or services (FAO, 2000). The regression is used to show that WTP correlates in predictable ways with quality of service variables (FAO, 2000).

There are three different approaches to asking the CV questions (Whittington et al., 1996). The differences in approaches emanate from response elicitation methods. Thus, the naming of the approaches is based on the method used to ask questions. Hence there are: Open ended (discrete choice method), where the respondents are simply asked to name the sum they are willing to pay, Sequential bids (referendum or dichotomous choice), where respondents are asked whether or not they would pay or accept some specified sum (the question is then repeated using a higher or lower amount, depending on the initial response). In this method, it is advisable to run a pilot survey large enough to provide the appropriate bidding figure and then conduct another survey for the actual data collection and close ended, where the respondents are asked whether or not they would pay a single predetermined amount. In this approach the sum is varied across respondents (Ray, 2004)

2.4.2 Strengths of Contingent Valuation Method

Like many other research methodologies CV has its strengths and weaknesses (Whittington, 1996). In this section some of the strengths and weaknesses are briefly discussed.

Strengths of CVM

Whittington et al., 1991 argues that Contingent Valuation Method is preferred because of its rigorous theoretical basis. Among the advantages of the method, UNDP (1999) contends that CVM is based on actual face-to-face surveys. Thus they provide proof that consumers are willing to pay for better services. It can measure WTP in a range of scenarios, the output of which can be incorporated into technical and financial plans for future augmentation. Since it uses hypothetical scenarios, it can provide WTP even for the systems that do not currently exists.

Carson et al. (2001) further adds that CV method is flexible; that facilitates valuation of a wide variety of non-market goods, including those not currently provided while FAO., (2000) complements the argument by concluding that contingent valuation remains the only technique capable of placing value on commodities that have large non-use component of value, and when improvements to be valued are outside of the range of valuable data. In recent years several agencies have taken CV method as a means of assessing the demand for improvement of water supply among other uses (FAO. 2000).

Contingent valuation method is the most popular method for estimating the benefits provided by public and non-market goods (Saz-Salazar & Garcia-Menendez, 2001). It is a hypothetical method based on the information people reveal when asked directly about the value of a particular public good studied (Carson and Mitchell, 1994; Saz-Salazar &

Garcia-Menendez, 2001). The CV method can be used to support a political decision that directly affects the provision of public good (*ex ante valuation*).

In spite of the advantages, the CV method has been criticized, and even among proponents of the methodology it is recognized that the method has its weaknesses. For example, CVM has been challenged that it does not conform to economic theories (Carson et al., 1996). He further adds the CV method is based on stated preference and not revealed preference. This fact then leads to a question of truthful statement (revelation) of preferences. When a consumer responds to a CVM questions and states his/her preference or willingness to pay, it usually is not certain that he/she will actually pay the stated amount for the goods or services in question (Carson et al., 2001; Hartwick & Olewiler, 1998).

FAO (2000) also argues that the quality of stated preference data is inferior to observing revealed preference, thus the CV method is highly flawed. This flaw however can be avoided by clearly explaining to respondent the good or service to be valued, how it will be delivered to the public, and what are realistic expectations of payment (Carson et al., 2001).

CV surveys are considered complex, time consuming and expensive to implement (Carson et al., 2001). He further argues that Contingent Valuation surveys are vulnerable to the warm glow effect. The warm glow effect is a form of interviewer bias. It occurs if a respondent in a CV survey attempts to please an interviewer by agreeing to pay some amount when he or she would not do so otherwise, except for the utility gain associated with telling the interviewer. Some authors claim that familiarity with a good is a necessary prerequisite to providing “meaningful responses” to CV questions. They also argue that personal experience or familiarity is a factor in the decision-making process when consumers make use of related experiences in making choices (Mitchell and Carson, 1989; Whittington et al., 1990). Therefore, CV survey designers need to ensure that prospective consumers understand what they are being asked to value, how it will be provided, and how it will be paid for (Mitchell and Carson, 1989; Whittington et al., 1990). This message should be clear to all respondents regardless of their variation in life experience and educational background (Mitchell and Carson, 1989).

2.5 Affordability and ability to pay.

According to Lopaying (2004), the notion of affordability is closely linked to the willingness to pay. However, whereas the willingness to pay survey gives information on whether the households are prepared to pay more for current and improved service or to avoid a worsening of the service, the affordability analysis gives information on the ability to pay. The data collected on affordability is "objective", but it has to be subjectively interpreted. This differs from the willingness to pay assessments that are based on the consumers' own subjective assessments of utility and budget constraint (Littlefair, 1998).

The affordability is related to the upper limit of expenditure on water services. An upper limit of expenditure on water for a household cannot be objectively established. Therefore, it is necessary to apply tools to obtain an overview of the average income and the distribution of income, and hence provide indicators as to when there is a problem of affordability that needs to be addressed. Such indicators must be derived from income, expenditure patterns and water consumption (Whittington, 1994). A household is assumed to be unable to pay if it cannot pay the water and wastewater bills without having to cut down significantly on basic needs, such as food, and other public services, such as heating.

Another definition of ability to pay could be related to the behaviour if non-paying customers were cut off. In this strict sense, few customers would have affordability problems, as water is a necessity good (Whittington, 1994). However, Roy (2004) argues that the definition is relevant only after the investment decision has been made, and affordability issues cannot influence the level of service provided. The result of the affordability analysis should influence the target service and the tariff level. Furthermore, it can provide input for the design of subsidy schemes to poor households. The analysis might influence the political acceptability, especially when poor households constitute a major rating block, or if their plight is of concern to the electorate.

Affordability or ability to pay for water is expressed by the ratio of monthly household water consumption expenditure. According to McIntosh (2003) some 20 years ago, a figure of 5% of household income was arbitrarily set as a realistic ceiling on affordability for water supply and sanitation services. This is in tandem with other authors and organization that set the range of 3% - 5% of the average household income as the maximum affordable level of water services (World Bank, 2003., WSP, 2003., Whittington, 1996). This is as a first indicator of affordability. It was felt that nearly all people in developing countries could pay this amount.

2.6 Level of service

According to Webster (1999) the level of service can be defined in the following terms:
• Technical terms as follows:
- For water supply in terms of the quantity and quality of the water available within a given distance;
- For sanitation in terms of whether there is a pit latrine, pour-flush latrine or piped sewerage;
• Performance terms e.g. a stipulated measure of reliability.

Table 2.6.1 gives the different definitions of levels of service in Southern Africa as highlighted by Webster (1999)

Table 2.6.1: Typical levels of service providing access to safe water supply in high density areas of Southern Africa (Adopted from Webster, 1999)

Level of service	**Water Supply**
Deficient	Water source unsafe, or in adequate, return travel time to source more than 30 minutes.
Basic	Community stand posts or kiosks. A minimum of 25 litres of potable water per person per day. This should be provided at a minimum flow rate of not less than 10 litres per minute. The source should be within 200 meters of a household. There should not be more than seven days interruption of the supply to any consumer per year i.e. water should be available 98% of the time. Return travel time to a source should not be more than 30 minutes.
Intermediate	Point source e.g. yard connection on householder's plot and adequate water supply with no more than seven days of interruption of service per year.
Full	Piped connection into house an adequate water under continuous pressure.

2.6.1 Typical urban water demand figures for Southern Africa

Countries in Africa supply water services at different levels (WUP, 2003). An overview of urban supply for some cities in Southern Africa is given in Table 2.6.2 below. Urban water demand is often quoted in terms of litres per capita per day (l/c/d) or litres per person per day (l/person/day). It should be noted that the figures in Table 2.6.2 represent the water production figures. These are the quantity of water produced at a water treatment plant and not the quantity of water used at the point of consumption. In urban water supply schemes there is usual a considerable difference between the water production figures and the water used at the point of consumption. The difference is known as unaccounted for water which is caused by a variety of factors (e.g. leakage, illegal connections, and errors in metering readings).

Over the past five years performance indicators for African water utilities have been collected by the Water Utilities Partnership (WUP, 2003). One of the parameter that was collected was per capita domestic consumption. This indicator represents the average daily water consumption per person per day. For utilities where most domestic properties are metered, the total domestic consumption can be estimated quite accurately. However, for utilities where the majority of the domestic customers are not metered it can be difficult to determine the spilt between the actual customer consumption and the unaccounted for water. In the UK the per capita domestic water consumption figures range from around 130 l/person/day to 170 l/person/day. The average domestic per capita consumption in the UK is approximately 150 l/person/day (World Bank, 2003). In southern Africa the average urban domestic per capita water consumption ranges from 35 l/person/day to over 370 l/person/day (Baba, 1996). It should be noted that the accuracy of the various estimates of urban demand will vary significantly and is dependent on the accuracy with which they are recorded.

Table 2.6.2 Overview of urban water production for selected cities in Southern Africa (Adopted from WUP, 2003)

Country	**% City population covered**	**City**	**Water Production in the city (l/c/d)**
Angola	34	Luanda	30
Botswana	100	Gaberone	286
Lesotho	98	Maseru	81
Malawi	95	Blantyre	90
Mozambique	86	Maputo	183
Namibia	100	Windhoek	-
South Africa	92	Pretoria	-
Tanzania	80	Dar es salaam	150
Zambia	88	Lusaka	255
Zimbabwe	100	Harare	156

3 STUDY AREA

3.1 General

The research was conducted in the city of Lilongwe the Capital City of Malawi. Malawi is a landlocked country in the southern Africa located between 33^{o} E and 36^{o} E longitudes and between latitudes 9^{o}S and 17^{o}S within the great East African Rift Valley that stretches from Ethiopia. Malawi form boundaries with Tanzania, Zambia and Mozambique (NSO, 2004). Figure 3.1-1 shows the map of Malawi showing Lilongwe city.

The city of Lilongwe is the second largest city in Malawi and the city is located in the central part of Malawi and lies between 33.5 ^{o}E and 34.5^{o} E longitudes and between 14.5^{o}S and 13.5^{o}S latitudes (NSO, 2004). It was declared as a Capital City of Malawi in 1975 and since then, Lilongwe has witnessed a growth in development both economically and socially.

The city has an altitude ranging from 1000 meters above the sea level to1500 meter above the sea level. The average rainfall in the city varies from 600 to 1200 mm per year. Average temperatures range from a minimum of 6^{o} in winter to a maximum of 30^{o} in summer.

Mtandile-Mtsiliza townships are high-density residential areas in the City of Lilongwe in Malawi. Water supply in these areas is provided mainly by Lilongwe Water Board through standpipes and kiosks.

3.2 Water Supply in Lilongwe City

Potable water to the City of Lilongwe is supplied by Lilongwe Water Board (LWB). LWB was incorporated under the Waterworks Act No. 17 of 1995, for the purpose of supplying potable water drinking water to the residents of the City of Lilongwe. LWB abstracts water from Lilongwe River with two storage dams about 20 kilometres west of the abstraction point. Water from the dams is released back into the river where it flows down the natural stream up to the intake point. Figure 3.2-1 shows the water supply area for Lilongwe Water Board

The city of Lilongwe covers an area of 350,000km^{2}. at present, the water supply coverage to the city population by LWB stands slightly above 75%. The remaining 25% of the city resort to alternative sources such as boreholes and wells.

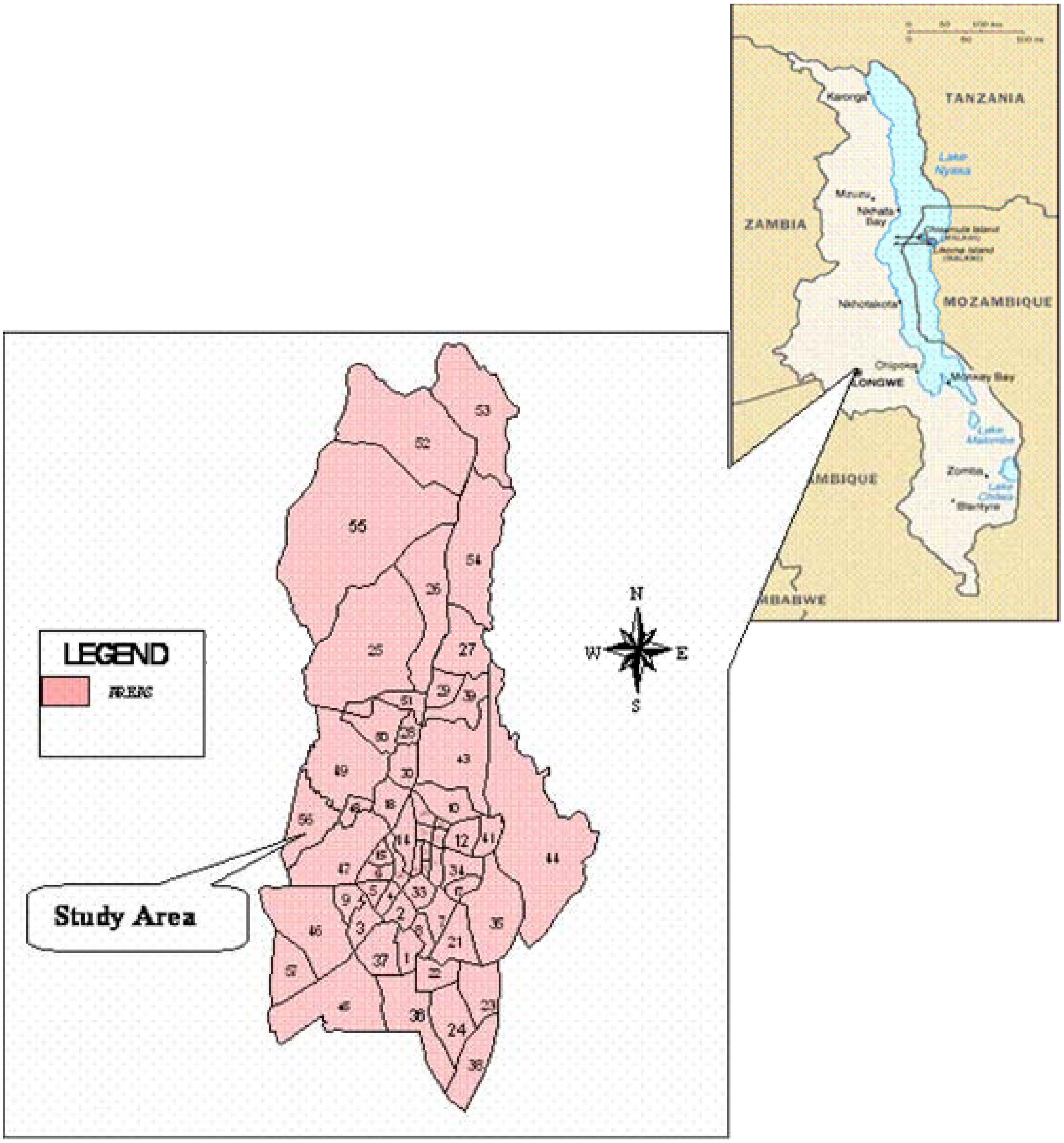


Figure 3.2-1 Map of Malawi showing Lilongwe City (Source: WaterAid, 2005)

3.3 Background Information of Lilongwe Water Board

Lilongwe Water Board (LWB) was established in 1947 and is responsible for the production, transmission, distribution and maintenance of an adequate supply of potable water to the City of Lilongwe and ensuring a sufficient supply of water to meet the needs of future developments. The following sections describe briefly the major components of Lilongwe water supply scheme.

3.3.1 Raw Water Source

LWB draws its raw water for treatment from the Lilongwe River. The River, which originates from Dzalanyama range, has a catchment area of approximately 1,870,000km^2 and the river passes through the agricultural area making the purification of water very costly. Lilongwe River has tributaries upstream of the intake of the water treatment plants namely Likuni, Chinkhandwe and Lisungwi streams.

There are two dams constructed on Lilongwe River. Kamuzu dam I with a storage capacity of 4.5 million cubic meters was raised in 1999 to increase the storage capacity to 19.9 million cubic meters. The dams act as an improving reservoir and through regulated flow from the dam, the water reaches the treatment works, which is about 20km downstream of Kamuzu dam II, along the natural river course (LWB, 2005).

3.3.2 Water Treatment Works

There are two treatment works which produce water for Lilongwe City. The works are situated along the Lilongwe River approximately 3km upstream from the centre of the city. The treatment works have gone through several extensions since the first major construction was completed in 1966 for the first treatment works. Currently, the first treatment works produces a total of 35,000 cubic meters per day of treated water. The second treatment works was constructed in 1989 with an initial production capacity of 27,000 m^3/dy was expanded in 2000 to produce a total of 60,000 cubic meters of water per day (LWB, 2005).

3.3.3 Water Production and consumption

Table 3.3.1 above gives the average water production data in Lilongwe City. The drop in water production in 2001 was caused by drought.

Table 3.3.1 Annual water production and supply, Lilongwe (Source: LWB, 2005)

Year	**2000**	**2001**	**2002**	**2003**	**2004**	**2005**
Average daily water production (m^3/dy)	53,990	51,640	54,510	54, 510	56, 770	58,650
Average daily water consumption (m^3/dy)	39,739	41,050	39,756	42,250	42,250	43,870

Table 3.3.2 gives a summary of how metered connections for the Lilongwe Water Board were distributed between different consumer categories as of the year 2006.

Table 3.3.2 number of Connections per Consumer category: Dec. 2006 (Source: LWB, 2005).

Description	Number of Connections	% of total
Residential individual connections	18,701	90.9
Institutional connections	400	1.9
Industrial/ Commercial	1,180	5.7
Community Kiosks/Standpipes	302	1.5
Total Connections	**20,583**	**100**

As can be seen from table 3.3.2 above, over 90% of the connections are residential individual connections and the least are community kiosks, which are used to supply low-income areas in the city.

3.4 Metering System for Lilongwe Water Board

Lilongwe Water Board bills water consumption of customers through installed connection meter on monthly basis. Meter readers do the manual meter readings and computer operators enter the meter reading data into the computer both for bulk and connection meters. Up to June, 2003 the monthly average new a connection to the supply system was 50 per month; however from July 2003 the monthly average new connection rate doubled to 100. The sharp rise in new connections among other factors was mainly because the fee for a standard connection was reduced from MK6, 750.00 (US$ 49) to MK2, 460.00 (US$ 18)[*].

Water supply in low income areas is done through kiosks and in some cases individual connections. These kiosks area metered and managed by water user associations, who employ kiosk attendants who man the kiosks and sell the water using 20l containers. The proceeds are then handed over to the water user associations who bank them and pay the bill to Lilongwe Water Board at the end of the month.

3.5 LWB Coverage and Population in Lilongwe

Table 3.5.1 below summarises available recent data on coverage and population, based on existing reports.

Table 3.5.1 Recent data on coverage and population

Lilongwe City		
	Percentage	**Data Source**
City population in low income areas	70%	Chilowa&Chinsinga, 2000
	70%	Kariuki, 2004
City Households served by Water Board	75%	LWB, 2005
Low Income Area households served by LWB	<50%	LWB, 2005

[*] 1 US$ = 140 Malawi Kwacha (March, 2007)

3.6 Water supply in low income areas of Lilongwe City

There are a total of 16 low income areas in Lilongwe City. Water supply in these low income areas of Lilongwe City is done by Lilongwe Water Board through the provision of kiosks and individual connections. Of late, Lilongwe Water Board has set up a special department to oversee water supply in low income areas. This department is known as the kiosk management unit. Figure 3.6-1 below shows the staffing and the reporting structure of the unit.

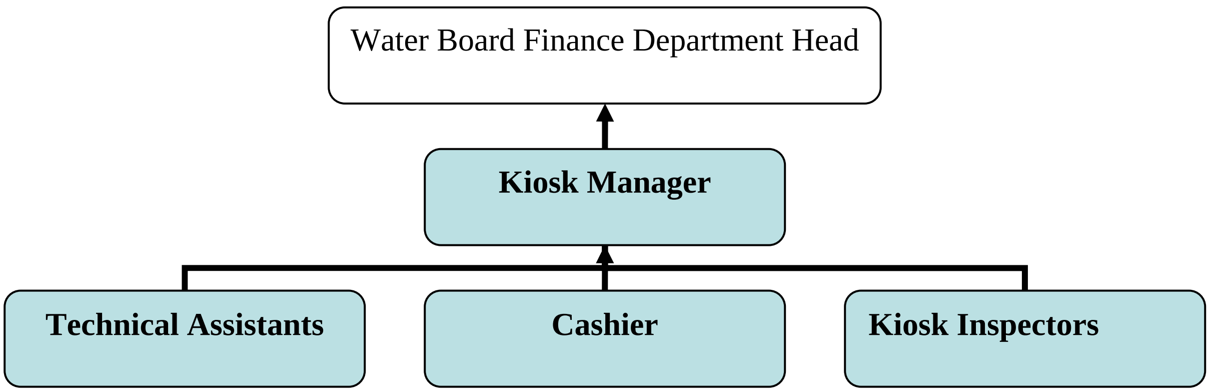


Figure 3.6-1: Structure of the Kiosk management Unit

The kiosk management unit's key functions are to both regulate and support water Users Associations, which now operates over 60% of the kiosks in Lilongwe, by:

- Providing technical assistance including both technical advice and actual repair and maintenance work.
- Responding to consumer demand for expanded water services, including engaging in community consultations, designing expansion plans, and supervising procurement of materials and construction by the Project Implementation Unit of the water board.
- Receiving and recording bill payments from Water User associations and keeping running accounts of their payments and balances.
- Participating in each Water user Association meetings and ensuring that all correct protocols are followed including clear documentation of all correspondence, decisions and transactions.
- Responding to complaints from Water User Associations and consumers.

3.7 Mtandile-Mtsiliza Townships

Mtandile-Mtsiliza (also known as Area 56) are neighbourhood unplanned settlements in Lilongwe and have a total of 71 kiosks. Historically, these kiosks were managed by a committee nominated by the surrounding community. Each committee had three members who were responsible for collecting tariffs from the households using the kiosks. Each kiosk was metered and the Lilongwe water Board would invoice the community for the kiosk water based on meter reading or an estimate of usage. The National Statistics Office from its National Health and Demographic Survey estimates the population of the area to be 22,369 with 3,561 households and an average income of MK8, 500.00 (NSO, 2004)

Many households who had paid to kiosk committees for water usage found that their sums had not been successfully passed on to Lilongwe Water Board. Faced with huge losses, Lilongwe Water Board was unable to invest in maintenance and expansion of the existing supply network, or support existing kiosk connections. This forced the water board to look at ways of sustainably managing the kiosks that would result in effective bill payment. This led to the establishment of the kiosk unit within the water board whose duty is to look solely into water supply in low income areas. The kiosk units are helped on the ground by water user associations. The associations employ kiosk attendants and also kiosk supervisors who collect the sales from the kiosks every three days. The bill is got by reading the meter at the kiosks[†] and then establishing the usage and hence the bill.

[†] A kiosk is a structure that is built and a water connection made to it and water is sold to the communities.

4 MATERIALS AND METHODS

4.1 Study design

The City of Lilongwe has a total of 16 low income areas which are mostly served by Lilongwe Water Board. Mtandile-Mtsiliza Township is one such low income area. This area was chosen for the study as a representative sample of the low income areas as it was not possible within the time and resources constraints to do the study in all the low income areas. However, Mtandile-Mtsiliza Township possesses most of the characteristics that are in most low income areas and hence it was deemed representative. The existence of water management structures in the area was one other reason for the choice of the study area. This area was also one of the areas where a recent socio economic survey was conducted by the National Statistics Office in 2004 and hence socio economic data is readily available.

4.1.1 Data Collection Methods

The main data source is a contingent valuation survey conducted in Mtandile/Mtsiliza Townships. The study employed Contingent Valuation Method to get the respondents' Willingness to pay for improved water services, their perception to service, water sources in the area and reliability of the system. A one-on-one person interview was used to administer the survey. Relevant documents from the Ministry of Irrigation and Water Development, Lilongwe Water Board, the National Statistics Office. Water Aid and other relevant secondary sources were also used as data sources.

During this in-depth research, participatory research methods were combined with direct observation. Unstructured interviews were used to collect relevant information from the Lilongwe City Assembly, Lilongwe Water Board staff, private water service providers and the communal leaders in the two areas.

4.2 Quality of water services

To assess the quality of water services in the area, the following indicators were considered:

- Reliability of water services
- Accessibility of water services
- Sufficiency of water services in terms of quantity.

These factors are further explained in the next sections.

4.2.1 Reliability water services

For a water supply system to be deemed reliable, it was considered that it should meet the following factors:

- The quality of water should be acceptable.
- The downtime periods of water facilities in the area should be low.
- The hours of water availability should be high.
- The pressure/yield of water from the facilities should be high.

These were then compared with internationally accepted standards from World Bank research documents, World Health Organisation recommendations and the Malawi Bureau of Standards.

Water quality

In this research, water quality tests were carried out to determine the quality of water in the area and to compare with the consumer perceptions to the quality of the water. The main parameters used in the water quality tests were, turbidity, electrical conductivity, pH, temperature and faecal coliforms count. The parameters were chosen because they are deemed to have a direct bearing on perception of consumers on the quality of the water. Grab samples were used and the tests were done by the Ministry of Water Development's Central Laboratory. For comparison's sake, the tests were done on water from kiosks and also from shallow wells which are the two main sources of water in the study area. One kiosk and one shallow well were selected from each of the study areas and samples were collected and analysed from these sites twice a month for three months. The sites chosen were Kiosk 2 and Jezumulu shallow well in Mtsiliza and Kiosk 32 and Machinga shallow well in Mtandile Township.

Yield of water from the facilities

To determine the yield of water from the facilities, bucket tests were conducted. In carrying out these tests, two sites were selected one from Mtandile and one from Mtsiliza. A standard 20l container was used to conduct these tests. Observations were made for 2 hours from 6.00am to 8.00am (which are peak hours in the area) and at intervals of 10 minutes. These tests were done to determine the time it took to fill a 20l container. A total of 6 data sets were obtained from each site from which the average flow from the taps at the kiosks was calculated. These tests were done to better explain the consumers' perception to the pressure of the water from the taps.

Downtime Periods

One of the indicators of reliability of a water supply system is the continuity of service. To assess downtime periods of the facilities, direct observations on broken down facilities in the area. This was done to validate the responses got from the consumers on the continuity of service. Information on facilities that were not functioning at the start of the research was obtained and bi-monthly random checks on some of the facilities were done until the end of the study was also obtained, to see if they have been repaired.

4.2.2 Accessibility of water services

Queuing time

Direct observations were made on how long consumers had to queue to get water from the kiosks. For the sake of convenience, sites that were selected for the bucket tests were the same sites that were selected for the observation of queuing time. In making these observations, a stop watch was used and recordings were made on particular individuals monitoring their time of arrival until they get the water from the kiosks. Peak hours were also chosen for these observations. A total of six data sets were obtained for analysis. A structured questionnaire was used to solicit people's views on times that they have to queue to get water.

Walking distance and walking time.

Other factors that were considered when assessing the accessibility of water services in the area were walking distances and walking time. Structured questionnaires were used to solicit information on how long the consumers walk to get their water from a nearby source. Transect walks were also undertaken in some instances to validate the distances and times that were being given by the respondents.

4.2.3 Sufficiency and acceptability of water services

Factors that were considered in assessing the sufficiency and acceptability of water services in the area were quantities of water that the households use for their daily needs and their perception to the service. These factors were assessed by soliciting responses from the consumers by the use of structured questionnaires. Focus group discussions were also used in soliciting this information.

4.2.4 Willingness to pay for current and improved services

To solicit consumers' willingness to pay for current and improved services, a Contingent Valuation Method (CVM) was used, where consumers were asked to indicate how much they are willing to pay for the current service and for a hypothetical improved service. For the hypothetical improved service the consumers were told of a scenario where the quality of service will be good.

4.3 Focus Group Discussions

Focus group discussions (FGD) were also undertaken by to better explain trends identified through qualitative survey. A small group of four representatives from the water users association, consumers, political and traditional leaders and a member from Lilongwe Water Board. A detailed focus group guideline was developed to probe major point of interest to the study and the issues included the area's current water scenario including the opportunity cost of water procurement, perception to current service, vision for improved services, operation and maintenance.

4.4 Structured Questionnaires

Structured questionnaires were administered to the consumers and they were aimed at getting data on general household characteristics, income and expenditure levels, and perception to the service they get and soliciting their willingness to pay for current and improved services. A structured questionnaire is one whereby all or most of the questions are closed (Lopez-Easamnz et al, 2005). The questionnaire that was developed and used in the survey is shown in appendix 1. The questionnaire was administered on one-on-one basis and the respondents were helped by clarifying issues that the respondents raised in the questionnaire.

A Discrete Choice Method was used to elicit the consumers' willingness to pay. this method was selected because of time and resource limitations as it was not possible within the time and resources available for the study, to run a pilot survey large enough to provide an appropriate bidding figure and then conduct another survey for the actual data collections as recommended by Whittington et al (1997) if a researcher is to conduct a Dichotomous Choice Method of elicitation. Therefore in this study, respondents were asked what amount they would pay for water supply services at the current service level and what amount they would pay if the service were to be improved to a certain hypothetical but practical level.

4.4.1 Study Units

In this study, the primary study unit is the household. It is estimated that Mtandile-Mtsiliza Townships have 1,400 households. The data from this study were gathered from 70 randomly selected households in the area which represents 2.5% of the total households in the area and which is above the minimum sample size of 0.3% for contingent valuation method as recommended by Whittington, (1993) and Roy (2004). Of these respondents, 62 did not have individual connections and relied on water kiosks and 8 had individual connections. Local leaders and the water users association were used as the point of entry into the communities. Ideally the study targeted a person who managed household finances or spouses though this was not possible always.

4.4.2 Interview approach

That interview approach that was used in this study was in-person on a one-on-one basis, with the aid of a questionnaire (Appendix 1). This was deemed appropriate due to several limitations of other interview approaches in developing countries which include low literacy levels and low telephone ownership (Roy, 2004). Nonetheless, in person interviews are generally used to produce highest quality data (FAO, 2000; Whittington, 1991). The questions were asked in such a way that respondents were given full responsibility and freedom to decide on the value and provision of other information. The questions asked in the questionnaire can be grouped into three sets:

- General socio-economic and demographic characteristics of the household,
- Characteristics of the current water sources, availability and
- The households' willingness to pay.

4.5 Data Analysis

Analysis of the data was carried out at three levels. First, the socio-economic and demographic data were summarized. Secondly the mean willingness to pay for current and improved services was calculated, thirdly the reliability and hence the quality of the current service was analysed and lastly the indicators of quality of service were compared against the willingness to pay to investigate their influence. Quantitative data collected was analysed using the Statistical Product and Service Solutions (SPSS) version 10, Microsoft excel and Minitab. Responses from the questionnaires were coded with points from 1-7.

This study uses the Probit Analysis model to statistically estimate the influence (determinants) of different variables on quality of service on willingness to pay and the appropriate amount that consumers are willing to pay for water services. In this study the continuous variable is the amount households are willing to pay.

Table 4.5.1: Variables included in Probit Model

Variable	**Expected Relation to WTP**
Source of water the household is uses: it is dummy variable, and takes 1 if the household does not have an individual connection and 0 if connected to individual connection. It is assumed that those respondents with private connection to the existing service is more willing to pay than those not connected since they are more aware of the benefit they get.	Negative
Time taken to fetch water from the existing water service in minutes and meters, and queuing time. It is assumed that people who spend more time fetching water are more willing to pay for improved services than those who don't. In the analysis, a dummy variable takes 1 for those who travel long distances (>200m) and 0 for otherwise. One benefit of providing improved and adequate water service is saving time, which has an opportunity cost of using the time for other activities. Besides, consumer demand theory suggest that household would pay more for an improved supply when costs in terms of time of obtaining water from the existing sources are higher than if this cost were low (WB, 2003; WSP, 2003).	Positive

Reliability of the existing source of water: Dummy variable, and takes 1 if the respondent says unreliable; 0 if the response is otherwise. A positive sign is expected. People are willing to pay more for the improved water if the existing water supply is unreliable. If the household/respondent considers the existing water supply in the town is unreliable, we expect a positive relation between this variable and WTP for improved water service.	Positive
Respondents' perception about the quality of the existing water supply: Dummy variable 1 if the quality of the existing water supply is poor 0 otherwise. The expectation is that a household would be more willing to pay for an improved source when the perceived quality of the existing water source is poor.	Positive
Daily water consumption by the households: Continuous variable. More water consumption means more monetary expenditure, which lead to stated less value.	Negative

Table 4.5.1 above shows the variables included in estimation, their expected sign and the rationale for their expected effect on willingness to pay for new hypothetical improved water supply

5 RESULTS AND DISCUSSIONS

5.1 Reliability of water supply

Reliability of water supply in the area was measured by looking at the downtime periods of the facilities, the hours water is available from the sources, the yield of the water from the kiosks and the price and affordability of the water services.

5.1.1 Downtime periods

One of the indicators of the reliability of a water supply system is the continuity of service on a particular facility. It has been revealed during the study that when facilities breakdown, the water board takes an average of 1.5 months to repair them. There are a total of 71 kiosks in Mtandile-Mtsiliza townships and only 38 (53.5%) of the kiosks were functioning at the time of the research. Of the non-functional facilities, 20 (60.6%) of them were monitored for a period of three months. It has been observed that 3 (9%) of the facilities were repaired after one month, 7 (21.2%) were repaired after one and half months and the rest were not repaired for the three months. This forces the kiosk operators to find temporary solutions to the problems or close the kiosk altogether until the plumbers come to fix the problem. Interviews with key personnel from Lilongwe Water Board revealed that the facilities take long to be maintained because there is low staff productivity at the water board in section maintenance staff tasked to service low income areas.

There are a total of 16 low income areas in Lilongwe City with a total number of 771 kiosks and only 3 plumbers allocated to these kiosks giving a staff productivity level of 1 plumber per 257 kiosks.

The normal downtime for water facilities as recommended by WUP (2003) is 2-3 days. The long down time periods might contribute to the non- reliability of water services in the area and hence decreasing the service quality

5.1.2 Continuity of water supply

The period water is available to the consumers in a day is also another indicator of reliability of a water supply system is as it has significant consequences for the quantities and accessibility of water available to consumers. All the respondents who get water from kiosks indicated that water is generally available only six hours a day in all areas. This was also confirmed by interviews with kiosks operators and during focus group discussions. Of the respondents with individual connections 87.5% indicated that water is available 24hours a day while the rest indicated that water is available on average 12-18 hours a day. Those who get water 12 – 18 hours stay on the peripherals of the city and sometimes pressures are very low in these areas. Responses from those who use kiosks show that 5 (8.1%) of the respondents would want if water is available 6 hours a day, 52 (83.9%) want the water available 12 hours a day 2(3.2%) want the water available 18 hours a day and the rest 3(4.8%) want water available 24 hours a day. From focus group discussions conducted with the consumers it has been found that the consumers would prefer that water be available for a minimum of 12 hours a day. According to guidelines from World Bank and WUP (2003), a good and performing utility should be able to supply water to its consumers for 24 hours. It has also been found that the water consumption levels of the respondents in the area is low and these short hours of water availability might be one of the factors that are contributing to these low water consumption levels.

5.1.3 Water Quality

Quality of water has been identified to be one of the indicators of reliability of water supply systems as they usually affect consumer perception. Concerning the quality of water, the respondents were asked to rate their perception in terms of the quality of water they get from Lilongwe Water Board. The respondents were asked to rate the water in terms of odour, colour, taste and soap consumption on a scale of acceptable, fair and unacceptable. Figure 5.1-1 shows a graph depicting how consumers rated the taste, odour colour and soap consumption.

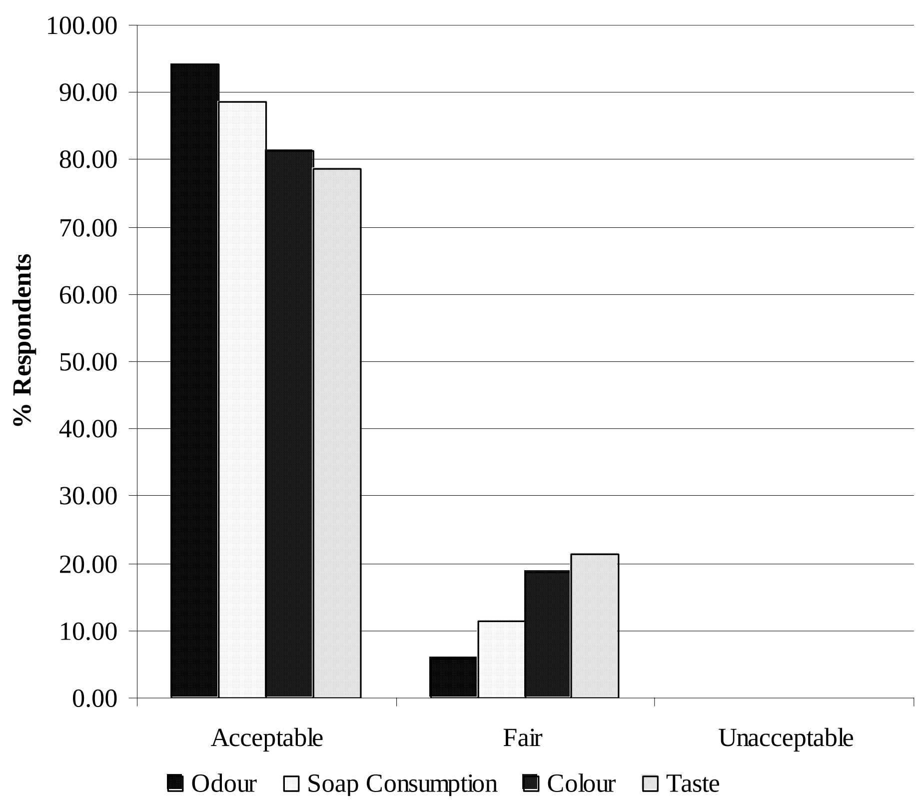


Figure 5.1-1 Consumers perception to quality indicators

As can be seen from Figure 5.1-1 above, the consumers gave an acceptable rating to the indicators of quality and none of them rate odour, soap consumption, colour and taste were ranked as unacceptable. These indicators were chosen because they are of direct bearing to the acceptance of water by consumers. In general as can be seen from figure 5.1-1 it may be said that most of the respondents (above 85%) were satisfied with the quality of water they get from Lilongwe Water Board. Another question that was posed to the respondents was whether they treat water from the kiosks. All the respondents indicated that they do not perform any treatment or purification of the water. Of the respondents, 94.6% said they believe piped water is pure and does not need to be treated further, 4.2% said they dot see the need to treat the water and 1.2% said they do not know that water should be treated (purified) before drinking.

Water quality tests of water from the kiosks and from shallow wells to analyse and determine their quality and cross check with the consumer responses on indicators of water quality. The parameters chosen to assess the quality of the water were electrical conductivity and turbidity. These parameters were chosen because they have a more direct bearing to the acceptability of the water and hence consumer perception.

Two kiosks were selected (Kiosk 2 in Mtsiliza and Kiosk 32 in Mtandile) and two shallow wells (Jezumulu in Mtsiliza and Machinga in Mtandile) where samples were taken twice a month for three months and tested to determine their turbidity, electrical conductivity and faecal coliforms count. Table 5.1.1 shows a summary of the average results of the laboratory tests while the results from the whole sampling campagn are shown as Appendix 3. The values in brackets are standard deviations from the mean.

Table 5.1.1 : Summary of water quality results

Site	**Turbidity (NTU)**	**Electrical Conductivity (µs/cm)**	**Faecal Coliforms Count (Per 100ml)**
Kiosk Number 2	2.8 *(1.04*[‡]*)*	142 *(26.8)*	0
Kiosk Number 32	2 *(0)*	155 *(9.3)*	0
Shallow Well 1 (Jezumulu)	10 *(1.41)*	1289 *(134.0)*	2154 *(164)*
Shallow Well 2 (Machinga)	7.7 *(2.06)*	1218 *(215.7)*	3423 *(958)*

The Malawi Bureau of Standards (MBS) recommends a turbidity of 1-5 NTU for drinking water which is the range that is also recommended in the World Health Organisation (WHO) guideline for drinking water. The results on the turbidity of the water from the kiosks show that the turbidity is within the accepted range of 1NTU to

[‡] Figures in brackets represent standard deviations of the mean.

5NTU. However, the turbidity is high for water from shallow wells as the values of the turbidity are higher than the recommended range. This turbidity value then means that the water from the kiosks is aesthetically accepted to the consumers and explains why most of the consumers when asked about their perception of the colour of the water from kiosks rated it as being good and fair and none said the colour of the water from kiosks is poor.

The electrical conductivity of water has an effect on the taste of the water whether it is saline or not. Water from kiosks had on average a lower conductivity 148.5µs/cm as compared to water from the shallow wells which had a high conductivity, an average of 1253.5 µs/cm. However the average conductivity for the kiosks and the shallow wells are all within the maximum allowable level of 3000 µs/cm. these results tally very well with the responses given by the respondents on the taste of water and the soap consumption in which none of them rated the taste as being poor.

A faecal coliforms test was also done to see if there were any faecal contamination on the water from the kiosks and the shallow wells. Faecal contamination of the water can lead to an outbreak of diseases such as diahorrea and dysentery for those who orally consume the infected water. Results of tests from both kiosks showed no indication of faecal contamination. However faecal contamination is very high in water from shallow wells (average of 2788 faecal counts per 100ml) when compared to guidelines. WHO (2000) and the Malawi Bureau of Standards recommendation is that for any drinking water there should not be any indication of faecal contamination (0 faecal counts/100ml) .Almost all respondents said that they never use water from the shallow wells for drinking and cooking purposes.

It can therefore be concluded that water that Lilongwe Water board supplies in the area through the kiosks is of acceptable quality while the quality of the water from shallow wells is objectionable for drinking and cooking purposes.

5.1.4 Yield of water from the kiosks

The yield of water from the source is another indicator of reliability. If the yield is low, consumers take time to fill their buckets which in turn leads to long queues and hence long queuing times. This in turn increases the water collection time.

To validate responses that were given on the consumers' perception to pressure, bucket tests were carried out at peak hours (6a.m – 8.am) to determine the flow of water from the kiosks especially at peak hours. These tests were done by determining how long it took to fill a 20l container. Figure 5.1-2 below shows the results from the bucket tests.

The World Bank (2003), Sphere Standards (2004) and WHO (2000) recommends that the flow of water at communal water points should not be less than 10 – 12 litres per minute. Results from the bucket tests show that the average flow of water from the kiosk taps was 7 litres per minute, which is lower than the minimum recommended flow of 10 litres per minute. The low flows from the taps might be one of the reasons for the long queues at most of the kiosks in the area.

The low yields from the taps might explain why from the study, 72.6% of the respondents felt that the pressure is poor, 14.5% of the respondents felt that the pressure is fair while 12.9% of the respondents felt that the pressure is good. Focus group discussions revealed that most of those who said the pressure is good stay close to the facilities and get their water very early in the morning when the pressures are at least better.

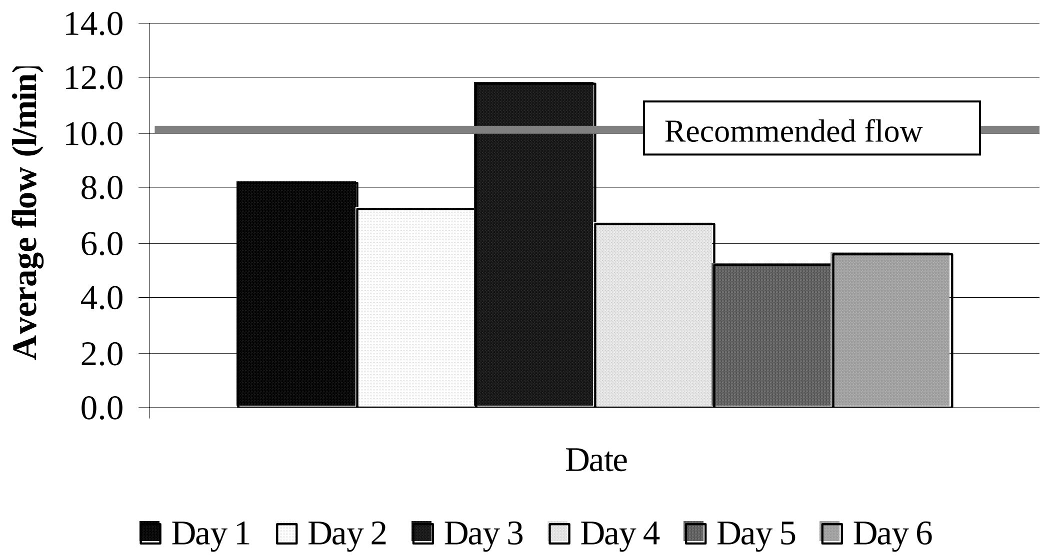


Figure 5.1-2 Graph showing yield of water from the kiosks at different days

Appendix 2 shows the results of the bucket tests where it can be seen that generally the yields were high in the first hour after the opening the taps. Interview with key informants from Lilongwe Water Board revealed that though this area was deemed as a high pressure zone, the pressures are deliberately lowered in order to better serve the neighbouring low density area which is home to some influential citizens.

Table 5.1.2 below summarises the performance of the indicators of reliability of a water supply system in the area. It can be seen from the table that most indicators scored very low and hence it can be concluded that the reliability of water supply in the area is low when compared to international and national standards.

Table 5.1.2 : Summary of reliability indicators

Indicator	**Contribution to reliability**
Downtime periods	Low
Water quality	High
Hours of water availability	Low
Yield of water from taps	Low

5.2 Accessibility of existing water supply

5.2.1 Sources of water supply in the area

Responses regarding the type of water supply used by the households indicate that 11.4% of the respondents have individual connections while 62(88.6%) of the respondents are not individually connected to the Lilongwe Water Board Supply but buy water from kiosks that are provided by Lilongwe Water Board. All of the respondents that are not directly connected to the water board however, indicated that they depended on water provided by the water board through kiosks. Those respondents who are privately connected to the existing water supply water were asked whether their water meter is functioning or not, and all of them responded that it is functional.

Households that do not have access to private piped water were asked the reason why they are not individually connected to the existing water supply system. The responses shows that 61.4% of the respondents said the main reason is due to high connection cost, 31.6% of the respondents said because they do not have their own house and hence connection to the existing system is difficult and the remaining 7.0 % said they do not need to have private connection. The other question asked to the same sample households was whether they have ever applied to Lilongwe Water Board to have access to individual house or yard connections. Responses to this question indicate that 32.8% applied and are just waiting for response while 67.2% did not apply. Those who did not apply gave different reasons. Among the reasons given 62.5% said connection costs are too high, 31.4% said they did not own their house and were waiting for their landlords to apply and 6.1% said they believed piped water is expensive.

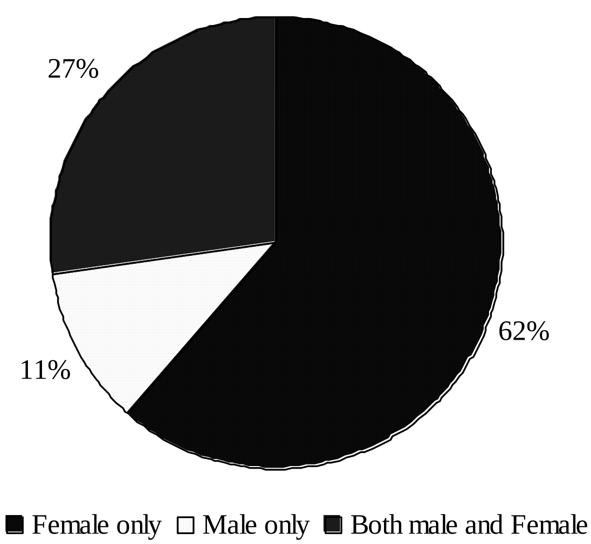


Figure 5.2-1 : Distribution of responsibility of fetching water.

Responses regarding the responsibility of fetching water indicated that 43(62%) of the respondents indicated that it is only female member of the family who are responsible for fetching water from the kiosks, whereas 8(11%) of the respondents said the male members are responsible and 19(27%) said it is the duty of either female or male, there is fetching water is the responsibility of both male and female members of the household as has been shown in Figure 5.2-1.

5.2.2 Walking distances and queuing times

Accessibility of water services is another factor that is considered when assessing quality of water services. Accessibility is also determined by assessing the distance consumers walk to access water, the times they have to queue to get water and the times that they have to spend to fetch water. If the consumers spend a lot of time fetching water, their social activities suffer, their consumption levels are low and hence they are forced to look for alternative sources of water which might not be health (WUP, 2003). Table 5.2.1 below summarises the findings on the walking distances, walking time and average queuing times.

Table 5.2.1 **Descriptive Statistics on walking distances, times and queuing times**

	Respondents	**Minimum**	**Maximum**	**Mean**	**Std. Deviation**
How far is your house to the nearest water board kiosk? (meters)	62	5.0	1,500.0	581.532	152.09
How long does it usually take to walk to and from the nearest water board kiosk? (Minutes)	62	0.1	30.0	11.852	8.725
Average time taken on the queue to get water from water board kiosk (minutes)	62	1	60	31.10	14.45

As can be seen from the table 5.3 above, people walk an average of 681.53m one way to fetch water. Actually, 53.7% of the households walk more than 500m to fetch water. However, the World Bank (2003) and WHO (2004), recommend that for improved accessibility of a water supply system in urban areas, water in urban areas should be available within 200m of households. The Sphere minimum standards in disaster response however recommend that water should be made available to users within 500m of their households. The distances that the consumers in the area walk in order to fetch their water is therefore higher than the recommended 200m for areas of this setting. This might be one of the reasons for low consumption levels in the area.

As can be seen from Figure 5.2-2, as the distance from the water point increases, the water that the households consume decreases. However, for those households that are far from the source but still has high consumption levels, this might also be a function of the household size as two or members from the same family go to fetch water.

It was observed that on average, people in the study area queue for about 30 minutes in order to get water from the kiosks as can be seen from Table 5.2.1. This might be because of the low yield from the taps, the larger number of people at the kiosks due to a high number of non-functional boreholes. The Sphere Standards Handbook for disaster response that people should not queue for more than 15 minutes to get water from a source (Sphere Project, 2004). These long queues in turn forces people to use less quantities of water as can be seen from Figure 5.2-2.

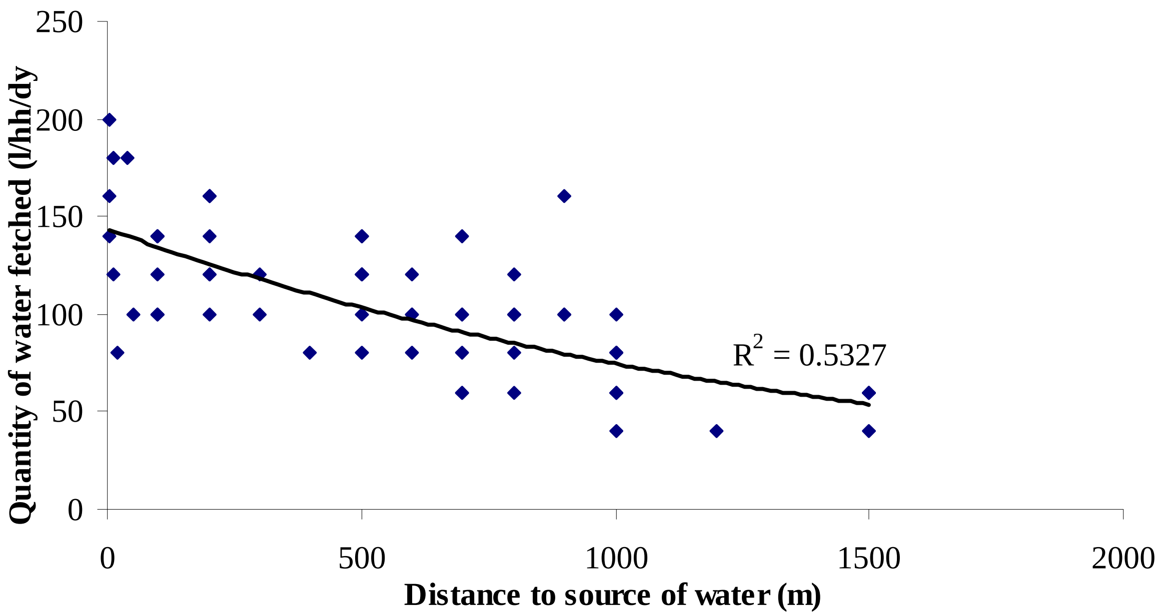


Figure 5.2-2: Relation between distance travelled and quantity of water consumed

However, information gathered through transect walks and short interviews with consumers and the water users association revealed that the consumers have the water facilities close to them but the facilities have been on breakdown for so long and this forces them to walk for long distances to where the facilities are functioning. This in turn increases the queuing time at the taps (Fig 5.2-3). An addition of the walking time, queuing time and time it takes to draw water, reveals that in total, people in the study area spend an average of 1 hour fetching water. Considering the fact that most people have to go to the kiosks three times a day, then the households spend about 3 hours a day on fetching water alone.

Figure 5.2-3 : Picture showing long queues at a kiosk in Mtandile

Household surveys by Gulyani et al. done in Kenya found that poor low income households in Kibera who rely on kiosks for their water supply spend, as much as 55 minutes collecting water and this was deemed to be too high (Gulyani et al., 2005).

5.2.3 Sufficiency of water in the area

From the study, it was found out that the average household consumption for household that buy water from water board kiosks is 100 litres per household per day ranging from 20 litres per household per day to 160 litres per household per day as is shown in Table 5.2.2 below. This only takes into account portable and clean water that is recommended to be provided to consumers.

Table 5.2.2: Household daily water consumption

Water used per household (litres)	**Frequency of response**	**Percent (%)**
20	1	1.6
40	5	8.1
60	6	9.7
80	8	12.9
100	18	29
120	12	19.4
140	9	14.5
160	3	4.8
Total	62	100

Number of respondents = 62, Stdev= 33, Mean = 100l, Min = 20l, Max = 160l

Results from the study have revealed an average household size of 6 members. When the average household water consumption is compared with the average household size, it is found that the average per capita water consumption of the area is 16.7 litres per capita per day (considering consumption from LWB supply only which is the major source of potable water in the area). This is below the average per capita consumption for hygienic purposes of 25 l/p/d recommended for hygienic purposes by WHO (2004) and which is also the targeted by Lilongwe Water Board. Some of the reasons that might explain the low consumption levels are the long distances that the consumers have to travel to collect water from kiosks, which force them to use less water, the long queuing times at the kiosks, the less hours of water availability, low pressures at the kiosks, the high cost of the water and availability of alternative sources of water like shallow wells.

From the household questionnaires, it was found that on average the consumers felt that an additional 60 litres per household would help them meet their daily water needs. The household survey provides both a qualitative and quantitative measurement of the sufficiency of their current water consumption. Given the gap between aspired water consumption and actual consumption levels, it is not surprising that only 40.3% of the entire sample rated their primary source as “Always sufficient”.
And the rest felt that the water supply is insufficient.

5.2.4 Existing price of water

Water at the kiosks is sold at a price of MK2.00 per 20 litre container (K100/m^3) which translates to 0.72US$/$m^3$ [§]. Those with individual connections have meters and they are billed monthly. The respondents were asked to produce a copy of their monthly bills and it has been found out that consumers with individual connections are charged K52/m^3 (0.37US$/$m^3$) as has been shown from the water bill in Appendix 4. WUP (2003) estimates the median water tariffs in Africa to be US$0.41 per cubic meter which means that those with individual connections in Mtandile-Mtsiliza Townships pay less than the median value in Africa while those who use kiosks pay more. Studies done by Whittington found that low income area consumers in Onitsa, Nigeria pay almost 24times more than their high earning (Whittington, 1991).Studies by WSP in Kibera which is a low income area in Kenya found that consumers on average pay US$3.50 per cubic meter which is much higher than what the consumers in Mtandile-Mtsiliza are paying. The main reason behind these high prices is that households are buying water from on-sellers such as tankers, kiosks and water delivery services.

The respondents were also asked their perception on the cost of water. For those respondents that have individual connections 87.5% indicated that the price of water is cheap and the rest said the price of water is fair. Of those respondents that are not individually connected to the water supply 40.3% felt that the water is cheap, 12.9% said that they felt that the price of water is fair and the rest, 46.9% felt that water in the area is

[§] 1 USD = 140 Malawi Kwacha (March, 2007) expensive. Figure 5.2.4 below summarises the findings on the consumers' perception to the price of water in the study area.

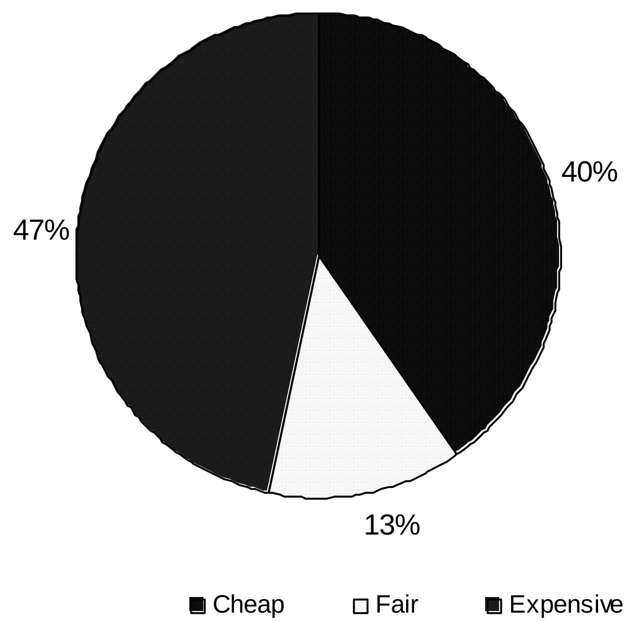


Figure 5.2-4 : Consumers' perception to price

Studies by WSP suggested that the price of water in low income areas can be one of the deterrent factors to attaining acceptable consumption levels of water (WSP, 2003). Looking at the average consumption levels of the consumers in the study area, it is clear that the consumers who get their water from kiosks pay more for water but consume less as compared to those consumers with individual connections.

5.3 Consumers' perception to service

Responses regarding the perception of the respondents towards the water supply service they get from Lilongwe Water Board indicate that out of the 70 respondents, 39(55.7%) felt that the service they get is unacceptable, 13 (18.6%) felt that the service they get is fair and the remaining 18(25.7%) felt that the service they get is acceptable. For those respondents that felt the service is poor, the following were the reasons or combinations of reasons given: Long walking distances, long queues at taps, Low pressures at taps, kiosks close to them that have been on breakdown for long without being maintained, high prices of water and short hours of water availability

Figure 5.3.1 below shows the findings on consumers' perception to service. It should be noted however that over three quarters of the respondents (87.5%) that had individual connections, rated the service from the board as being good. This might be because they do not experience the problems that their neighbours without individual connections experience and they feel that they are better off.

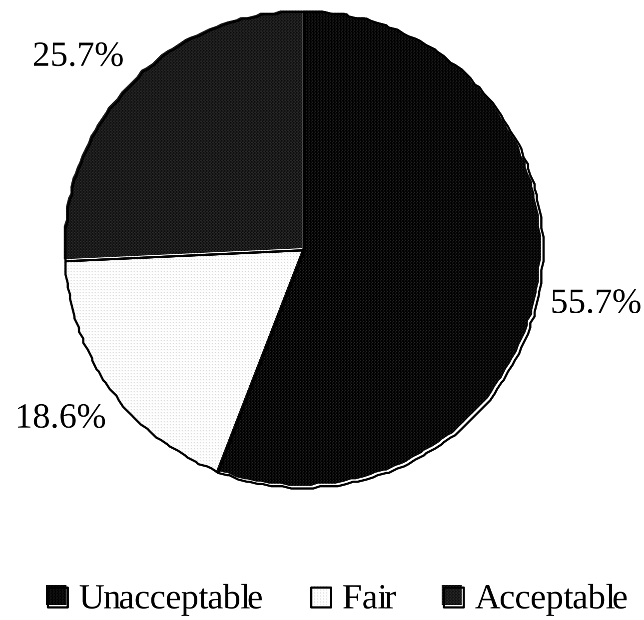


Figure 5.3-1 : Consumers' perception to water service.

However, when asked what management structure they feel is appropriate, 41(58.6%) felt that the current structure of LWB managing the kiosks through water user associations is preferred, 21(30%) felt that LWB alone should manage the kiosks, 3(4.3%) said an elected local committee should manage the kiosks, 3 (4.3%) said a private individuals should manage the kiosks while 2 (2.5%) said a local politician or a traditional leader should manage the kiosks.

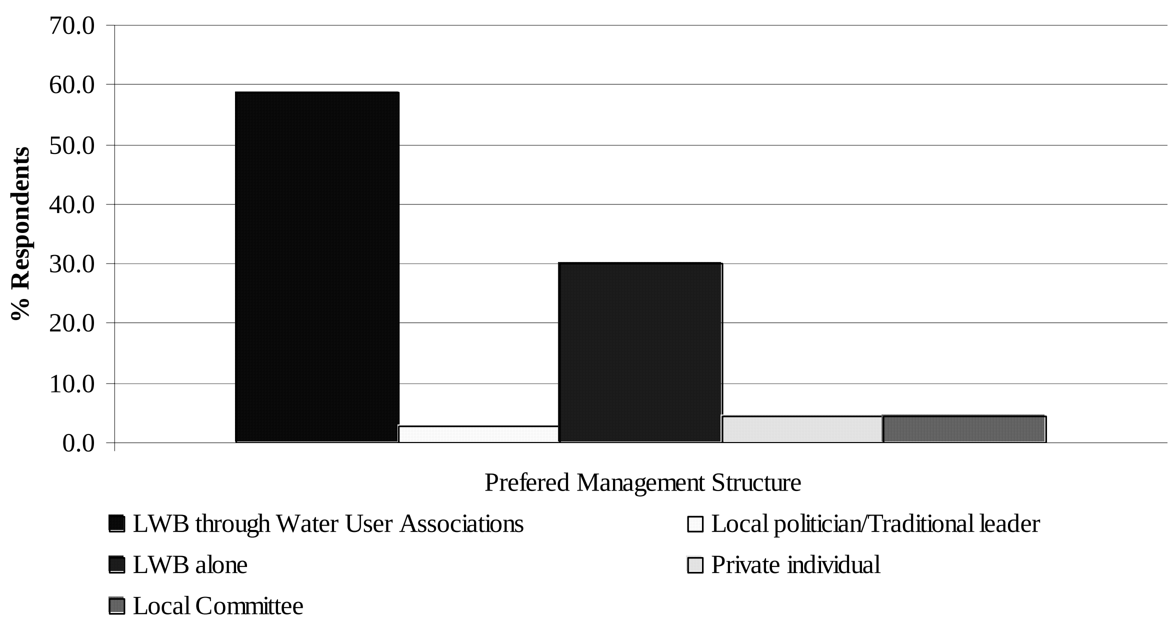


Figure 5.3-2 : Consumers' Preferred Management Structure

In summary, though the quality of water that Lilongwe Water Board supplies in the area is acceptable, the reliability of the water supply system is low, the consumption levels are low as compared to internationally accepted standards, the accessibility for water services is also low and not surprisingly, the consumer perception to the service they get is that the quality of water services in the area is poor. This then leads to a safe conclusion that the quality of water service in the area is low and needs to be improved.

5.4 Consumers' willingness to pay.

5.4.1 Households' Characteristics

To understand well the consumers' willingness and affordability to pay, it became necessary to assess the general characteristics of the area and socio economics of the respondents. As can be shown in Figure 5.4-1 below, from the total sample respondents, 57 (81.4%) are male headed and 13 (18.6%) are female headed. The average family size of the total sample household is 6 members per household, and ranges from 1 to 8. Data about the age of the respondents shows that 36 years is the average age. The maximum is 66 years and the minimum is 18 years. The education level of the respondent ranges from minimum of not able to read and write to the maximum of college graduate.

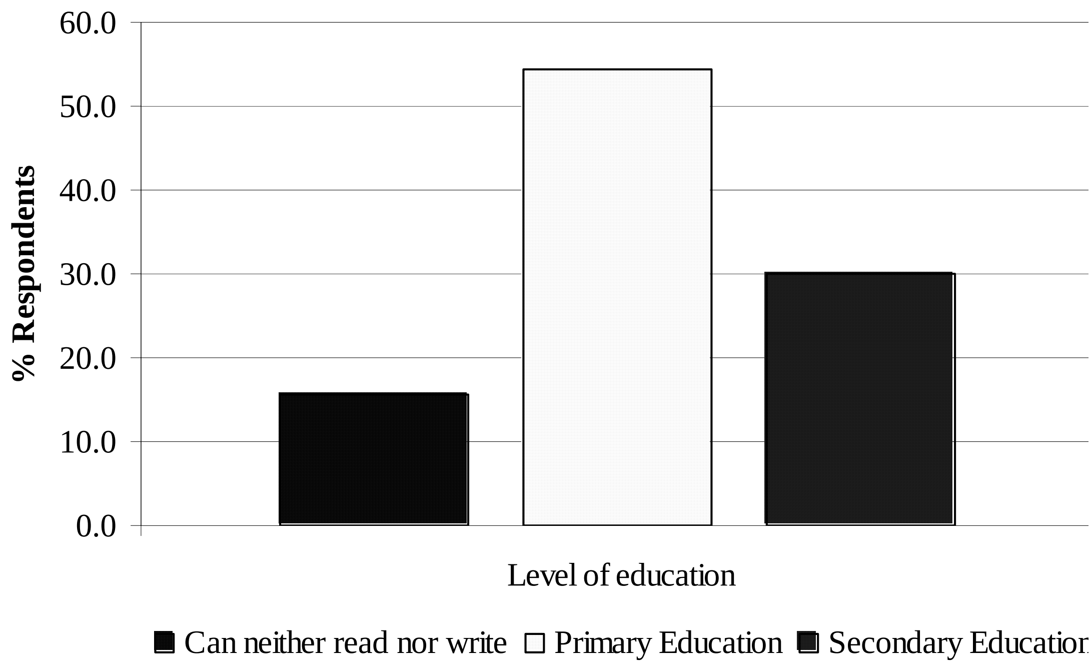


Figure 5.4-1 : Level of education of respondents

From the total respondents 11(15.7%) can neither read nor write, 38(54.3%) have completed primary education, 20(28.6%) have completed secondary school. The data about the occupation of the respondent shows that 41(58.5%) work in the formal sector, and 27(38.6%) work under informal sector or are unemployed while 2(5%) did not disclose their occupation

The average monthly income of the household of the total sample is in the bracket of Kwacha 6,000 -8,000 ranging from the maximum of Kwacha 10,000-15,000 bracket to the minimum of Kwacha 0- 4,000 bracket per month. This income distribution is shown in Figure 5.4.2 below.

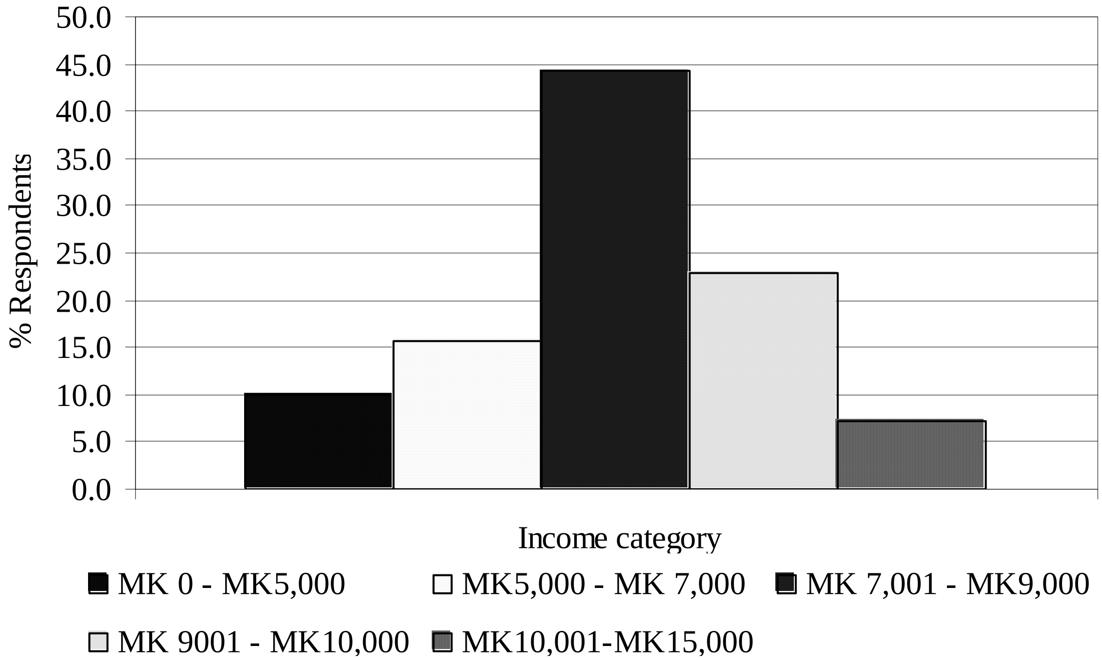


Figure 5.4-2 : Monthly household income

These results show a slight variation from the results that the National Statistics found in its National Demographic Studies which shows the average income for the area to be MK 8, 500. 00 and the average age for the area to be 38 years. However the results agree on the average household size of 6 per household.

5.4.2 Housing characteristics

Data for the wealth of the households, which is proxied by whether the respondents owns house or not, show that 29(41.4%) of the respondent do not live in their own house where as 41(58.6%) own the house they live in. The main floor material for most of the respondents is cement (76.1%) and sun dried bricks (68.2%) for wall material. The most prevalent toilet type is traditional type latrines (89%) in some cases with sanitation platforms.

5.4.3 Willingness to pay for current and improved service levels

This part of the result is an outcome of the analysis of the response from the two main questions asked during the survey. Are people willing to pay for current service? Are they willing to pay for improved services? These results answer the major concerns: how much are people willing to pay for the current service? How much are the consumers willing to pay for improved services? As it can be seen in table 5.4.1 and figure 5.4.3, the mean willingness to pay for current service level is at MK 236.29 per month ranging from a minimum of MK100 to a maximum of MK500. The mean willingness to pay for improved services is MK 374.14, ranging from a minimum of MK200 to a maximum of MK600.

Table 5.4.1 : Descriptive Statistics (Willingness to pay)

	Respondents	Minimum	Maximum	Mean	Std. Deviation
How much are you willing to pay for the current service? (MK)	58	100	500	232.76	71.67
How much are you willing to pay for improved services?(MK)	58	200.00	600.00	374.14	98.34
How much are you willing to pay as connection fee?(MK)	58	800.00	4000.00	1864.66	621.55

When the willingness to pay for current service levels and improved service levels are compared, it is found that the respondents were willing to pay more for improved services than for current service levels in fact when the quality of service is hypothetically increased the willingness to pay increases by 60.7%. Figure 5.4-3 shows the shift that is there when the quality of service is hypothetically increased

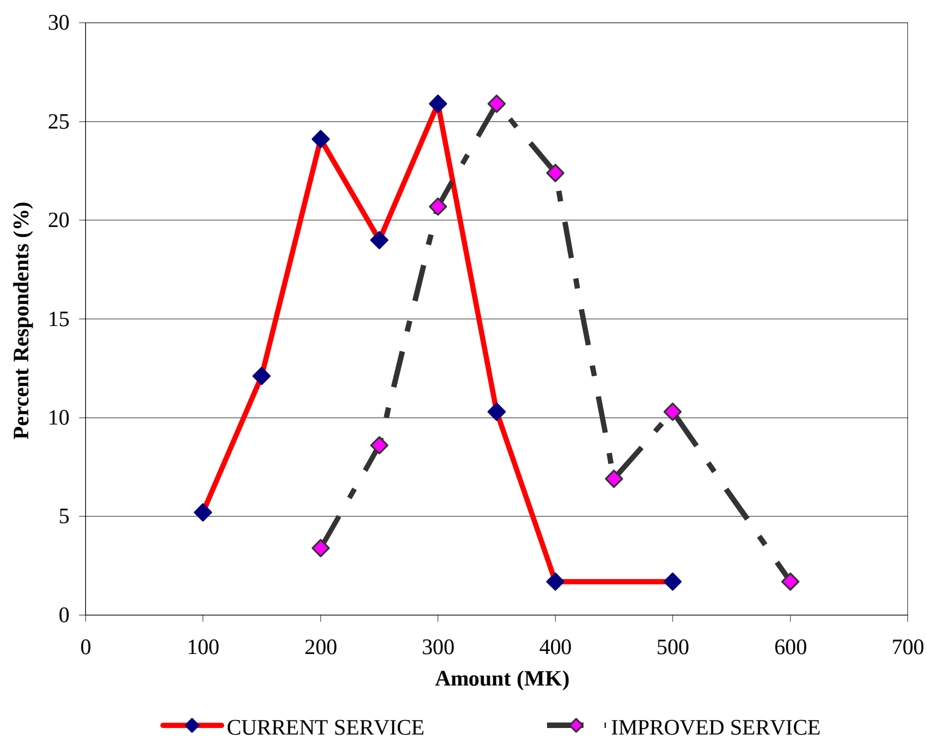


Figure 5.4-3 : Comparison of WTP for current service and improved services

These results compare very well to those obtained by Castilia Consultants (2006), in which they reported the willingness to pay in Makhetha, a low income area in Blantyre (Malawi) with very similar characteristics with the study area. In its findings, Castilia (2006) found that low income households of Makhetha in Blantyre are willing to pay MK405.10 for improved services and MK251.76 for the current service level. The consumers' willingness to pay for improved services is actually 4.6 % of their monthly income, well within the World Health Organisation and World Bank recommendation that households should not spend more than 5% of their income on water services. These findings are within the range that would be expected in similar situations. For instance FAO mentions that depending upon various factors, household water expenditure in developing countries ranges from 2 to 18 percent of household income (FAO, 2000).

The hypothetical question on improved service was based on 24hour water availability, high pressures (minimum of 10l/minute), low walking distances (less than 200m or yard connection), and acceptable water quality.

(Exchange rate used: US $ 1 = MK140.00 (March, 2007))

5.4.4 Willingness to pay for connection fee

For improved services to be made available there is need for the consumers to ay connection fees. The respondents were therefore asked how much they are willing to pay as connection fee. A total of 58 respondents, representing 93.5% were willing to pay for connection fee while the rest were not willing to pay. The average willingness to pay for connection fee has been found to be MK1, 864.66 ranging from a minimum of MK800.00 to a maximum of MK4, 000.00.

There is just a slight increase in these results when they are compared to findings by Castilia, 2006 who found that the mean willingness to pay for connection fees in low income area of Makhetha in Blantyre, which has similar characteristics as the study area, was MK1, 759.00. However this mean willingness to pay for connection fees is lower than the connection fees Lilongwe Water Board is currently demanding which is MK2, 460.00. An analysis of the results shows that only 24.4% of the respondents can afford the connection fees.

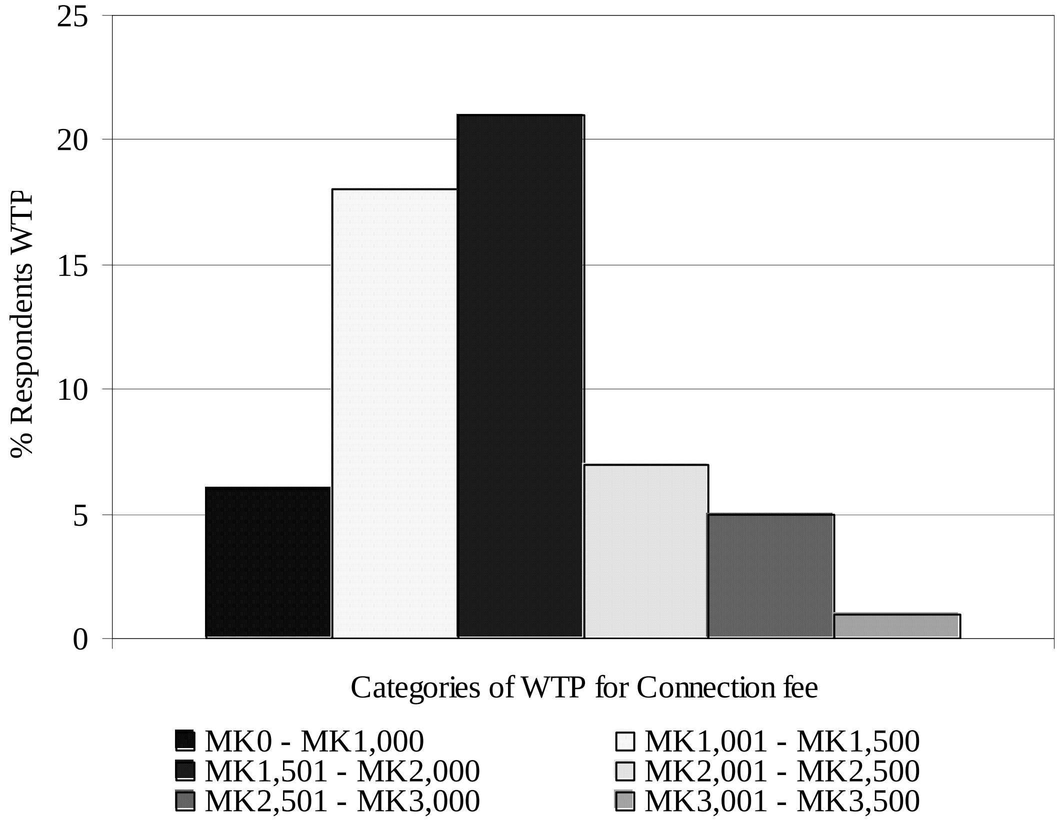


Figure 5.4-4 : Graph showing distribution of willingness to pay for connection fee.

5.4.5 Reasons for not willing to Pay

For various reasons a proportion of respondents in all CV analyses would refuse to pay for any amount for services or goods in question (Bradley et al., 1999). If the reasons for not paying are dissension regarding a procedural aspect of the CV, the response is called a protest response, which has to be censored from the collected data (Bradley et al., 1999). However, if a respondent refused to pay for mitigating reasons (e.g., too poor to pay) that is not a protest response. This is not a protest response because a respondent is giving an answer based on his/her inability to pay and “money is not a perfect indicator of utility since some people have more of it than others” (Whittington, 1991). Therefore, where respondents said that they are not willing to pay for water supply services, this study tried to find out why. This was intended to gauge the attitudes of individuals who are not willing to pay for water services, either improved or at current service levels. From the results of this study, it was found that 6.9 % of respondents were not willing to pay any amount for either current or improved service levels. 25% of those not willing to pay said they are satisfied with the current service levels, 50% said they believed it was government’s obligation to give free water to its citizens and 25% gave no reason. These responses were classified as protest zeros as recommended by Bradley (1999).

5.5 Ability to pay for water services

It has been seen from the previous section that the consumers in the study area are willing to pay for water services in general and improver water services in particular. However being willing to pay is one thing and being able to pay is another. It is necessary to investigate therefore, if the willingness to pay match with the ability of the consumers to pay for the water services.

Analysis of the results from the consumers' willingness to pay for current services indicates that consumers are willing to pay an average of MK 232.76. Studies done by the national Statistics Office (NSO) in 2004 indicate that the average income level for this area is MK8, 500.00. Comparing the consumers' average income levels and their willingness to pay for the current service, we find that consumers spend on average 2.7% of their income on water alone. This expenditure is within the World Bank's recommendation, which states that a household should not spend more than a maximum of 5% of its monthly income on water. However, comparing the average price of water charged on consumers with individual connections (MK52/m^3) to the price charged on consumers who use kiosks (MK100/m^3) it can be concluded that the consumers in the study area who buy their water from kiosks can afford to pay if provided with improved water supply.

Looking at the consumers' willingness to pay for improved service levels; we find that the consumers are willing to pay MK 374.54 on average for improved service levels. Comparing the willingness to pay against the estimated average income level of the area, it is found that consumers are willing to spend 4.4% of their income on water alone which is below the recommended maximum expenditure of 5% for affordability of water services. Therefore from the results it can be concluded that consumers in the area are able to pay for current water services and will be able to pay for improved service levels as their expenditure for water is well below the maximum threshold of 5% recommended by the World Bank and WHO.

5.6 Influence of quality of service on willingness to pay for improved services

It is evident from the previous section that consumers are willing to pay more for improved water services. To comprehend household decision making on the willingness to pay for the improved service level a probit analysis was done to find out if certain variables of indication of quality of service had a significant influence on the households' decision on willingness to pay for current and improved water services. The analyses were conducted to statistically comprehend how different indicators of service quality might have influenced household decisions on willingness to pay for improved service. The null hypothesis that is being tested in these analyses is that the indicators of water service quality do influence household decisions on willingness to pay for improved water service.

This study was used to get information on several responses on several indicators of water service quality. Some of these indicators are then used in the analyses as variable to describe household decision making. Table 5.6.1 shows a summary and description of the indicators that were used in the probit analysis regression model.

Table 5.6.1: Description of variables used in Regression Models

Variable	**Description**
Ksk_qnty	Average daily Quantity of water drawn from the kiosk by the household
Ksk-dist	Distance a household walks to fetch water from the nearest kiosk.
Ksk_wktm	Time a household member walks to and from the nearest kiosk.
Queu_tm	Time a household member queues at the kiosk
Ksk_pres	Household's perception of pressure of water at the kiosk
Ksk_rlbt	The perception to reliability of the kiosks in the area.
Perceptn	The perception of the household to the service.

These variables were used because they were deemed most likely to contribute to and influence in household decision-making on willingness to pay (Whittington., 1996; Brisce,1997). The following is detailed explanation and reasons for inclusion of individual variables into the regression models:

Average daily quantity of water drawn from the kiosk by the household (**ksk_qnty)** is one of the factors that are included in the model. This is because the households with higher water consumption needs will ideally have to spend more efforts to bring water to their households; thus, in times of shortage it would spend a lot more effort in fetching water. Thus, it is assumed that willingness to pay of households with higher daily consumption may be greater than willingness to pay of households with lower consumption.

Time that a household uses to fetch water (**ksk_wktm)** is incorporated in the model because it is an investment a household makes to get water, thus it has monetary implication. This is expected to influence the model in terms of opportunity cost that a household would be willing to pay for reliable services so as to spare time for other productive uses instead of water fetching activity.

Distance a household walks to fetch water from the nearest kiosk **(ksk_dist)** is included in the model for similar reasons as the *ks_wktm* It is assumed that the longer the distance the less motivating for a household to follow water services. Thus a household that has to fetch water from longer distance will be less willing to pay for the current water services but will be willing to pay more for improved services that will reduce the distance that they have to walk to get water.

Another factor that is included in the models is the time a household member queues at the kiosk in order to get water **(queu_tm).** It is assumed that the longer the period a household member queues to get water, the less he is willing to pay for the current water services and the more he is willing to pay for improved water services.

The consumers' perception to pressure **(ksk-press)** was also another factor that was considered in the regression models. This was because it was felt that those consumers who felt the pressure was low would be less willing to pay for the current water service but will be willing to pay more for improved water services.

Perception to service **(perceptn)** is also another factor that was used in the regression models. This was to see if the perception to service has any effect on the willingness to pay. It is assumed that those consumers who feel that the service is poor will be less willing to pay for current water services but will be willing to pay more for improved water services.

The consumers' perception to the reliability **(ksk_rlbt)** of the system was another variable that was included in the regression models. This was put in the model with the assumption that those who deem the system as being unreliable will be less willing to pay for the current water services but will be more willing to pay for improved services.

The seven variables to service of water quality were fitted into the regression model and test for the significance of the variables in influencing household decision on willingness to pay. The tests were done at the level of significance of 5%.

Table 5.6.2 present results of a probit analysis between household decision on WTP for the improved service level and different variables for services quality. As can be seen from table 5.6.2 above, the pseudo r^2 value is equal to 21.8%, which is higher than the widely recommended value of 3% for discrete data and hence the model was fit to be used for the analysis of willingness to pay Scot (1997) and Whittington et al (1993).

In this model it has been found that the variables *ksk_pres, perceptn, nqueu_tm, nksk_wkt, nksk_dis, ksk_rlbt* significantly correlated with the households' decision to pay for improved service levels (as can be seen from their p values which are less than 0.05) while the other variables *pctprice* and *nksk_qty* did not have any influence on the households decision to pay for improved services. That is to say that these six factors have a significant influence on the household decision to pay for improved water services.

The (ksk_pres) results can be interpreted that for an increase in pressure from the source (i.e. from poor increasing to good pressure), it is 13% more likely that the household will be willing to pay for water services.

Results on the perception to service also show a positive sign and it can be interpreted that those who view the service as being poor are 2% more likely to pay for a change to improved services.

Similarly, if a household has to queue for long time to get water, it will be less willing to pay for water services at the current level. However they are more willing for a change to improved services. From the results in Table 5.6-2, these households will be 11.8% more likely to pay for an improved service so they have to walk short distances. Similarly those household that spend long times walking to water sources and those that walk long distances to fetch water are less willing to pay for water at the current level but are likely to be influenced to pay more for improved water supply. Actually from these results those who spend more time and walk long distances to fetch water are 4.9% and 3.4% more likely to pay for water services respectively. This study result confirms the economic theory by Whittington (1997), which suggests the less an improved water source costs in terms of time, the more likely a household would be willing to choose it.

Table 5.6.2 : Probit Analysis model estimates of influence of quality of service variables on willingness to pay for improved services.

Number of obs = 62					
Pseudo R^2= 0.218					
Variable	Coef	SE Coef	dF/dx	Z	P
ksk_pres	0.57597	0.04383	0.130	13.14	**0.000**
perceptn	0.28443	0.04180	0.020	6.81	**0.000**
nqueu_tm	0.08175	0.03521	0.118	2.32	**0.020**
ksk_rlbt	0.021458	0.05482	0.3180	5.13	**0.010**
nksk_wkt	0.033268	0.04988	0.280	6.67	**0.000**
pctprice	0.02372	0.05849	0.130	0.41	0.685
nksk_qnt	0.02938	0.05312	0.031	0.55	0.580
nksk_dis	0.31487	0.03447	0.012	9.13	**0.000**

Bold: significant at significance level of 5%
dF/dx is for discrete change of dummy variable from 0 to 1

Reliability of water services is also another factor that was considered in the probit model analysis. From the results, it can be concluded that the households are likely to pay more for a reliable improved service and hence the positive sign on the coefficient. From the results, these households are 31.8% more likely to pay for improved services. The value on the dummy increment on the discrete variable seems low. This can be explained by the fact that the different variables can have an influence among themselves and hence it is difficult to isolate the different variables and assess them on their own. However, the main focus of the analysis was to find if the different variables have an influence on the household's decision on willingness to pay.

It can therefore be concluded that the quality of service do influence household decisions on willingness to pay to some extent. When the service is low, people are not willing to pay much as has been shown in this study while people decide to pay more for improved water services.

6 CONCLUSIONS AND RECOMMENDATIONS

6.1 Conclusions

The following summarises the major conclusions from the study:

1. It was found that the reliability, accessibility and sufficiency of water services in the area are low as compared to international guidelines and practices.

2. Most consumers (55.7%) in the area perceive the quality of water services in the area to be low and are hence dissatisfied with the service.

3. The quality of service in the area has been found to be low as compared to international guidelines and standards since the reliability, accessibility and sufficiency of water services is low.

4. The mean willingness to pay for current service in the area is MK232.76, the mean willingness to pay for improved services is MK374.14 and the mean willingness to pay for connection fees is MK1, 864.66. On average consumers can afford to pay for water as they spend 2.7% of there income per month on water which is below the recommended threshold of 5%.

5. It is also concluded that the quality of water services has an influence on households' decision on willingness to pay for improved service.

6.2 Recommendations

In order to improve the service quality in the area the following are the recommendations made based on the findings of the study:

1. More maintenance staff needs to be recruited in the utility company so that facilities that are on breakdown should be repaired, and hence improving accessibility and decreasing walking distances and time spent on collecting water.

2. It is also recommended that the water board should have a deliberate policy to increase access in the low income areas by providing new facilities and rehabilitating the old ones.

3. It is also recommended that some consumers should be provided with individual yard connections. Since the consumers' willingness to pay for connection fees is lower than the current charge, it is also recommended that the connection fee be reduced, subsided or an option be given that the consumers can pay the connection fee in two instalments.

4. It is recommended that further research needs to be done on legal implications of supplying water to low income areas and more specifically on how access for water can be improved.

7 REFERENCES

Altaf, A., Jamal, H. and Whittington, D. (1992) *Willingness to pay for water in rural Punjab,Pakistan*, UNDP-World Bank Water and Sanitation Program, World Bank, Washington, D.C. (1818 H St., NW, Washington 20433).

Africa Environmental Outlook, 2004. Making Cities work. Urban Water Supply and Distribution, World Bank Publications. Volume 4, Pp 45.

Baba, A.F. (1996) *Water resources, water supply and sanitation in managing water resources for large cities and towns*, Report from the Beijing water conference conducted by the United Nations Centre for Human Settlements

Billing, P., Bendahmane, D., Swindale, A., 1999. Water and Sanitation Indicators, Measurement Guide.

Bradley J S, Syme G J, Bishop B J & Nancarrow B E (1999). Protest Response in Contingent Valuation. *Environmental and Resource Economics* 14: 131 – 150. Kluwer Academic Publishers.

Briscoe, J., 1997. Managing Water as an Economic Good. *Water: Economics, Management and Demand.*

Briscoe, J., Furtado P. and others (1993) “Toward Equitable and Sustainable Rural Water Supplies: a Contingent Valuation Study in Brazil”, The World Bank Economic Review, Vol 4, No 2, pp115–134.

Castilia Strategic Advisors, 2007. Water Supply Pilots to Improve Access in Low income Areas. Ministry of Irrigation and Water Development. Unpublished report.

Collignon, B., Vézina, M., 2000. Independent Water and Sanitation Providers in African Cities Full Report of a Ten-Country Study.

Cross, P.,Morel, A., 2003. Pro-Poor Strategies for Urban Water Supply and Sanitation Services Delivery in Africa.

Cameron T A and James M D (1987). Efficient Estimation Methods for “Close-Ended” Contingent Valuation. *The review of economics and statistics*. 69:269-276.

CWS (China Water Sector), 2002. Briefing Note Series. Assessing Ability and willingness to Pay, Briefing Note 10.

Kurukulasuriya, P & Mendelsohn, R (2001). The Shadow Price of improvements to water quality and reliability: An application of contingent valuation analysis in Greater Colombo, Sri Lanka.

Saz-Salazar S D and Garcia-Menendez L G (2001). Willingness to Pay for Environmental. Improvements in a Large City. *Environmental and Resource Economics* 20: 103 – 112. Kluwer Academic publishers.

FAO (2000). Applications of contingent valuation methods in developing countries. Economic and social development paper 146.

Hartwick J M and Olewiler N D (1998). The Economics of Natural Resource Use. Second edition. Addisson-Wesley.

Global water supply and sanitation report 2000 Water Utility Partnership (2001) *Report of performance indicators African water supply and sanitation utilities 2001*

Gleick, P. H. (2001): The Worlds Water 2000 – 2001. The Biennial Report of Freshwater Resources. Pacific Institute for studies in development environment and security. Island Press

Gulyani, S., 2001. "The Demand Side Approach to Planning Water Supply." *The Challenge of Urban Government.* World Bank, Washington, D.C.

Gulyani, Sumila, Debrabrata Talukdar and R. Mukami Kariuki. 2005. Water for the Urban Poor: Water Markets, Household Demand and Service Preferences in Kenya. Water Supply and Sanitation Sector Board Paper Series Paper No. 5.

Giraud K L, Loomis J B and Cooper J C (2001). A comparison of willingness to Pay Estimation Techniques from Referendum Question. *Environmental and Resources Economics* 20: 331-346.

Littlefair. K., Willingness to Pay for Water at the Household Level: individual financial responsibility for water consumption.

Lopaying, D., 2004. Household Affordability and Willingness to Pay for Water, 30th WEDC International Conference, Vientiane, Lao PDR.

LWB (Lilongwe Water Board), 2005. Strategy for the Provision of Water and Sanitation Services to Low-Income Areas. (Unpublished).

McIntosh A.C., 2003. Reaching The Urban Poor, Asian Water Supplies.

Mitchell, R.C. and Carson R.T., 1989. *Using Survey to Public Goods: The Contingent Valuation Method*. (The Johan Hopkins University Press, Washington D.C.)

Mwanza, D. D., 2001. Water and Sanitation to the urban poor, 27th WEDC Conference.

National Statistics Office, 2004. Malawi Health and Demographic Studies. 2004. URL : http//nso.malawi.net (accessed on 5th December, 2006)

Rogerson, C ., 1996. Willingness to pay for water: The international debates, *Water SA*, **22**(4), p373-80.

Roy, J., 2004. Willingness to Pay Studies: A Policy Tool, Paper Presented at the Conference on Market Development of Water & Waste Technologies through Environmental Economics.

Safege Consultants, 2002. Engineering Studies for Lilongwe Water Board. Additional Water Supply System Report. Lilongwe, Malawi. (unpublished).

Scott L. L J., 1997. *Regression Model for Categorical and Limited Dependent Variable* (SAGE Publication, California.)

Sphere Project, 2004. Humanitarian Charter and Minimum Standards in Disaster Response.

Tynan N and Kingdom B (2001) *A Scorecard for Water Utilities in Developing Countries* World Bank http://rru.worldbank.org/HotTopics/Hot_Topics_tynan_kingdom.asp accessed on 17 January, 2007.

UN (United Nations) Millennium Development Goals, URL: http//www.un.org/milleniumgoals/ (Accessed on 25th October, 2006).

UN World Water Development Report, Valuing Water, Facts and Figures. URL http://www.unesco.org/water/wwap/facts_figures/valuing_water.shtml. accessed on 14 May, 2007

UNDP (United Nations Development Programme)-World Bank (1999), Willing to Pay but Unwilling to Charge, Do "Willingness to Pay" Studies make a difference? Field Note, New Delhi: UNDP-World Bank Water and Sanitation Program, South Asia.

United Nations (UN), 2003. *Water for People, Water for Life*. World Water Development Report.

United Nations Development Programme (UNDP). (1994). *Human Development Report1994*. Oxford University Press, New York.

USAID (United States Agency for International Development), 1996. *Environmental Health Project,Coping with Intermittent Water Supply:Problems and Prospects*, Dehra Dun, Uttar Pradesh, India, Activity Report, **26,** Washington DC, USA.

WaterAid (Malawi), 2005. Saving Community Water Kiosks in Malawi. (Unpublished Report)

Webster M (1999) *Effective demand for water supply in South Africa – Technical and Financial implications of design to meet demand*, Water, Engineering and Development Centre, Loughborough University, UK

Wedgwood, A., Sansom, K, 2002. Targeting Low-Income Consumers, Service Options, WEDC Publications, Loughborough University, United Kingdom.

Whittington, D. 1997. "Guidelines for Conducting Willingness-to-Pay Studies for Improved Water Services in Developing Countries." WASH Technical Report No. 56. Washington, D.C.: USAID Water and Sanitation for Health Project.

Whittington, D. and Swarna, V. (1994) *The economic benefits of potable water supply projects to households in developing countries*. Asian Development Bank, Manila, Philippines.

Whittington, D (2002) Improving the Performance of Contingent Valuation studies in Developing Countries. *Environment and Resource Economics* 22: 323-367. Kluwer Academic Publishers.

Whittington, D., 1991. Administering Contingent Valuation Surveys in Developing Countries, World Development.

Whittington, D., Altaf, M.A., Decastro, P.F., Griffin, C., Okorafor, A., Okore, A., Singh, B., Ramasubban, R., Robinson, P. and Smith, V.K. (1993) The Demand for Water in Rural-Areas - Determinants and Policy Implications. *World Bank Research Observer*, 8(1): 47-70.

Whittington, D., D. T. Lauria., A. M. Wright., K. Choe. 1993. "Household Demand for Improved Sanitation Services in Kumasi, Ghana: A Contingent Valuation Study.*Water Resources Research,* **29**(6): 1539.

Whittington, D., Lauria, D. and Mu, X. 1991. A Study of Water Vending and Willingness to Pay For Water in Onitsha, Nigeria, *World Development*, **19**(2/3), p179-198.

Whittington, D.,Briscoe, J and Mu., 1987. "Willingness to pay for water in rural areas: methodological approaches and an application in Haiti." WASH field report No. 213 93p.

WHO (World Health Organisation), 2004. Guidelines for drinking Water Quality. Third Edition. Volume 1: Recommendations, Geneva, Switzerland.

WHO (World Health Organization)., 2000. Global Water Supply and Sanitation Assessment Report.

WHO (World Health Organization *)2000. Water Supply and Sanitation Sector Report Year 2000. Africa Regional Assessment*

WHO World Health Organization, 2003. "The Right to Water", 2003, Available at http://www.who.int/water_sanitation_health/en/rtwrev.pdf

WHO, and UNICEF (2000) *Global water supply and sanitation assessment 2000 report*. World Health Organization, United Nations Children's Fund, Geneva, Switzerland.

Willingness to Pay but Unwilling to Charge: Water and Sanitation Program, June 1999

Winpenny, J T., 1994. Managing Water as an Economic Resource, Routledge, London

World Bank Water Demand Research Team, 1993. "The Demand for Water in Rural Areas: Determinants and Policy Implications", The World Bank Research Observer,8 (1): 48–69.

World Bank, 1991. Urban policy and economic development: an agenda for the 1990s. World Bank, Washington, D.C.

World Bank, 1996. African Water Resources, World Bank Technical Paper no. 331, World Bank, Washington D.C.

World Bank, 1997. World Development Report 1997: The State in a Changing World, World Bank, Washington D.C.

World Bank. 1994. "Infrastructure for Development:" World Development Report I994: Oxford University press

World Bank. 2003. Summary of the Study Water for the Urban Poor: Insights from Household Surveys in Kenya, The World Bank, Nairobi.

WSP (Water and Sanitation Program), 2003. Better water and sanitation for the urban poor,Good Practice from sub-Saharan Africa.

WSP (Water and Sanitation Program) *Fieldnote*, 1998. A Study of Kiosks in Kibera, Nairobi.

WUP (Water Utilities Partnership) for Capacity Building in Africa, 2003. *Better Water* and Sanitation for the Urban Poor: Good Practice from Sub-Saharan Africa.

8 APPENDICES

Appendix 1: Household questionnaire

1. GENERAL INFORMATION

Date of Interview			
Time Interview Started		Time Interview Ended	
Location			
Sex of respondent	0= Male	1= Female	
For How long has the household lived in the current house? (Years)			
Occupation of Interviewee			
Age group of interviewee			
Maximum level of education attained			
Number of People who usually live in the house			
Number of bedrooms of the house			

Codes:
Highest qualification
1= No schooling
2= Primary education
3= Secondary education
4= Technical/Vocational
5= University
6= Other

Age group Codes
1= 18 – 25
2 = 26 – 30
3 = 31 – 35
4 = 36 – 40
5 = 41 – 50
6 = > 50
7 = Don't know

2. HOUSING CHARACTERISTICS

What are the main materials of the walls of the main house?	What is the main material of the roof of the main house?	What are the main materials of the floor of the main house?	What is the main material of the windows of the main house?
1= Poles and mud 2= Compacted earth 3= Sun-dried bricks 4= Burnt bricks	1= Grass thatched 2= Tiled roof 3= Iron sheets 4= Cement	1= Cement 2= Mud 3= Other (Specify)	1= Wood 2= Grass 3= Glass 4= Uncovered 5= No windows

Is the ownership status of the house that you live in?	How do you dispose of your waste matter?	Does the household have a toilet?	If Yes what kind of toilet facility?
1= Own 2= Rented 3= Employer provided 4= Being purchased 5= Other (Specify)	1= Burning 2= Special place 3= Throw anywhere 4= Other	1= Yes 0= No	1= VIP Latrine 2= Traditional latrine 3= latrine with san plat 4= Other

3. OWNERSHIP OF ASSETS, INCOME SOURCES AND EXPENDITURE PATTERNS

Code	Type of Asset	Do you own (…..)	How many (…..) do you own?	When was the last time you acquired the (….)? Year
301	Bicycle			
302	Bed			
303	Table			
304	Chair			
305	Fan			
306	Radio			
308	Television			
309	Sewing Machine			

What have been the <u>two major</u> sources of income for this household in the last 12 months? (Use codes from below)		
	1st	
	2nd	

Indicate in how many months and how much income the household received in the last 12 months from the following sources

Code		Number of months	Monthly Income(K)	Annual Income (K)
101	Sale of crops			
102	Sale of livestock			
103	Sale of assets			
104	Small business			
105	Income transfers			
106	Wages from public works			
107	Salaried employment			

Indicate in how much money and in how many months the household spent in the last 12 months on the following?

Code		Number of months	Monthly Spending(K)	Annual Spending (K)
201	Food expenses			
202	Assets/ household expenses			
203	Education expenses			
204	Health expenses			
205	Clothing expenses			
206	Transport expenses			
207	Farm inputs/labor expenses			
208	Land rental expenses			
209	Fuel expenses			

108	Piece works (Ganyu)			
109	Other Specify			
110				

210	water expenses			
211	Remittances (transfers)			
212	All other expenses			

4. SOURCES OF WATER FOR THE HOUSEHOLD

	Type of facility	What are the sources of water for the household	What do you mostly use this water from (….) for? 1= Drinking or cooking 2= Washing 3= Cleaning	How much water do you use from (…..) per day, week, and month? (Litres) Ask for recent monthly bill if available	How much do you spend on water from (…..) per day, week and month? (Kwacha)	How much does this water from (…..) cost per unit? Code: 1= Litre 2= 20 Litres 3= Other		How far is your house to the nearest (…..)? Code: 1= Meter 2= Km 3= Mile		How many days per week is water available from (…….) Code: a= 0, b= 1, c= 2, d= 3 , e= 4, f = 5, g= 6 , h = 7	How many hours per day is water available from (…….) Code: a= 0-6, b= 7-12, c=13-17, d=18-23 , e= 24
				Day	Day	Code	Cost	Code	Units		
a	Own piped into dwelling										
b	Own piped outside dwelling, personal										
c	Water Board Kiosk										
d	Private Operator kiosk										
e	Neighbour's individual connection										
f	Communal hand pump/borehole										
g	Protected spring										
h	Personal open unprotected well										
i	Communal open unprotected well										
j	River/Spring										
k	Other/Specify										

	Type of facility	How long does it usually take to walk to the nearest (…….)? minutes	Do you have to queue to get some water from (…….)? 1= Yes 2= No	For how long do you have to be on the queue to get water from (…..)? Minutes			How do you rate the water from (….) in terms of? 1=Good 2= Average 3= Poor						
				Min	Average	Max	Soap consumption	reliability	Heath concern	Flow of water	Taste	Odour	Colour
a	Own piped into dwelling												
b	Own piped outside dwelling, personal												
c	Water Board Kiosk												
d	Private Operator kiosk												
e	Neighbour's individual connection												
f	Communal hand pump/borehole												
g	Protected spring												
h	Personal open unprotected well												
i	Communal open unprotected well												
j	River/Spring												
k	Other/Specify												

5. FOR HOUSEHOLDS WITH OWN PIPED WATER INTO DWELLING OR OUTSIDE DWELLING

This section only applies to households with individual connection into the dwelling or outside dwelling

When did you obtain individual connection?		What was the main source of water for cooking and drinking before the individual connection?			What has been the impact of the switch to individual connection?	
Year		1= Water Board Kiosk 2= Private operator kiosk			1= Better quality of life 2= Time saving	
		3= Neighbour's individual connection	7= Personal open unprotected well		3= Less expenditure on water	
		4= Communal stand pipe	8= Communal open unprotected well		4= Less incidence on disease	
		5= Communal hand pump/borehole	9= River/Spring		5 = Other (Specify)	
		6= Protected spring	10= Other (specify)			

Do you some times resell water to other households?		At what price do you resell the water?		Is reselling the water profitable?		How do you rate the service you get from LWB?	
1= Yes 0= No		Code: 1= Litres 2= 20 Litres 3= Other Kwacha		1= Yes 0= No		1= Good 2= Fair 3= Poor	

6. FOR HOUSEHOLDS USING WATER BOARD OR PRIVATE KIOSK OR NEIGHBOUR'S CONNECTION (IC)

This section only applies to households using Water Board or private kiosk or neighbour's connection

When did you start collecting water from Kiosk or IC?		What was the main source of water for cooking and drinking before the kiosk or the neighbour's individual connection?		What has been the impact of the switch to kiosk or IC 1= Yes 0= No	
Year		1= Communal standpipe		a) Better quality of life	
		2= Communal handpump/borehole		b) Time saving	
		3= Protected spring	10= Other (specify)	c) Less expenditure on water	
		7= Personal unprotected open well		d) Less incidence on disease	
		8= Communal open unprotected well		e) Water readily available	
		9= River/ spring		f) Other (Specify)	

What type of kiosk would you prefer?		Are willing to pay to pay for improved service? 1= Yes 0= No		What do you think are the likely impacts improved services?		
1= Water Board alone 2=Water board through Water User associations 3= Private Operator 4= Local committee 5= Local Politician/Tradional Leader 6 = Other		Are you willing to pay (….) to upgrade to individual connection? 1= Yes 0= No		a)	Better quality of life	
Why?		How much are you willing to pay for individual/yard connection?		b)	Time saving	
				c)	Less expenditure on water	
				d)	Less incidence of diseass	
				f)	Water readily available	
					Other (Specify)	
		If household not willing to pay what is the reason?		What is the maximum amount you are willing to pay for improved service?		

Improved service:
Walking distance < 200m or yard connection or individual connection
Pressure: good
Reliability: good
Low queuing times

Appendix 2: Results from bucket tests

BUCKECT TESTS					
Date	**Time**	**Time it takes to fill 20l bucket (sec)**	**min/20l**	**l/sec**	**l/min**
16-Jan	6:00:00 AM	100	1.7	0.20	12.0
	6:10:00 AM	100	1.7	0.20	12.0
	6:20:00 AM	110	1.8	0.18	10.9
	6:30:00 AM	110	1.8	0.18	10.9
	6:40:00 AM	130	2.2	0.15	9.2
	6:50:00 PM	140	2.3	0.14	8.6
	7:00:00 AM	150	2.5	0.13	8.0
	7:10:00 AM	150	2.5	0.13	8.0
	7:20:00 AM	150	2.5	0.13	8.0
	7:30:00 AM	145	2.4	0.14	8.3
	7:40:00 AM	145	2.4	0.14	8.3
	7:50:00 AM	145	2.4	0.14	8.3
	8:00:00 AM	143	2.4	0.14	8.4

Date	**Time**	**Time it takes to fill 20l bucket (sec)**	**min/20l**	**l/sec**	**l/min**
25-Jan	6:00:00 AM	90	1.5	0.22	13.3
	6:10:00 AM	90	1.5	0.22	13.3
	6:20:00 AM	110	1.8	0.18	10.9
	6:30:00 AM	150	2.5	0.13	8.0
	6:40:00 AM	150	2.5	0.13	8.0
	6:50:00 PM	150	2.5	0.13	8.0
	7:00:00 AM	145	2.4	0.14	8.3
	7:10:00 AM	145	2.4	0.14	8.3
	7:20:00 AM	145	2.4	0.14	8.3
	7:30:00 AM	145	2.4	0.14	8.3
	7:40:00 AM	140	2.3	0.14	8.6
	7:50:00 AM	140	2.3	0.14	8.6
	8:00:00 AM	138	2.3	0.14	8.7

Date	Time	Time it takes to fill 20l bucket (sec)	min/20l	l/sec	l/min
20-Feb	6:00:00 AM	75	1.3	0.27	16.0
	6:10:00 AM	90	1.5	0.22	13.3
	6:20:00 AM	90	1.5	0.22	13.3
	6:30:00 AM	95	1.6	0.21	12.6
	6:40:00 AM	100	1.7	0.20	12.0
	6:50:00 PM	100	1.7	0.20	12.0
	7:00:00 AM	110	1.8	0.18	10.9
	7:10:00 AM	110	1.8	0.18	10.9
	7:20:00 AM	110	1.8	0.18	10.9
	7:30:00 AM	100	1.7	0.20	12.0
	7:40:00 AM	120	2.0	0.17	10.0
	7:50:00 AM	126	2.1	0.16	9.5
	8:00:00 AM	125	2.1	0.16	9.6

Date	Time	Time it takes to fill 20l bucket (sec)	min/20l	l/sec	l/min
24-Feb	6:00:00 AM	98	1.6	0.20	12.2
	6:10:00 AM	103	1.7	0.19	11.7
	6:20:00 AM	104	1.7	0.19	11.5
	6:30:00 AM	106	1.8	0.19	11.3
	6:40:00 AM	125	2.1	0.16	9.6
	6:50:00 PM	125	2.1	0.16	9.6
	7:00:00 AM	130	2.2	0.15	9.2
	7:10:00 AM	140	2.3	0.14	8.6
	7:20:00 AM	142	2.4	0.14	8.5
	7:30:00 AM	142	2.4	0.14	8.5
	7:40:00 AM	145	2.4	0.14	8.3
	7:50:00 AM	145	2.4	0.14	8.3
	8:00:00 AM	142	2.4	0.14	8.5

Date	Time	Time it takes to fill 20l bucket (sec)	min/20l	l/sec	l/min
19-Mar	6:00:00 AM	110	1.8	0.18	10.9
	6:10:00 AM	110	1.8	0.18	10.9
	6:20:00 AM	110	1.8	0.18	10.9
	6:30:00 AM	109	1.8	0.18	11.0
	6:40:00 AM	110	1.8	0.18	10.9
	6:50:00 PM	109	1.8	0.18	11.0
	7:00:00 AM	120	2.0	0.17	10.0
	7:10:00 AM	120	2.0	0.17	10.0
	7:20:00 AM	125	2.1	0.16	9.6
	7:30:00 AM	125	2.1	0.16	9.6
	7:40:00 AM	124	2.1	0.16	9.7
	7:50:00 AM	125	2.1	0.16	9.6
	8:00:00 AM	123	2.1	0.16	9.8

Appendix 3: Results from water quality tests.

Date: 16 January 2007

Site	Turbidity NTU	Electrical Conductivity µs/cm	pH	Feacal Coliform Count
Kiosk Number 2	2	174	8.27	0
Kiosk Number 32	2	160	7.9	1
Shallow Well 1 (Jezumulu)	10	1434	6.2	1900
Shallow Well 2 (Machinga)	8	1060	6.82	2300

Date: 20 February 2007

Site	Turbidity NTU	Electrical Conductivity µs/cm	pH	Feacal Coliform Count Per 100ml
Kiosk Number 2	3	152	8	0
Kiosk Number 32	2	163	8	0
Shallow Well 1 (Jezumulu)	9	1360	6.5	2300
Shallow Well 2 (Machinga)	10	1120	6.8	2750

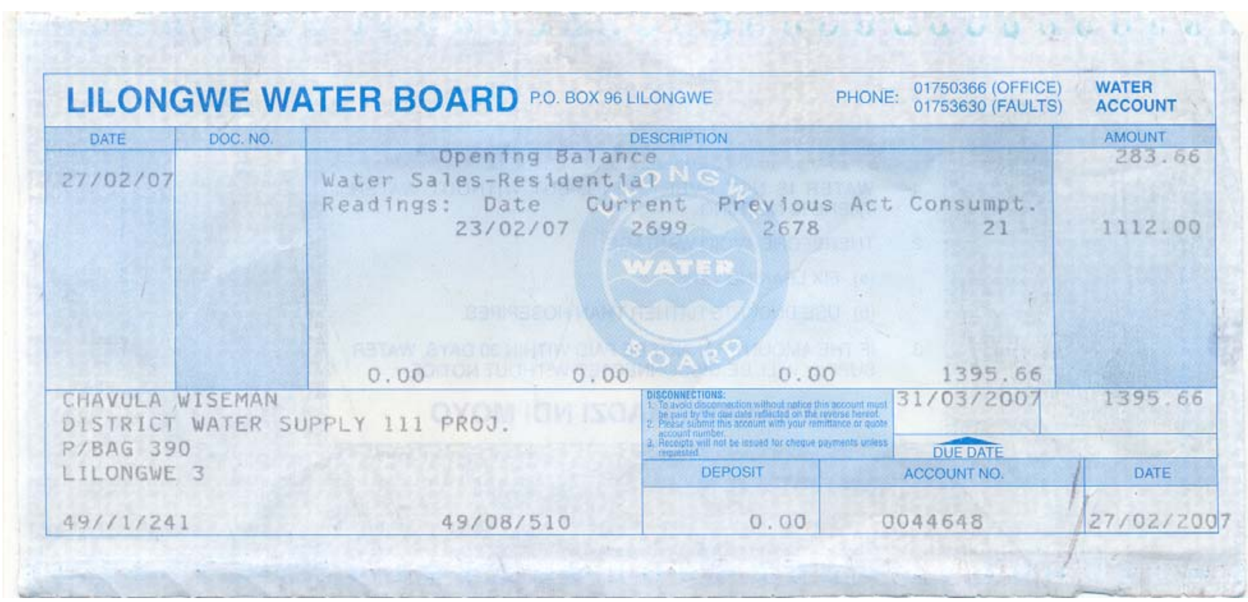
Date: 19 March 2007

Site	**Turbidity NTU**	**Electrical Conductivity µs/cm**	**pH**	**Feacal Coliform Count**
Kiosk Number 2	2	130	7.8	2
Kiosk Number 32	2	157	7.5	0
Shallow Well 1 (Jezumulu)	12	1230	6.7	2215
Shallow Well 2 (Machinga)	8	1156	6.9	5320

Date: 10 April 2007

Site	**Turbidity NTU**	**Electrical Conductivity µs/cm**	**pH**	**Feacal Coliform Count**
Kiosk Number 2	4.2	112	7.8	0
Kiosk Number 32	2	142	7.5	0
Shallow Well 1 (Jezumulu)	9	1133	6.7	2200
Shallow Well 2 (Machinga)	5	1536	6.9	3320

Appendix 4: A photo of Lilongwe Water Board bill.


LILONGWE WATER BOARD P.O. BOX 96 LILONGWE PHONE: 01750366 (OFFICE) 01753630 (FAULTS) WATER ACCOUNT

DATE	DOC. NO.	DESCRIPTION	AMOUNT
		Opening Balance	283.66
27/02/07		Water Sales-Residential	
		Readings: Date Current Previous Act Consumpt.	
		23/02/07 2699 2678 21	1112.00
		0.00 0.00 0.00 1395.66	

CHAVULA WISEMAN
DISTRICT WATER SUPPLY 111 PROJ.
P/BAG 390
LILONGWE 3

DISCONNECTIONS:
1. To avoid disconnection without notice this account must be paid by the due date reflected on the reverse hereof.
2. Please submit this account with your remittance or quote account number.
3. Receipts will not be issued for cheque payments unless requested.

31/03/2007 1395.66
DUE DATE

		DEPOSIT	ACCOUNT NO.	DATE
49//1/241	49/08/510	0.00	0044648	27/02/2007