Service Provision Governance in the Peri-urban Interface of Metropolitan Areas Research Project

WSS PRACTICES AND LIVING CONDITIONS IN THE PERI-URBAN INTERFACE OF METROPOLITAN DAR ES SALAAM: THE CASES OF TUNGI AND STAKISHARI

DRAFT FOR DISCUSSION

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ABOUT THE PROJECT

This report is one of several outputs from the project *Service provision governance in the peri-urban interface of metropolitan areas*. This is a three-year project run by the Development Planning Unit, University College London in collaboration with a number of institutions from developing countries and with support from the UK Government's Department for International Development (DFID).

The purpose of the project is to improve guidance on governance and management of water and sanitation in the peri-urban interface (PUI) of metropolitan areas, in order to increase access by the poor and promote environmental sustainability. Presently there is a gap in the operating knowledge of implementing agencies on the specific problems that arise in the PUI. A premise of the project is that greater knowledge of the social, environmental and governance issues arising from changes in the management of water supply and sanitation in the PUI, and more specifically of the impact on these of different and changing regulatory frameworks, would be beneficial not only for the poor but also for these agencies and other local agents.

The project examines the cases of five metropolitan areas, each with different and changing service management regimes influencing the governance of basic service provision: Chennai (India), Dar es Salaam (Tanzania), Cairo-Giza (Egypt), Caracas (Venezuela) and Mexico City.

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LIST OF ABBREVIATIONS

CBO	– Community Based Organisation
CIS	– Corrugated Iron Sheets
FGD	– Focused Group Discussions
URT	– United Republic of Tanzania
PEVODE	– An association involved in mobilisation and sensitisation
UMAWA	– Local association involved in environmental cleanness campaigns in Tungi
TPDF	– Tanzania Peoples' Defence Forces
WAHECO	– Voluntary Association of Animators organised at Municipal level
WEO	– Ward Executive Officer
WDC	– Ward Development Committee
WRI	– Water Resources Institute

1. INTRODUCTION AND STUDY METHODOLOGY

1.1 Introduction

The peri-urban interface (PUI) of many third world countries including Tanzania represents diverse socio-economic and environmental systems which are continuously changing from rural to urban. In Dar es Salaam, the transition from rural to urban is characterised by numerous changes including:

- Increased pressure on natural resources such as water, land and forest
- High population growth rate and rising housing densities.
- Changed sources of livelihoods, essentially from farming to non-farming activities such as petty trading, repair workshops, small scale industries and service provision.
- Intensification of mining /quarrying
- Accelerated immigration and settling by the poor.
- Declining level (quantity) of basic infrastructure services especially water and sanitation.

At the same time, the central and local governments are experiencing severe shortage of resources needed to provide and improve WSS commensurate with the growing population in the metropolitan areas. The limited resources available are often directed into the consolidated primarily planned urban areas which are dominantly occupied by middle and high income settlers. As a result, the poor in PUI suffer most due to poor or lack of WSS services. The highly uncoordinated and unregulated initiatives by the private sector to provide WSS and fill the gap created by the public sector deficits do not seem to offer affordable safe and most important sustainable options. One of the major challenges which Tanzanian government is facing therefore is how to improve access to and governance and management of WSS among the poor in the metropolitan PUI settlements. Most of the latter in unplanned or informal, therefore growing haphazardly. This report aims to examine current WSS in two PUI settlements of Tungi and Stakishari in the metropolitan Dar es Salaam.

This report looks at several issues including demographic, socio-economic, environmental and institutional aspects of WSS. Attention is also given to characteristics and trends of the WSS, the policy environment as well as the socio-political and cultural aspects. At the end of the presentation social and political conflicts around WSS in two study areas are discussed together with a summary of the key emerging issues. A number of the latter are cross cutting.

This is the second report which together with the first (Metropolitan Profile) and third one (Opportunities and Constraints and room for improvement of the current regulation WSS in PUI) are intended to contribute towards policy reform as well as provide operational guidelines in relation to improvement of WSS services in the metropolitan PUI areas. This report forms an integral part of parallel studies conducted in China, India, Cairo-Giza, Egypt, Mexico valley, Mexico, and Caracas, Venezuela.

1.2 Study methodology

The research in the two study peri-urban areas was carried out between September 2003 and March. The nature of the WSS study called for face to face interactions with the various actors both men and women involved in WSS. Qualitative data collection and analysis methods were largely deployed so as to preserve the context which shapes access to WSS. The main

methods used to collect data and information are Focused Group Discussions (FGD). In total 8 and 6 FGDs were held in Tungi and Stakishari, respectively with a total of 86 persons. Each FGD comprised between 3 and 7 persons (Table 1). WSS conditions and activities ongoing in the two study areas were also recorded through transects which focused on the critical housing issues especially water sources (wells, boreholes), sanitation facilities, land use and development characteristics, social services and economy.

In depth studies comprising semi and unstructured ended questions were administered at Subward and Ward levels as well as with members of the various functional committees to include Water Committees and Health Committees. Also interviews covering 50 households was carried out in each study area. Furthermore, interviews were also held with other purposely selected informants (15 in Tungi and 34 in Stakishari). This covered settlers who were involved in or have played important roles in WSS in the past or represent a specific disadvantaged group. These include, for instance, proprietors of manual and electric motor wells, elderly (disabled) and very poor persons and former (retired) water technician. A summary of the interviews conducted are presented on Table 1.

Table 1: Key interviews conducted in Tungi and Stakishari

Type of interviews	No. of Focused Group Discussions (FGD)	Total/ No. of persons in the FGDs	Other purposely selected informants	No. of Subward Committees & persons	No. of persons/ Ward Level interviews	No. of households interviewed	Remarks
Tungi	8	44	15	3 (9)	2	50	
Stakishari	6	42	34	4 (5)	3	50	
Total	**14**	**86(45.31)**	**49**	**7 (14)**	**5**	**100**	**254**

Source: Fieldwork studies in Tungi and Stakishari, September 2003 -March 2004.

Focus Group Discussions were held with key players (users and providers, overseers) in WSS in Tungi and Stakishari. These include:

- Artisans (borehole/well drillers)
- Water vendors (bicycles/pushcart)
- Food vendors
- Local brewers
- Gardeners
- Brick markers
- Batik makers
- Shop keepers and bar owners

Of the total of 254 respondents who were interviewed, almost half (47.5%) 47 in Tungi and 48% were women. Initial contacts with Subward leaders and water committee members facilitated contacts with FGDs. Selection of key respondents including identification of low income families which comprised bulky of the household respondents allowed respondents' to be selected taking into account the nature of respondents involvement in WSS, role (i.e. user or supplier of WSS service), socio-economic status as well as geographical distribution of the respondents in the settlement.
It is noteworthy that, unlike Tungi, Stakishari has no water vendors who use pushcarts and bicycles because the owners of boreholes have facilitated private connections to individuals and water selling points.

2. THE CASE OF TUNGI

2.1 Profile of the peri-urban locality

2.1.1 Introduction and justification of the peri-urban case study

- **Hierarchy, and location of the peri-urban area**

Dar es Salaam City comprises the three Municipalities of Temeke, Kinondoni and Ilala. In total there are 72 administrative wards (Map 1). Tungi covers 54 hectares and is the largest of the four administrative Subwards of the Kigamboni Wards a peninsular stretching south-east of the city center. Others are Tuamoyo, Kigamboni, and Ferry. A count using the 1992 aerial photographs revealed that in 1992 there were 1180 houses and a gross density of 14 houses per hectare. By 1999 the number of houses had soared to 1,680 accommodating 17,500 people giving a gross density of 20 houses or 208 people per hectare. Currently it is estimated that Tungi accommodates more than half of the Ward population estimated to be 36,500 people according to the National Population Census 2002.

- **Environmental, socio-economic and institutional**

Overall there is very little data on environmental aspects at case study level, discussion here therefore will somewhat only try to give a general picture based on mainly field studies and questionnaire surveys.

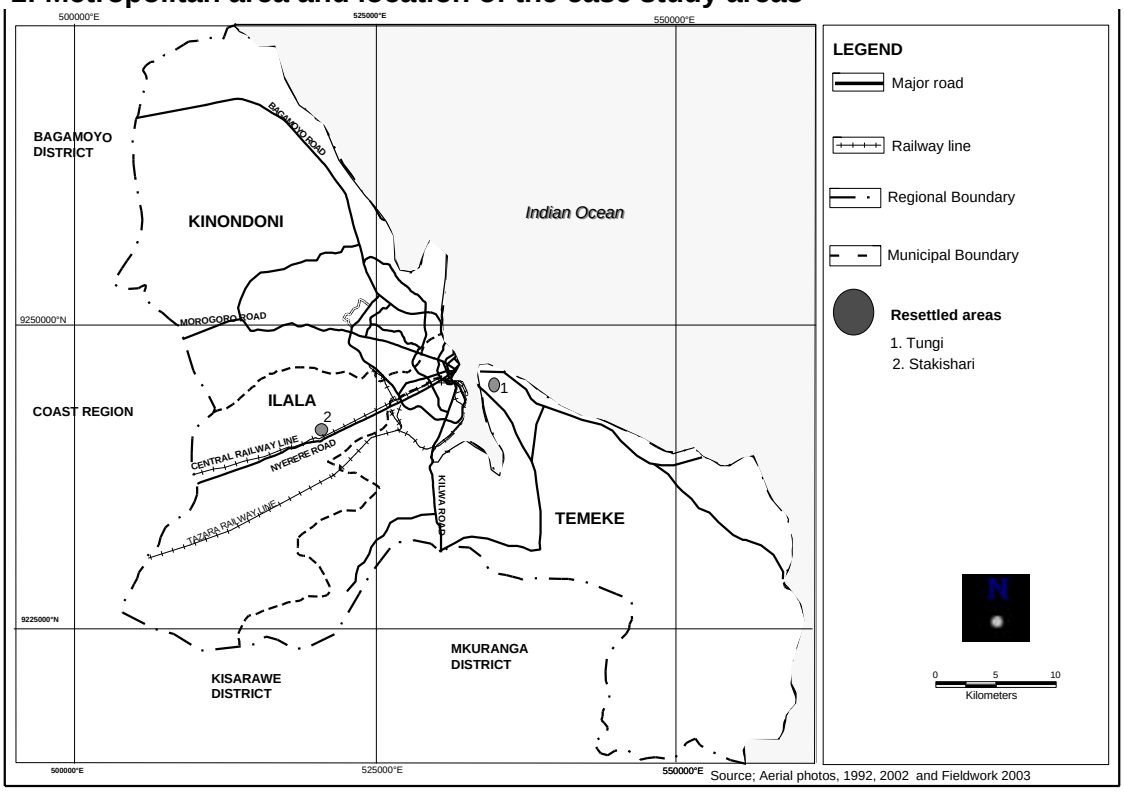
Land use changes, which have taken place in Tungi over the last two decades have more or less displaced agriculture and farming activities, and affected the natural ecosystem. However, the fact that all houses are low rise (single storey, detached), that housing densities are fairly low, and at the same time there is extensive vegetational cover to include trees and grass, particularly in the periphery of the densely built up areas, makes Tungi appear physically heterogeneous. The green valley to the East and low lying flood plain to the South where gardening activities take place, enhance spatial and environmental heterogeneity.

Another important characteristic of Tungi is the increasing incursion of middle income groups, some of whom are ex-civil servants, salaried or retail, and wholesalers has created a middle class group which also manifests itself in form of fairly good quality houses, built of permanent materials and good finish. Amidst these, are houses of modest or low quality that are owned and occupied by the poor households. These features (social, economic and environmental heterogeneity) influence the level and quality of WSS services.

Even though there has been no confrontation, the interests of the emerging middle class and low-income groups in Tungi have been at times conflicting. For instance most boreholes and deep wells proprietors and water vendors alike were motivated to invest in water supply business because they consider it a profitable income generation activity. No wonder many have maintained high prices despite glaring indications that the majority of residents cannot afford. On the other hand, it ought to be acknowledged however, that it is the settling of the same middle class residents that gave rise to the improvements in water services.

Because WSS services in Tungi were until very recently dominated by unorganised actors, there has been no institution involved in WSS. Administrative institutions of the local governments namely the Subward and Ward institutions have until very recently played insignificant or no role at all in so far as WSS services which were provided by private individuals are concerned.

Map 1: Metropolitan area and location of the case study areas



In fact, their role is limited to the WaterAid funded water improvement Project. They have been largely concerned with other matters related to maintenance of peace and order and mobilisation of residents to participate in other local development initiatives. Unlike many other informal settlements, there exist no community organisation (CBO).

What is also glaring is the existence of a weak link between the municipal council and its institutions at Subward and Ward level in so far as WSS is concerned. Subward leaders attend conflicts, which emerge from interactions between various service providers or agents. However overall, their role in resolving conflicts has been disappointing primarily because they are unable to ensure compliance even in situations where public health is at stake.

2.1.2 Institutional and legal framework in Tungi and Stakishari

- **EPM institutions**

Even though Tungi was designated a residential area under the *1999 EPM generated City Strategic Plan,* there has been no initiative by the Municipal or Ward or Subward to implement this proposal so far. Currently there are no institutions or activities associated with Environmental Planning and Management processes. This is primarily because 20 EPM working groups have been operating at the City and Municipal levels but not at Subward or Ward level Units.

Like other Subward areas of Kigamboni Ward, Tungi is represented in the Temeke Municipal Council by an elected Councilor. Administratively it is headed by an elected Subward leader, who is also the local government representative at the Subward level.

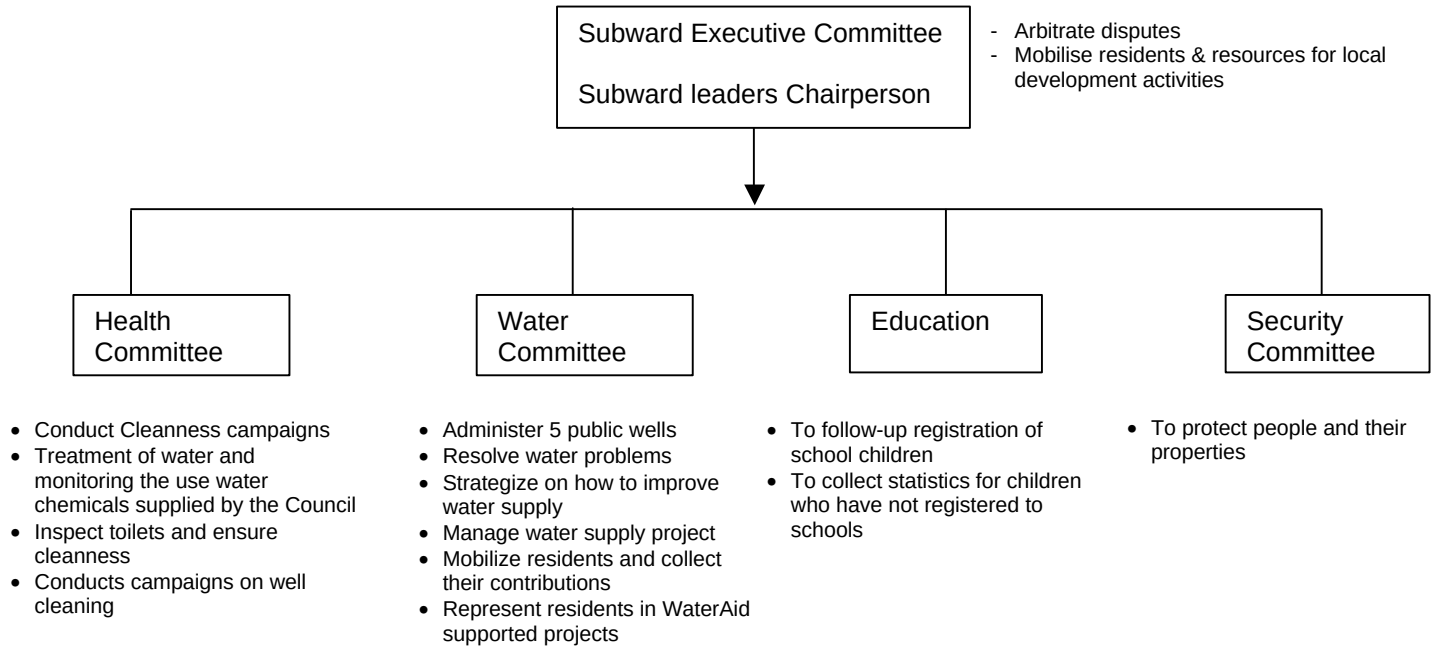
- **Roles of Subward units and sources of financing**

According to the Local Government (Urban Authorities) Act 1982, the main functions of Subward units are:

- To implement the policies of their respective local councils
- To advise the council on matters relating to development plans and activities of the Subward
- To advise the Ward Development Committee on matters relating to peace and security in their areas (Mtaa/Subward).
- To keep proper records of the residents of the Subward
- To do any other function as may be conferred upon it by the Ward Development Committee.

In executing its roles, Tungi operates with four task specific Committees. The committees are answerable to the Subward Executive Committee, which comprises of six members, four of whom are the Chairpersons of the four task specific committees shown of Figure 1.

Figure 1: Subward structure and functions of the committees.



Within the context of WSS improvement, it is noteworthy that the 1994 National Water Policy empowers villages and local committees to form water management committees whose role is to mobilize residents to participate and contribute in cash and in kind towards provision, operation and maintenance of water systems. The Tungi Water Committee was established in the mid 1980s to manage the boreholes built with a financial support from the Lions Club.

When the WaterAid project commenced in the year 2000, the committee was restructured and given more responsibilities to include representation of the community in the project. According to the Water Committee Chairman, the committee meets once a month. It prepares and submits progress report to the Subward Executive Committee, pointing out the tasks undertaken, achievements as well as problems encountered. It is also responsible for evolving proposals on

how to improve access to potable water supply and submit the same to the Subward leaders approval. Since the committee started overseeing operations and maintenance of the WaterAid water project in November/December 2003, a number of issues have emerged and been resolved in collaboration with Subward Executive Committee, these are:

- Clarification of the role of the committee vs the Subward Committee
- Maintenance needs
- In other sessions, Subward has met Water Committee members so as to iron out differences between them. According to the agreement with WaterAid, Subward leaders are required to closely follow up and monitor the roles and activities undertaken by the Water Committee. The Water Committee in this regard is considered an operational arm of the Subward, responsible for water management.

The institutional framework for Stakishari is similar to that for Tungi except with respect to a few specific aspects which are pointed out in the following discussion.

MODECO is a sub-committee of the Project Development Committee, as discussed earlier. It deals with the daily administration of and monitoring of the boreholes which were constructed by DAWASA through a World Bank financial support. As pointed out earlier, the project was initiated by the Kipawa Ward Development Committee. The ward development committees in collaboration with DAWASA experts identified appropriate areas for location of DAWASA boreholes. Thereafter, DAWASA drilled 4 boreholes in Mogo sub-ward, 3 out of them are in Sitakishari.

In order to have affective management of the boreholes, the Mogo Development Committee (MODECO) was established primarily to manage and ensure that the boreholes are properly managed. Each borehole has a committee constituting 8 members. Out of 8 water committee members, 5 are women including the Treasurer. Like in Tungi, the rationale for electing more women into the water committee was the fact that the women are considered the most critical stakeholders, which is in turn partly because as they are most hit when there are water shortages or problems. Households pay TShs 10 per 20-l bucket for water from these boreholes and the funds collected is used for maintenance of the boreholes.

The main actors in the borehole water projects in Sitakishari settlement were initially DAWASA and the World Bank. DAWASA constructed three boreholes with financial support from the World Bank. Other actors and their roles are as outlined in Table 2.

Table 2: Local institutions, committees and their roles

S/N	Institution	Role/Responsibility
1	Ward	Facilitated meetings, sensitisation and supervision of election of water committees. Selection of appropriate sites for the boreholes.
2	Mogo Sub-ward government	Overseeing and spearheading development projects within Mogo sub-ward area. It is the lowest level of the local government
3	Mogo Development Committee (MODECO)	A sub-committee formed in 2002 under the sub-ward government to manage and oversee the day to day running of the boreholes constructed by DAWASA
4	Dar es Salaam Water and Sanitation Authority (DAWASA)	The parastatal body under the Dar es Salaam city council responsible for the management of water and wastewater in Dar es Salaam city.

Source: Fieldwork studies 2003/2004

Water committees are responsible for managing water sales and administering funds including maintenance activities, payment of electricity bills, payment to guards and boreholes attendants. Like in Tungi, the current water charges are not based on cost recovery. They cover only operational and maintenance needs. Apparently, the revenue collected from water sales can only pay the guards, electricity bills and maintenance of the boreholes. This implies that in case there are major breakdowns, the present charges can not meet the costs. This raises questions related to the sustainability of the system.

2.1.3 Demo-graphic and socio-economic characteristics

- **Demographic trends**

Household interviews conducted for a study of community infrastructure services in Tungi in 2002 revealed an occupancy rate of 2 households per house and mean occupancy of 5.2 people per house. Most of the existing houses (86%) are built of permanent building materials; mainly cement blocks and Corrugated Iron Sheets. The rest are built of mud poles and thatched roofs. The latter are predominantly occupied by poorer inhabitants, comprising indigenous settlers, mainly Zaramo. Immigrant settlers include Nyakyusa, Chagga, Hehe, Gita, Sukuma and Kuryas. The main economic and income generation activities are petty trading, food and vegetable vending, fishing and small scale (repair) workshops. Few residents are employed (salaried) mainly in commercial and service sectors in the city centre (Table 4).

Even though Tungi is only five kilometres from the Central Business District (CBD), it still exhibits peri-urban characteristics both in terms of land use, economic activities and occupational characteristics, this is primarily because of retarded development emanating from poor transport link with city centre. The estuary at Magogoni separates it from the rest of the city, making Kigamboni Ward one of the areas experiencing poor transport link to the rest of the city. In fact apart from the boat which shuttles between Kigamboni and Magogoni, there is no direct transport link with the city centre. Vehicular access to Kigamboni and Tungi exists through a circuitous route from Kilwa road at Kongowe, about 20 kilometres from the city centre. Passengers and vehicles using the boat pay TShs.100/= and TShs.1000/= per trip respectively. Plans and negotiations by the Government of Tanzania are ongoing to build a bridge at Magogoni, to directly link city centre and Kigamboni. If this project materialises, Tungi and Kigamboni Ward in general, will experience dramatic changes in socio-economic and physical development, particularly because of its proximity to the city centre and attractive white sand beaches. Already speculators have started grabbing land in some Subwards of Kigamboni especially along the beach and in the sparsely built housing neighbourhoods such as Mji mwema.

- **Environmental setting**

One of the key environmental features of Tungi, in the context of the WSS study is its location within a peninsular, with limited natural surface water systems. The swamps at Ubaka and Chaboko are the only water bodies in the settlement. There are however springs in other areas such as Vijibweni. The low lying land along the eastern site of Tungi locally referred to as Tungi Primary School valley is wet almost throughout the year, but more or less dry during dry season (December – February). This is the period water is mostly required due to high temperatures, sometimes reaching as high as 34^{o}C. During the period, shallow wells and most deep wells and boreholes dry up. Water vendors are reported to make good business during the period because the demand is high and the supply is limited. During rainy season, which lasts from March to May, Tungi experiences heavy down pour with annual rainfall of between 800mm and 1000mm. During this period, groundwater, the main source of water, is recharged and water

table level rises. The fluctuations during dry and rainy season is the key factor, which determines groundwater level. According to a technician who has been extensively involved in drilling boreholes and digging wells in Tungi, soil profile varies remarkably with depth. Up to one metre it is silt-day, while between one and three metres is loam (Table 3).

Table 3: Soil profile in Tungi

Depth (m)	Soil type	Remarks
0 - 1	Silt & Clay	Semi-permeable, shallow wells vulnerable to pollution
1 - 3	Clay & loam	Impermeable due to high clay content. Water does not easily percolate through thus reducing possibilities for the contamination of wells and boreholes.
3 – 6.5	Clay, with stone pebbles	Water percolates, giving rise to possible contamination of wells by pit latrines
> 6.5	Sandy	Easily drained, deep wells and boreholes not likely to be contaminated

Source: Mr. Mundo, former tutor at Water Resources Institute, and a leading settler involved in digging wells and drilling boreholes.

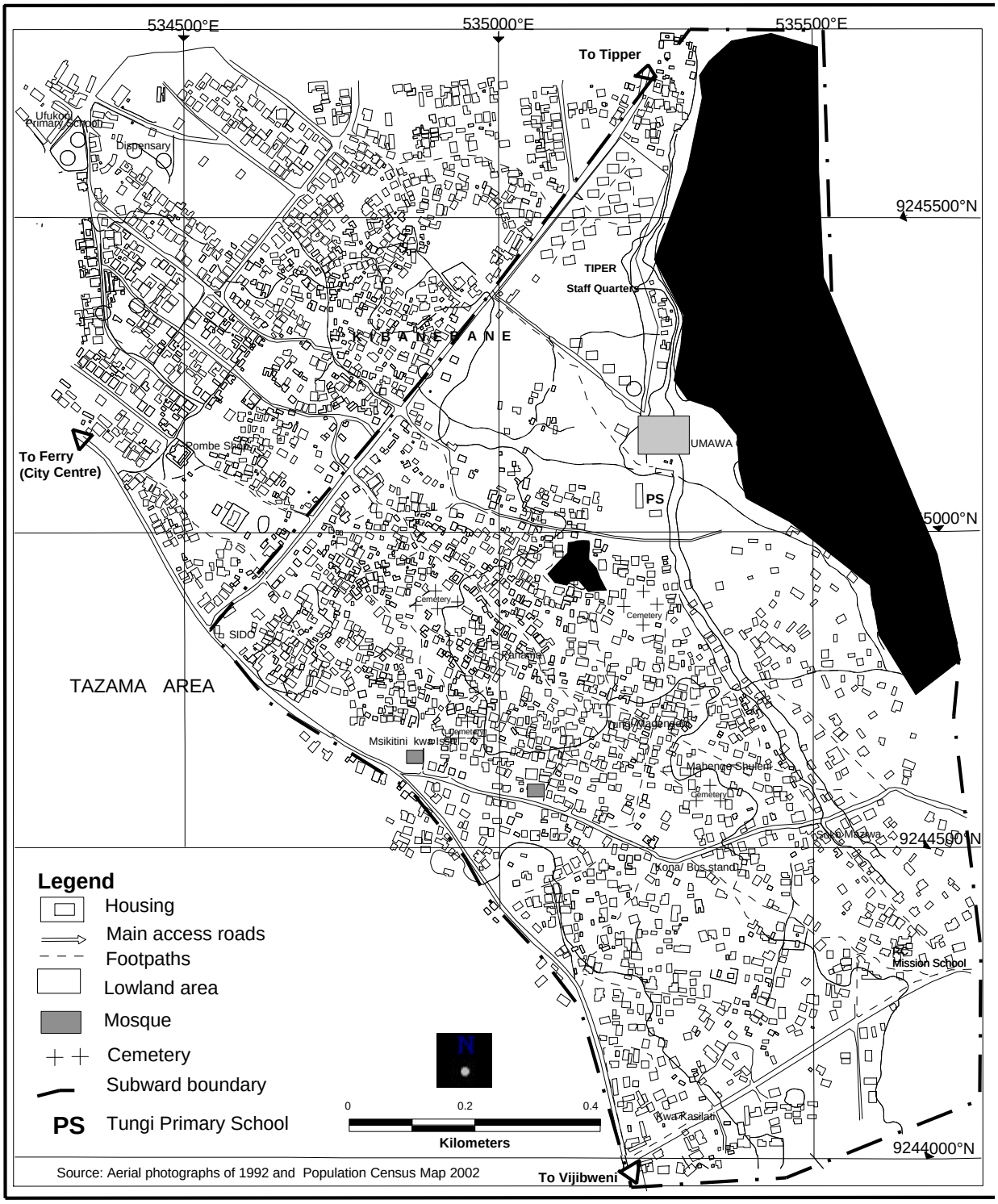
The topography of the study area is gently undulating towards south and east. Because of the landform, the recently completed WaterAid project which abstracts water from a low-lying site in the south, pumps water into an overhead reservoir. Thereafter the water is distributed to public distribution points by gravity.

- **Development patterns**

Until early the 1940s, Tungi comprised bush land with few, hardly 40 households engaged in subsistence farming and fishing. From the 1950s, immigrants from other parts of the city started settling in Tungi, clearing bush, engaging in farming activities. During operation villagisation in the early 1970s displaceès from villages such as Mizinga in Kigamboni were resettled at Tungi.

The establishment of a Navy camp in 1970, together with the construction of an oil refinery in 1967 opened up Kigamboni to more immigrants. Elderly settlers observed that owing to the extended drought, food shortages in the mid 1970s and the subsequent food production campaigns which were conducted nationally, many people moved from the city centre to low income housing areas including Kariokoo, Ilala and Buguruni to the peri-urban areas such as Tungi in search of land for farming. Land parcelling and house construction activities were reported to have intensified starting from the mid 1980s i.e. after drilling and commissioning of the first five boreholes, which were financed by the Lions Club. According to Mr. Mundo a water technician responsible for drilling the first boreholes in 1985, before the five boreholes were drilled Tungi was largely a bush land. As soon as water became available people from various areas of the city shifted to settle in Tungi.

Map 2: Existing land use in Tungi



Privatisation of the former state parastatals coupled with massive retrenchments in the public employment sector starting from the mid 1980s accentuated immigrants from the inner city into the peri-urban areas such as Tungi where land for housing and farming was easily accessible. A number of respondents, who were met during the focused group discussions, said they shifted into the area because they lost their employment through retrenchment exercises. Immigration of people from the inner city housing areas to the peri-urban zones has also been observed in studies conducted in housing areas in the city *(Kombe and Kreibich 2002; Kombe et al 2003)*. Most of the current inhabitants moved into the area starting from the mid 1980s. According to the household interviews and focused group discussions, factors which motivated most immigrants to settle in Tungi include availability of cheap land for housing or farming and proximity to the city centre, where many of them depend for their livelihoods. Besides, improved ferry services linking Kigamboni and the city centre after the purchase of a new boat, MV Kigamboni, in 1995 also enhanced immigration.

Of the present settlers, 90% are immigrant house owners who accessed land through buying. The plot sizes vary remarkably; half of the plots measure less than 400m^2, the rest measure between 800-1500m^2. In the 1990s residential plots measuring between 400-600m^2 were selling between TSh 20,000/= and TShs.30,000/= (US$30-42) at present a similar plot size is selling between TShs.500,000 and TShs.700,000/= (US$500-700) depending on its location and proximity to the main roads. In general, land closer to the main roads and in the northern part of Tungi sell higher than areas away from the roads or in the southern part, understandably because of proximity to transport service and the city center. The differences in plot sizes and sporadic nature of housing development gives the area distinct physical appearance with fairly dense housing clusters in the northern part, and less dense as one moves South and North East where there are still several pockets of unbuilt land (Map 2).

- **Socio-economic trends**

Most of unbuilt land is under subsistence farming of crops such as maize, coconuts, fruits, cassava and vegetables. Apart from housing densities, the north also exhibits a more consolidated urban characteristic than the south, particularly in terms of livelihood activities. Most of the retail shops, food and vegetable vending kiosks and petty trading activities are in the north (Table 4).

Table 4: Main livelihoods activities in Tungi

Main Activity	% of settlers	Remarks
Petty trading	62%	Incl. retail traders, vegetable vendors, hawkers, food and fish vendors, water and pancake vendors, charcoal sellers and subsistence farming.
Artisans	20%	Incl. carpentry, tailoring, mansions, repair workshops, concrete block making, saloons & barbers and local laundries.
Salaried	8%	Incl. teachers, soldiers, police, nurses, clerks, messengers, drivers, barmaids watchmen and shopkeepers.
Unemployed	10%	Incl. retired civil servants, and young people school leavers.

Source: Field studies 2003/2003, a total of 50 household interviews were conducted.

The relatively high proportion of persons engaged in petty trading activities underscores the declining role and importance of farming as a source of livelihood. Whilst the change can also be seen as a positive response to the opportunities created by the liberal economic policies adopted by Tanzanian Government, from mid 1980s, it also shows an emerging pattern of poor household livelihood in most peri-urban areas of the city. The increasing proportion of petty

trading activities can also be associated with corresponding low expenditures, observed among most households. The interviews conducted among 50 randomly selected households revealed that 95% of these have an average total monthly expenditure of between TShs.30,000-90,000/= per household, i.e. equivalent to between 0.2U$ - 0.6U$ per person per day. From these figures, it is apparent that most of Tungi inhabitants fall within the *absolutely poor* category; this view was confirmed during *the focused group discussions* with various groups in the settlement. It is generally difficult to assess income in many urban communities, especially because many people either do not keep records or are reluctant to reveal their real incomes while others may exaggerate or even lower their expenditures (declared in Tungi) in the hope to attract moral or material support. The incomes derived from expenditures are admittedly crude, but they give us an impression of the poverty and implied WSS consumption levels and problems in the area.

- **Livelihoods patterns, changes and their implications on poverty**

Table 4 shows that farming and gardening activities have ceased to be main source of livelihood in Tungi. There is however, full gamut of income and employment generation activities, most of which are subsistence. What was also most notable during fieldwork period is the fact that most of the activities are petty and confined to a small space within a plot or a room in a house. Some of the vegetables and fruits, which are produced, find outlets in the city centre where there is unmet demand due to the growing population. As pointed out earlier, landuse change from farming to residential coupled with shortage of water has given rise to food deficits and inflated price for foodstuffs. In the past, spinach (mchicha) was selling at TShs.20/= per bundle, now the same is selling between TShs. 50- TShs.100/=. Households, which are engaged in farming activities, travel long distances (over 15km) to areas where they can access land for farming. As a result, life among the already impoverished households has become more difficult. It ought to be noted also that due to poor incomes among most households, the purchasing power is generally low. Indeed the bulk of the petty traders is not making a significant income from their activities. Subsequently, nutritional status is often compromised. Entry into the job market in the city centre by young people from Tungi and other peri-urban areas has been difficult because of stiff competition and restrained opportunities in the formal and informal employment sectors. Consequently, while the change from farming to residential has opened up new prospects in non-farming activities, incidence and intensity of impoverished households is increasing. Confirming this, Subward leaders and social groups met during FGD said that most families take only one meal a day, because they cannot afford more. The picture that emerges is one where most households are engaged in subsistence and survival activities. The gloomy picture painted here may change in the coming years, if the dream to build a bridge to directly link the city centre and Kigamboni peninsular materialises. This might stimulate investments in industries and service sector and other non-agricultural sectors. On the other hand, increased land value might lead to the displacement of the poor.

- **Water related health problems**

There are a number of water and sanitation related diseases including diarrhoea, intestinal worms, typhoid, cholera and dysentery. Of these, typhoid, diarrhoea and dysentery were reported to be the most common epidemics. Overall, water related diseases do not represent a serious threat. In 2002, only three and seven persons were admitted in the ward, because of cholera and typhoid infections respectively. However, the number of diarrhoea cases almost tripled between 2001 and 2003. On the other hand in 2002, 299 cases of diarrhoea were reported, out of which 13 died. (Table 5). Officers at the health centre observed that low incidences of water related diseases are attributed to the fact that the majority of the residents have access to and use safe water from either boreholes or deep wells.The figures obtained from the health centre show number of reported cases over the last two years (2002-2003). The picture at Subward level is unlikely to be different.

Table 5: The top ten diseases in Kigamboni Ward 2001 and 2003

Diseases	Number of Cases		Remarks
Year ⇒	2001	2003	
Malaria	5087	6376	
ARI	1078	2696	
Diarhoea	486	1341	
Skin Infection	N/A	1144	
Pneumonia	558	902	
Int. worms	548	884	
Eye Infection	-	642	
Monor Surgery	1065	435	
Other diagnoses	N/A	415	
Ear Infection	N/A	367	

Source: Kigamboni Health Centre; NA= Not among the top ten diseases

2.1.4 *ENVIRONMENTAL CHARACTERISTICS AND PROCESSES OF CHANGE*

- **Environmental characteristics, land use change and ownership**

The increased immigration and subsequent clearing of bush and change of land use have not only been symptoms but also the leading cause of socio-economic and environmental changes. Besides, the predominance of informal land parcelling and transactions have led to the decline of plot sizes and intensification of house construction activities. In turn this has given rise to the abandonment of farming activities. Elderly settlers pointed out that most areas which were in the past used for poultry keeping, and cultivation of vegetables, fruits, cassava, maize and paddy have been cleared and built on. These include such areas as Bondeni, Mwembeladu and Tungi Primary School. Emphasising the foregoing an elderly respondent observed:

"Up to the 1980s, Tungi was one of the main sources of vegetables, cassava and fruits for city centre market outlets especially Magogoni and Kariakoo markets. Then, a lot of fruits and vegetables including mangoes and pineapples as well as sweet potatoes, tomatoes, amaranth**,** okra, pumpkins and coconuts were produced in Tungi and sold in the city centre. Because house construction activities have increased, presently there is very little farming on-going. Some of us who cannot any longer travel long distances to areas such as Mbutu and Gezaulole where farming land exists are facing food problem. This is particularly because young people do not want to engage in farming, they want to be employed and because there are no job opportunities, they are only idling".

Apart from the low-lying marshy area located in the Eastern boundary of the settlement behind Tungi Primary School Valley, which forms a pond during rainy season, there is no any natural ecosystem or land which remains underdeveloped. However, in others Subwards areas there are natural water bodies, these include Ubaka and Chaboko swamps which are famous for hippos. A natural forest which existed before the villagisation era in mid 1970s was cleared to pave way for farming and housing.

The extension of the administrative boundaries of the city in 1978 incorporate Tungi in the city as a potential urban planning area. This was reported to have accelerated rush to grass land for housing. Economic hardships among most households coupled with fear that the Municipality following the expansion of urban boundaries might appropriate land, were reported to be some

of the main reasons that catalysed land transactions. Following the extension of city boundaries many people including employees from the oil refinery, Tanzania Peoples' Defence Force (TPDF) soldiers, Kivukoni college staff and salaried people increasingly bought land and started construction of houses.

The change from farming to residential use has also given rise to another interesting social phenomena. For instance, it was repeatedly observed by respondents that the relatively smaller size of plots and poor house quality (often mud and pole) owned by the former landowners or their heirs while most immigrants occupy larger plots sizes and occupy better quality houses, i.e. those built with permanent building materials and good quality finishes, is the key feature that distinguishes indigenous landowners or their heirs from immigrants. However despite these differences, the two co-exist in harmony.

Asked what role were they playing in the ongoing land parceling and transactions, Subward leaders said that often they are not involved in land transactions because most land deals were mainly concluded by sellers and buyers. The leaders were only involved when buyers wish to authenticate rights of the seller before the deal is concluded.

As may be expected, because access to housing land is an activity that is largely directed by private individuals without any public surveillance, servicing of land to include provision for WSS has for decades been relegated to private individuals. Absence of public involvement or surveillance in housing land development and servicing has put more pressure on the natural resources such as land and ground water sources. For instance because provision of water was until recently dominated by private suppliers wells and boreholes have been mushrooming without regard to the water abstraction regulations and procedures. There are also several incidences where disputes have emerged because of conflicting land uses. In FGD with Subward leaders, they confirmed and elaborated on the existence of environmental impacts of unregulated house construction noting:

"Until the early 1990s most of the land was still under agricultural use. Most settlers would easily meet their water needs, from shallow wells. Then, we did not experience any water shortage for domestic and gardening. Water table was high, one did not require digging a deep well or drilling a borehole to get water. Now deep wells dry up, creating severe water shortages especially during extended dry season"[1]

Another member of the Subward Committee added:

"Because most of the good farming land including valleys have been built on, the production of vegetables and fruits has remarkably declined, leading to scarcity and high prices for vegetables such as potatoes amaranth, okra, sweet potatoes and egg plants. In the past one could walk to his neighbour and gather green vegetables without paying. Now this is not possible, everything is sold.[2]

Decline of agricultural activities and escalation of housing densities, has however, given rise to new income and employment opportunities, such as food vending, local beer brewing, boutique making and small scale industrial activities. Most of the activities are however, associated with

[1] Discussion with Zainabu Saidi, Tungi Subward Chairperson, on 5th February 2004 at Tungi Subward Office.
[2] Discussion with Athmani Makupula, Vice Chairperson, Tungi Subward, on 5th February 2004 at Tungi Subward Office.

high fuel wood and charcoal consumption, both of which may increase environmental degradation. During focused group discussion, there were complaints among particularly elderly settlers, that many trees have been felled because of the increasing demand of firewood and charcoal.

2.2 Characterisation of trends of water and sanitation

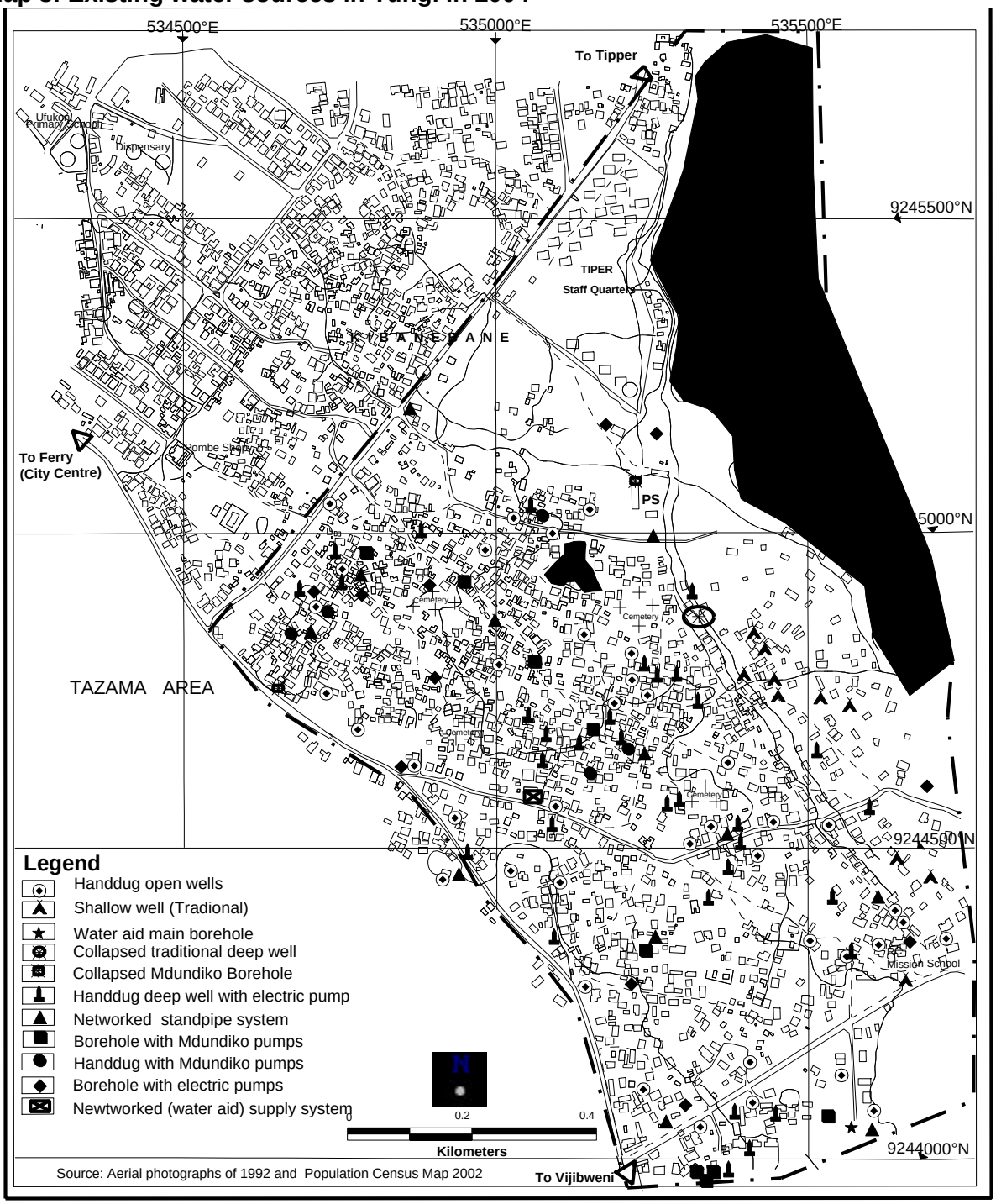
- **Water supply**

All water consumed in Tungi is from ground water sources. Based on the types of the source and distribution, four supply systems which complement each other can be identified, namely:

- Traditional (dug) shallow wells
- Deep wells and boreholes
- Networked (community managed) system
- Bucket (bicycles & pushcarts) vendors system

Most residents, i.e. 42 out of 50 (82%) depend on water supplied from two sources namely boreholes/wells and vendors. The rest use water from three boreholes sources that is, deep wells and shallow wells. Only 10% have wells on plot (Map 3). Domestic water consumption per day varies significantly among households, about a third of the households use between one and twenty litres a day while a quarter use between six and ten buckets a day. The rest use more than ten buckets a day. Mean water consumption per household is eight buckets or 160 litres per day. From the household interviews conducted in Tungi, half of the 50 respondents consider water supplied from deep wells to be unsafe primarily because it is salty, a fifth said it was unsafe, because it was either contaminated or polluted. The rest said it was safe. Focus group discussions with Subward leaders, Water Committee members and a Community Health Worker and WaterAid engineers invariably pointed out that the supply from deep wells in Tungi was generally safe, adding that boiling was advisable. However, it was unanimously agreed that most people use water without boiling.

Map 3: Existing water sources in Tungi in 2004



- **The traditional (shallow) wells**

Traditional wells refer to open wells, dug by individual households on their plots. Field studies conducted revealed that by February 2004, there were a total of 12 traditional wells whereas in 1999 there were 29 wells, suggesting that the users have been decreasing with the increased number of boreholes and deep wells. Most traditional shallow wells are mostly between one and two metres deep, therefore often bowls or dippers are used to scoop water. They are the oldest source of water in Tungi but seem to be increasingly abandoned, because water from shallow wells is often unsafe or contaminated and salty. Traditional wells were originally introduced by Arabs, who owned a number of large farming land in Tungi. At present water from traditional shallow wells is mainly used for washing, cleaning and gardening. Out of the 50 households interviewed only five (10%) asserted that they use water from both boreholes and shallow wells. Out of these, three said water from shallow wells was not polluted and safe, the others said it was unsafe. Given the number of shallow wells, it is likely that there are many more households using water from this source, who but declined to attest. Asked about why they use water from shallow wells for washing and cleaning and not for other domestic needs including cooking, most vendors said it was too salty and unsafe. They also said that they use shallow well sources in order to cut on expenditures on water. Most of the households which said they use water from shallow wells were mainly those with above the mean household size of 5 persons per household.

Photo 1: One of the shallow wells owned by a private individual.
It is approximately 2 metres deep and uncovered. Water from this source was initially used in house construction and is also being used for domestic purpose

Residents, who solely depend on water from shallow wells, comprise mainly elderly persons, who do not have stable sources of income. Focus group discussions with some of these residents revealed that they use water from shallow wells because they have no alternative. In the discussion, one of them noted:

"*Water from shallow wells is not clean, it is also salty and unsafe but when one does not have an alternative, this is the option unless one gets support from Good Samaritan. At times we use water from shallow wells because one feels uneasy to bother other people begging for water*"[3]

It was also reported that most of the poor, who cannot afford to pay for water bills, are normally granted free water (a bucket or two) by deep well or boreholes proprietors. This arrangement is however, not yet formalised by the Subward or water committee. Two elderly women confirmed that they were being granted free water they their neighbours who were operating deep wells. One of them has been getting the service for many years because her husband was blind and therefore she is granted free water as assistance. Therefore at present, there is no agreement with boreholes or deep wells proprietors to supply water to the elderly or poor imply that whatever support they get is informal. The exact number of persons who deserve free water allocation is also unknown. In a FGD with Subward leaders on whether there are residents who cannot afford the TShs.10/= per bucket and they intend to address this problem, the Subward leaders affirmatively responded admitting that this is an issue they are yet to address. She noted:

"Thank you for raising this issue. Yes, certainly there are few people who cannot afford the TSh.10/= changed for water, estimated around ten people or slightly more. At present we have no arrangements for them, but we will discuss this with the Water Committee members, so as to explore and establish modalities for assisting them"

During the field study it was also observed that people who are presently getting free water, were elderly persons, some of whom were engaged in subsistence farming in Tungi Primary School Valley. Inspection of the living conditions of some of those who requested the Subward leaders to grant them free water, showed that they are among the poorest, living in fairly poor housing made of mud and pole and thatch. Asked how much they would be able and willing to pay for water from deep wells, the elderly persons who enjoy free water service and those who had applied for a free grant said, they couldn't pay at all. One of them complained that his request was yet to be considered by the Subward leaders even though he had lodged the request a year ago. Another expressing deep problems of paying for water noted:

"At times I do not have money to buy water, I therefore negotiate for a free grant or loan if I cannot pay I request the well proprietor to consider cancelling the debt".

As noted in the foregoing discussion, the number of persons who cannot afford to pay for water is insignificant, lack of policy or strategy for the most needy are still problems that may accentuate problems of public health in Tungi if left to continue. A number of problems observed during the fieldwork associated with traditional shallow wells include: contamination from pit latrines, pollution due to crude dumping of waste including leaves, grass and waste droppings in some wells. Lacking of well protective walls as well as covers and drying up during dry season, were among the reported problems.

- **Deep wells and boreholes**

Two types of privately managed wells and boreholes exist, i.e. those fitted with manual (hand) pumps and those operated by electric motor pumps. Machines drilled all boreholes, whereas wells were hand dug. The latter are often between four and ten meters deep and between one and one and half metres wide. Wells, which are less than 1.25 metres in diameter, said to be unsuitable, because they are difficult to clean. Normally an attendant has to go down into the

[3] Discussion with Mzee Rajabu Mussa in Tungi, on 7th January 2004

well and clean it. Cost for digging a well varies between TShs.200, 000/= and TShs.350, 000/=, for materials including pipes and manual pump costs between TShs.280, 000/= and TShs.530, 000/=. The cost per wells is therefore between total TShs.480, 000/= and TShs.880, 000/=[4]. Drilling of boreholes or wells is done by individual households without authorisation or any regulatory mechanism.

Photo 2: One of the boreholes in Tungi that is manually operated (Mdundiko).
Note that the hand pump is tied to a lock to bar those who may try to collect water without the permission of the owner of the shallow well.

At present there are a total of 84 hand dug deep wells, six of them being manual ('Mdundiko' wells), 39 are fitted with electric motors, the rest (39) are open wells, and therefore water is scooped using buckets tied to sisal ropes (Table 6). According to the interviews conducted with wells proprietors Artisans use such tools as diggers, hoes to dig wells and in some cases where a drilling machine is considered more appropriate, they hire machines from renters in the city center, at a charge of TShs.200, 000/= (US$200) per well. Charges for drilling boreholes varies between TShs.300, 000/= and TShs. 600,000/=, depending on the depth and negotiations. Materials and plumbing cost about TShs.300, 000/=, whilst the price for a 0.5HP electric motor pump is between TShs.80, 000/= and TShs.135, 000/=. Drilling machines are normally used in areas where the plot is too small for had digging. Most boreholes and deep wells proprietors have installed water reservoir tanks (simtanks). A 2000 litre simtank costs around TShs.200, 000/=. Therefore a borehole fitted with an electric motor pump and with a reserve tank costs between TShs.850, 000/= and TShs.1, 250,000/= (i.e.US$850 and US$1,250).

[4] Discussion with Mr. Rugenzi and Maduka on 6th February 2004 in Tungi. One US$ is equivalent to TShs. 1000/=.

Photo 3: One of the deep wells without a pump.
Water is scooped from the well using a small container tied to a rope.

There are about 33 artisans who are skilled and involved in digging and drilling in Tungi. They are organized in ten teams each of between three and four persons. Each team works independently however, charges for drilling boreholes or digging wells and installation of a pump are more or less the same. According to the FGD with some of the teams and information collected from Subward leaders, all the persons who are drilling boreholes or digging wells in Tungi comprise Sukuma people from Mwanza, Tabora and Shinyanga regions. Underscoring foregoing during the discussions, a member of water committee noted:

"The Sukuma people are known for drilling wells. There is no any other tribe which is involved in this activity in Tungi, drilling wells is their area of expertise[5]".

From focus group discussions it was apparent that artisans involved in drilling boreholes or digging wells were trained by one Mr. Rugenzi, a Sukuma and a former small-scale miner from Geita in Shinyanga. In a discussion with him in the company of other team members, he asserted[6]:

"I am the first person to dig wells in Tungi and I started digging wells here in 1996. I taught all teams which have drilled wells in Tungi and in other settlements".

[5] US$ has been fluctuating between TShs.1000/= and TShs.1160/=, for the purpose of this study a rate of TShs.1000/= per one US$ is adopted
[6] Comments by Mr. Imanuel Msome, 5th February 2004

When asked about how he acquired the skills he noted:

"*I have not received any formal training in digging wells or drilling boreholes, but I acquired the skill while working in Gold mines in Geita. I came here to see my brother realized he had no water. I used my skills and knowledge from the mines to dig a well, I got good water at around ten metres depth. When the residents learnt about this they came one after another, requesting me to drill or dig wells for them. I started the business. I also fit pipes and pumps as well as do some maintenance of the wells when asked".*[7]

When asked to comment on the fact that it is the Sukuma people who are mainly engaged in digging and drilling work, Mr. Rugenzi observed that people along the Coast find it too risk to go 15 or 20 metres down; they consider it a dangerous undertaking.

Normally a household wishing to own a deep well or drill a borehole has to mobilize financial resources required for labour and equipment. Thereafter it negotiates with a team. Some households hired technicians from the Water Resources Institute (WRI) (now Rwegarulila Water Institute) to drill boreholes and install pipes and pumps but engaging technicians from WRI is not common nowadays primarily because there are artisans who are locally based and are therefore contracted for most jobs .[8] Most of the households, which own boreholes fitted with electric pumps, mobilised finances from own savings. Few borrowed money from friends or relatives. The labour charge for drilling boreholes is negotiable; mean price is however around TSh.350, 000/= (U$ 350) per well. Costs for fittings including the shaft and the pump and installation are between TSh.700, 000/= and TSh.900, 000/= per well depending on the supplier. Locally fabricated hand pumps are generally cheaper than those imported from India. Asked about the future of the boreholes drilling and well digging business, Mzee Rugenzi noted: "This has no doubt become a good job, better than farming. Up to now I have bought land (a building plot) and concrete blocks ready to start house construction. However, as I age, manual work is becoming quite tedious. I wish I could own a drilling machine. Hiring the machine costs a lot of money". (Ibid).

When asked how and why some households decided to dig wells or drill boreholes a retired navy officer said:-

"I came here in 1991 after I had retired from the Navy. Then there were five manual "Mdundiko" wells owned by the community of which three were in working condition and few others owned by private individuals. I asked one of the persons with a manual well, how much had he paid for it he told me that digging costs TShs.350, 000/= and fittings and installation costs TShs.750, 000/= for fittings and installation costs. He also introduced me to the artisans who did the job. I contracted them, to dig, buy materials including fitting, aggregates and pump. It took them nine days to complete the work. I took water to Water Resources Institute at Ubungo for testing, and it was found to be safe. The Institute technicians visited me later, took another sample to ascertain that the quality of the water they had tested before. They made on spot tests as well as inspected the surroundings of my well. They were satisfied that water was safe. I started selling water in October 1998. I charge TSh.10/= per bucket. When I started I used to earn between TShs.3, 000/= and TShs.4, 000/= per day. I therefore could recover all costs (i.e.TSh.1.05 mill) within nine months. Water sales have now dropped remarkably because of abundance of wells and boreholes. I get between TShs.1,000/= and TSh.2,000 per day. Unless

[7] Discussion with Mr. Rugenzi, on 6th February 2004 at Tungi.
[8] Rwegarulila Water Institute is a public institution responsible for training water technicians.

there is a person supervising customers water business is very involving; pumps break down frequently due to mishandling. Even without misuse, one has to repair the pump at least once every four or three months".[9]

Although a number of respondents said they decided to dig a well because they wanted to ease water blues for their families, findings from the focus group respondents, as well as from some of the deep wells and boreholes proprietors revealed that, most of them were motivated by the desire to get in the water business and make profits.

Almost all settlers use water from more than one source, about 76% are still using manually operated or *'mdundiko'* wells. Findings from the focus group discussions revealed that in recent times, *'mdundiko'* wells customers have decreased as more people have shifted to the wells or boreholes fitted with electrical motor pumps because in the latter case, they do not have to labour. Some of the women interviewed repeatedly expressed their delight because of the introduction of electric motor pumps: "*Wenye visima vya mdundiko wanadai fedha ile ile kama visima vya umeme, halafu mwenyewe anakaa tu, anangojea umpe fedha baada ya 'kukuangalia ukihangaika na ukidundika'. Hatutaki kudundika ndiyo sababu watu wanavikimbilia visima vya umeme"* …. Meaning one is charged the same price per bucket regardless of whether she is fetching water using a manual or electric pump. Owners of manual wells demand to be paid while they only sit and watch us doing the pumping of water. This is why many customers have shifted to electric motor pumps.[10]

When asked about why the wells fitted with manual pumps are called *'mdundiko*,' which refers to the traditional dance along the Coast, a woman informant narrated:

"When pumping water from deep wells, users of manual pumps, bob up and down, leap forward and backward like Mdundiko dancers. [11]

Water Committee members reported that wells fitted with electric motor pumps were first introduced in Tungi in 2000 when electricity was first connected in Tungi. All the 53 deep wells and boreholes fitted with electrical motor pumps belong to private individuals.

When asked about what motivated them to install electric motor pumps, most respondents noted they were motivated by profits, noting that it was more profitable and efficient to operate wells fitted with electric motors because it takes only a few minutes to fill a bucket. Others opted for electric motor pumps because they wanted to win more customers as more people were increasingly shifting to those wells and boreholes operated by electric motors.

[9] Discussions with Mr. Rashid Shetava on 6th February 2004 in Tungi.
[10] Discussion with Ms. Anna Kisoli 19th August 2003 in Tungi.
[11] Discussions with Bibi Baye 16th August 2003 in Tungi.

Table 6: Costs for providing deep wells and boreholes

Year	No.	Cost and source of funds	Remarks
1980s	5 (Manual) wells	Funded by Lions Club (Price not known)	Due to lack of funds for maintenance, two wells broke down and were abandoned
1990s	9 Manual wells and boreholes	Private individuals TShs1.0mill –1.3mill	Incl. recovery of costs
2000/2002	• Wells - Manual 45 - Electric 39 • Boreholes - Manual 12 - Electric 14	Between TShs.500, 0000/= to TShs.900,000/= per well Between TShs.850,000/= to TShs.1.25 million per well	Private individuals charges (incl. cost recovery) Exchange WaterAid Boreholes
2003	- Electric motor - 13 kiosks - 20,000 litres tank	WaterAid grant, approx. TShs. 40.0mill incl. pipes, labour reservoir tank and 13 public kiosks.	No cost recovery but charges TShs.10/= per bucket to cover operation and maintenance costs.

Source: Fieldwork studies 2003/2004

As regards maintenance, well proprietors observed that electric motor pumps unlike manual ones require occasional maintenance. But in either case, wells have to be cleaned at least once every 3 or 4 months. Normally cleaning of boreholes fitted with electric pumps is done using compressors. These are hired from firms in the city centre at between TShs 3,000/= and TShs. 5,000/= per day.

Although most respondents selling water from deep wells claimed of water safety after they had tested it at the Water Resources Institute, these claims were found to be untrue during FGD with the Subward leaders, the Water Committee and other social groups including women respondents.

The assertions that most boreholes and deep wells proprietors do not conduct water tests were rife. In a discussion with Mr. Mundo, a veteran water technician who worked for the Water Resources Institute (WRI at Ubungo) and was responsible for drilling and testing of water from the first five deep wells which were funded by the Lions Club in the mid 1980s, he observed that most of the deep wells which were drilled by local artisans have never been tested for their water quality. He remarked: "*wengi hawapimi maji, wanaonja maji kwa mdomo tu. Ni wachache wenye upeo wanapima",* meaning, the majority do not do tests of water quality; they simply sip it to test salt concentrations only. Only few enlightened people do conduct water quality tests."

Most households 75% (i.e. 36 out 50) buy only one bucket of water per day from vendors. The rest (25%) buy between 2 and 3 buckets. Generally, water bought from vendors is for drinking purposes, only few households use it for cooking or other domestic purposes. The main source of domestic water needs is deep wells or boreholes. In fact more than half of the households in Tungi use between 3 and 10 of buckets for their water needs per day from boreholes or deep wells. The mean water consumption from boreholes and deep wells per household is eight buckets or 160 litres per day.

Table 7: Household water sources and consumption

Water sources for households	No. of household[12]	Consumption per day/household	Remarks
Vendors deep wells or boreholes	38	- Six to ten buckets from wells or boreholes for other uses.	
Deep wells and boreholes	27	Between 3-10 buckets of water from boreholes and wells	Of the 27, four do not buy water from vendors, the rest do.
Shallow and Deep wells/boreholes	5	Use average of 5 buckets/day from shallow wells	Additional bucket per day for drinking and two buckets from wells or boreholes.

Fieldwork studies 2003/2004

Table 8: Water sources, operational system and distances to toilets and residential houses

Water source	Electric pump units	Mdundiko pump units	Scooping (manual)	Total units	Mean distance to house	Closest distance to toilet
Deep wells (Hand dug)	39	6	39	84	2.2m	3
Boreholes	14	12	-	26	2.8m	6
Traditional shallow wells	-	-	12	12	2.4m	8
Networked (WaterAid) taps	-	-	-	13	1.5m	N/A
Total	**53**	**18**	**51**	**135**		

Source: Field studies 2003/2004

- **Networked system**

Apart from the three deep wells, which were built with financial support from the Lions Club, in the year 2000 WaterAid provided funds for water improvement project in Tungi. The project comprised a borehole fitted with an electric motor pump, a 20,000 litre overhead reserve tank, and 13 water distribution points. A 75mm PVC pipe distributes water to the 13 public kiosks. Water from the borehole is first pumped into the overhead reservoir from which it flows by gravity into the distribution points. In total the network system covers 3.5 kilometres of PVC pipes. The networked water supply system became operational in early December 2004. The network covers only 50% of Tungi. Plans are underway to extend the networking system; according to the water committee chairperson, the project will raise finances for the proposed extension from savings of water sales and support from Municipal Council.

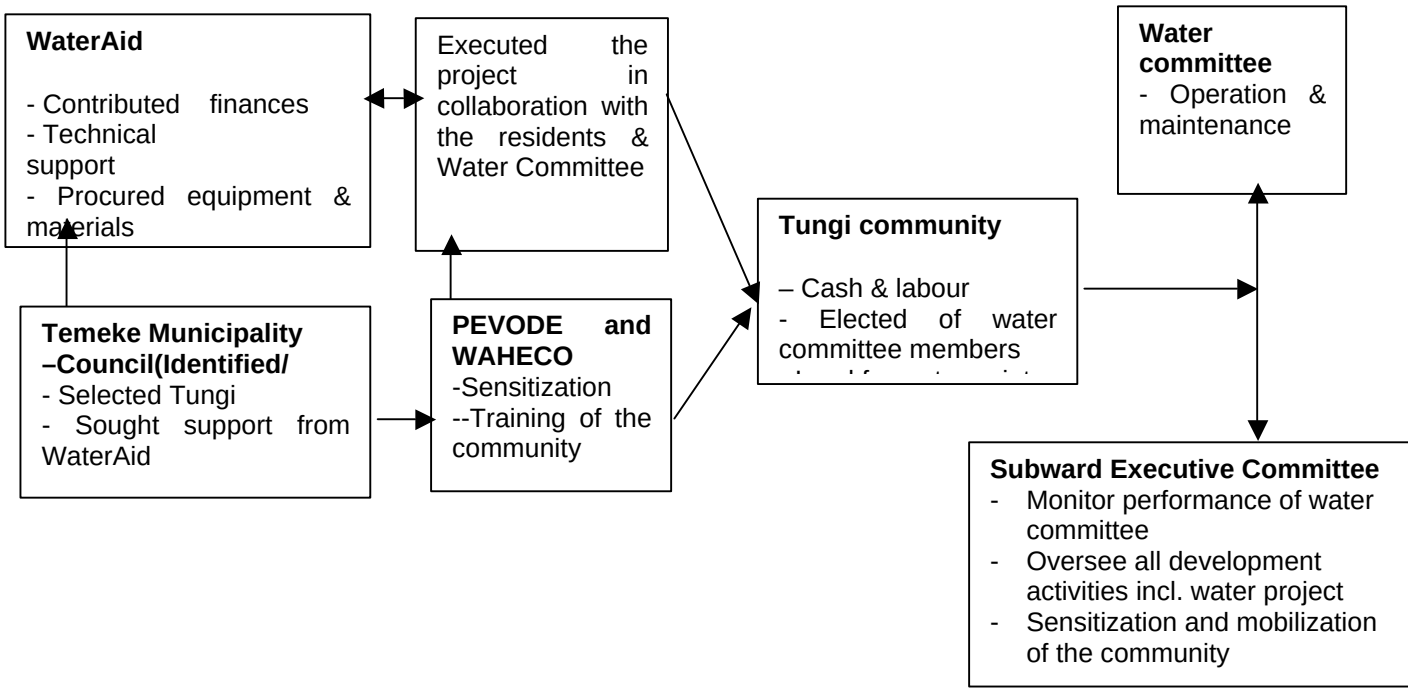
According to the water committee Chairperson, processing of applications for private water connection is yet to start because decisions and procedures for handling on-plot connections are still being worked out and approved by the Subward Committee.

[12] Discussions with Mr. Mando on 9th February 2004 at Tungi.

There were varying opinions regarding the quality of the water supplied by the networked system. The Subward leaders observed that the water is almost as good as the water supplied by vendors but a number of households interviewed complained that it is somewhat salty. Therefore many people still buy drinking water from vendors. Income from the 13 kiosks varies between TShs.1,300/= and TShs.1,500/= per day, per kiosk. Kiosk attendants are paid 20% of the total monthly collection. Electricity bill is about TShs.53/= per month.

The Water Committee is responsible for day to day management of the network including water sales at 13 kiosks. The roles played by the key actors in the WaterAid supported project are presented in Figure 2.

Figure 2: Actors and their roles in the networked (WaterAid supported) system[13]



The committee is administratively answerable to the Subward Executive Committee. Funds sought from water sales are kept in a special account operated by the committee. Following the commissioning of the networked (WaterAid Project) system, access to potable water has improved remarkably. Most settlers ($^{28}/_{50}$%) access water from less than 100m. Few access water within a 300meters radius (Map 3 and photo 3).

[13] PEVODE and WAHECO are voluntary associations Established in Temeke Municipal Council to mobilize and sensitise settlers in the Municipality on public health issues and their role in improving access to safe water.

Photo 4: The main overhead water tank constructed in Tungi settlement by Water Aid. Water flows by gravity to the public water kiosks.

Photo 5: The main water intake built by WaterAid.

- **Bucket (bicycles & pushcarts) vendors system**

Water vending business in Tungi is reported to have started in the 1990s following the commissioning of the two deep well water sources at Kwakijogoo and Kwa Msomali. Vendors who buy water from these two sources pay TShs.20/= per bucket and resale it at between TShs.100/= and TShs.150/= per bucket. A few vendors take water on credit and pay after selling. There are vendors who operate with two or more bicycles or pushcarts. These employ young people at a monthly salary of between TShs.12,000/= and TShs.15,000/=. Employed vendors normally live with their employers in the same household. Most vendors have permanent customers whom they supply an agreed amount of water (buckets) per day or week as the case may be. In such cases some customers are billed weekly or monthly depending on agreements entered between the vendor and customers. Most however, pay in cash upon delivery.

Photo 6: The water source at Kwakijogoo.

Apart from permanent customers, vendors do also ride around or push their carts searching for customers. Most of the inhabitants depend on water supplied by vendors for drinking. Vendors' income varies depending on the season, during dry season they make between TShs.5,000/= and TShs.6, 000/= per day, whilst in rainy season the income falls, sometimes to TShs.2500/= or even less per. Most of the vendors said they mobilised their initial capital from their own saving, their families assisted a few. Some of those who could not raise enough from own savings or families, negotiated with shopkeepers who loaned them buckets, others hired a pushcart at fee of between TShs.1000/= and TShs.15, 000/= per day, after some months they had made enough saving to pay for the buckets acquire own pushcart[14].

Explaining how he came into water vending business one of the vendors had this to say:

"Before I started water vending business, I was running a vegetable stall and I ran short of capital. In 2002 I embarked on water vending business, because water was in high demand in Tungi. I bought a second hand bicycle for TShs.35, 000/= and 10 buckets each at TShs.2, 000/=. Currently I have 30 buckets; I carry 5 buckets per trip, and make five or six trips per day. I buy water at Kwakijogoo. Starting from September through to the beginning of rainy season in March, the business is very lucrative. Some customers who do not use salty water from wells buy as much as ten buckets per day. I earn between TShs.5, 000/= and TShs.6, 000/= per day. In the beginning I used to store water in my house and then sell to customers. Then I used to sell between 15 and 20 buckets. Now I sell between 30 and 40 bucket per day because I supply the customers directly. I get lucrative income, I am paying fees for my children including TShs.80, 000/= for a boy studying at a Technical College in Arusha. I also meet other needs for my family including paying room rent (TShs.5, 000/= per month) and food from water business[15]."

[14] Pushcarts costs up to TShs.40, 000/=, whereas new bicycles cost between TShs.60, 000/= and TShs.80, 000/= depending on the make.

[15] Discussions with Mzee Abraham Juma a resident in Tungi since 2001, who hails from Kilimanjaro

Effective end of last year, water price at Kwamsomali has soared from TShs.20/= a bucket to TShs.50/= for individual household buyers. Attempts to find out why Msomali raised the price at the time when supply of potable water to Tungi has just improved, were in vain because Msomali was uncooperative[16]. Subward leaders contend that Msomali hiked water prices in order to maintain high profits as he anticipates a decline of customers following the commissioning of the recently completed WaterAid project.

Photo 7: Vendors can load one to six buckets of 20 litres each from the water source to Tungi.

[16] Msomali declined to answer questions claiming that he is a resident of another Subward area not Tungi as such he leaves outside the research area.

Table 9: Source of water and price per bucket

Source	No. Wells (water source)	Price Per bucket	Remarks-quality
Traditional shallow (open) wells	12	Free	Contaminated and salty.
Deep wells - Electric pump - Manual pumps - Manual (Scooping)	 9 6 39	TShs.5/= in public wells or boreholes, and TShs.10/= for private wells and boreholes	There are complaints that water is somewhat salty and contaminated.
Boreholes - Electric motor - Manual pumps	 14 12	Varies, between TShs.10/= and TShs.20/=	Increasingly attracting customers because it is not laborious like manual pump wells.
Borehole - Networked system - Public kiosks	13	TShs.10/=	Recently commissioned. Some complains that water is somewhat salty.
- Buckets	More than 50 vendors	TShs.100-150/=	Most preferred source but not affordable by many. Most residents buy only 1-2 buckets for drinking.

Fieldwork studies 2003/2004. Although number of interviews was 50, the number of respondents per sources exceeds 50 because normally a household consumes water from more than one source

2.2.1 Techno-infrastructure development

- **Characteristics of the systems infrastructure**
- **Water intake and treatment**

During the rainy season many households collect rainwater, this is done by using buckets. Asked why they have not adopted large scale rainwater harvesting technology, most respondents said erection of large reservoir on the plot is costly. Otherwise the rest of the water, which is consumed in Tungi, is abstracted from ground sources. Water is abstracted from between 7 and 16 meters. All of the 54 households, which own deep wells or boreholes, have installed diesel or electric motor pumps. They also have erected water reservoir tanks of between 1000 litres and 2000 litres. Deep wells and boreholes operated with manual pumps do not have water reserve tanks. Based on the borehole drilling tests conducted by WaterAid and discussions held with proprietors of deep well and boreholes the mean depth of boreholes is 15 meters. According to the WaterAid technicians, the deepest well in the Municipality is meters. Since 2002 the Department of Health of the City Council has periodically provided water treatment chemicals to Tungi. The Health Committee provides water treatment chemicals once every 3 or 4 months or whenever there is a threat of an epidemic such as cholera. According to the household interviews and focus group discussions, most of the boreholes and wells are between 15 and 20 years old. However, settlers reported that before the Lions Club donated the five wells in the mid 1980s, Tungi had four traditional (open) wells three of which were located on farms owned by some Arabs[17] and one at the mosque. The wells were built in the 1950s to freely supply water to settlers.

[17] *Discussions with a group of elderly residents at Tungi Subward office on 21st January 2004*

Photo 8: One of the traditional wells near the Mosque in Tungi.
This is one of the well built by the Arabs who owned farms in Tungi in the 1950s.

Inspection of the wells and boreholes during fieldwork showed that all boreholes are in good condition and well kept whereas most deep wells are not so well kept, and of them are poorly drained. There were also a number of activities on going around most wells. Some of these include washing and cleaning activities, which are undertaken within three metres radius from the well.

Out of the 50 households interviewed, 42% of respondents said their priority regarding future improvement of water supply is to provide private connection to their plots or houses. One third wanted to drill a borehole or dig a deep well; one fifth did not have any plan at all. The rest plan to install electric motors. Further probing among those who do not have any plans to improve access to water supply revealed that these hope to continue purchasing water as they do not have enough money to install an on-site connection.

- **Water supply network**

According to the water committee the mean yield for the borehole that supplies water to community-managed system is between 200-250 litres per minute. The highest yield per borehole in Temeke is 16.5 m^3 per hour, whereas the lowest is 3.4 m^3 per hour. The depth of boreholes varies; in some areas such as Kigamboni ward, it is 30 metres while other wards such as Mbagala or Kipawa it varies between 60-90 meters.

The main line that feeds the 20,000 litres overhead reservoir tank consists of 75mm PVC pipe. The distance from the intake to the reservoir is about one kilometre. The network, which connects the 13 water kiosks, comprises 50mm diameter pipes. The distribution of deep wells is generally evenly distributed however; some areas in the south and east are poorly serviced (Map 3).

As regards to performance of the wells during the dry season, the focused group discussions revealed that, there are some boreholes where water is continuously flowing (Table 10). A visit in Tungi in December 2003 and January 2003 confirmed the foregoing as most of the wells were dry.

Table 10: Water flow situation during dry season

Situation	No of wells and boreholes	Remarks
Decrease significantly	39	- Water flow declines in most wells and boreholes
Dries-up	8	- Most of these are found in Bondeni area. The shallower the well the faster it dries up.
Constantly flow	19	- This includes boreholes drilled 1985 and those at Kwakijogoo and Kwa Msomali.
Total	66	

Source: Fieldwork studies 2003/2004: Although the total number of boreholes and wells and water aid points is 135, only 66 people responded to the question.

The performance of boreholes and wells in terms of yield depends very much on the exploration i.e. whether it is deep enough to locate high yielding fissures or fractures as well as on the rain fall pattern. When rainfall pattern is disturbed by prolonged dry season, recharge of the ground water is grossly affected.

Most deep wells and boreholes proprietors complained that they have lost customers and revenues because of improved water supply, following the completion of the community managed water system as well as increased number of private households engaged in water vending activities. Prices for water supplied by private individuals has more or less remained stable although the competition has intensified. The picture might however, change if the networked system will be extended to cover the whole of Tungi. The price for the water supplied by the community will be significantly reduced. Such steps are most welcome as they might increase accessibility to water. They will however, occasion loss of more customers, leading to reduction of income among private water suppliers and give rise to uneasy relationship between the private water suppliers and community leaders. This is evidenced by the following excerpt from one of the informants, who happens to be a proprietor of a deep well. “Costs for electricity are high, if WaterAid water supply improves, I will have to close my business, I don’t know what I will do to earn a living”.

Another settler who has been in water business for five years added:

"We have strived so much to invest (in borehole or deep wells) in order to get some income. If WaterAid decides to provide free water or charge nominal fees, some of us will be thrown out of business and will not be able to recover the capital costs; we do not know what we will do".[18]

On the other hand, a number of owners of wells or boreholes asserted that even if WaterAid extended their services to the entire area they will not close down because they can still sell water especially when there are power cuts. One of them elaborated this, noting:

[18] Discussions with Mr. Kidaila Daniel on 5th February 2004 at Tungi

"During power cuts, water becomes scarce because WaterAid project cannot supply the commodity. Then we make good business. This happened this January. There were long queues for water not only here but also at the other wells with manual pump"[19].

Asked whether he or other water vendors will reduce the price to keep it competitive, the respondent remarked:
"No, I don't think so. One cannot however tell everything. In business everybody has a fortune"[20].

Foregoing suggest the need for the actors supplying water to come together and share their varying concerns, as well as evolve a consensus particularly on sensitive issues such as pricing water services as well as agree on modalities to support residents including elderly persons who cannot afford to pay the current charges. The users should also take an active role in the discussions. At present there are hardly any discussions between the private and community water suppliers

Table 11: Water and sanitation improvement stages

Service	Steps			Remarks
	Step 1	Step 2	Step 3	
Water Supply	Shallow wells & traditional wells < 1980	Deep wells & boreholes with manual pumps before year 2000	- Deep wells & boreholes with electric pumps after year 2000 - Piped and networked	Technical support provided to ascend from (1) to (2) to (3)
Maintenance	Little maintenance mainly cleaning	Community & households hire pump attendants and cleaners	- Water Committee - pump attendants - Hire compressor	- Poor routine cleaning
Quality of service	Poor – salty and contaminated water	Satisfactory water quality however not tested	Satisfactory Water quality not tested	No regulatory framework
Sanitation	No toilets <1960s	Traditional Pit latrine >1960s	- Improved pit latrines	No treatment or cesspit-empting services
Maintenance	No maintenance	Occasional repair of superstructure or replacement of pit if it collapses	- Occasional repair of roof and floor	Low priority on sanitation.
Quality of service	Poor	Poor	Satisfactory	Traditional pit latrines

Source: Fieldwork studies 2003/2004

[19] Discussions with Mr. Mohamed Abdalla 5th February 2004 at Tungi.
[20] Discussions with Mr. Kombo Abdalla 6th February 2004 at Tungi.

- **Sanitation**

Data collected from focused group discussions and household interviews show that 92% of all households use pit latrines, most of these being traditional latrines that are shallow, measuring only between five and eight feet deep and unlined pits. Some times however, metal drums are sunk into the pit to provide temporary lining. Traditional pits have a permanent shed or floors made of temporary materials. Modern pit latrines are lined with stones or concrete blocks and have permanent shed, have a concrete floor, CIS roof and concrete block walls or other permanent materials. The depth of modern pit latrines is between 12 and 20 feet. Table 8 shows the key steps involved in WSS improvement in Tungi.

The proportion of residents without pit latrines is insignificant. The health committee chairperson and Subward leaders estimate that in Tungi, there are at most ten households without any sanitation facility. Furthermore, out of the 50 households interviewed, only two did not have pit latrines. According to the focus groups discussions with Subward leaders and elderly settlers, it takes between three and five years for a traditional pit latrine to fill-up[21].

As regards to disposals of waste in filled up pit latrines, the most common practice among households is to seal filled-up pit latrine with earth and dig new latrines. In cases where there is shortage of space, a new pit is dug adjacent to a filled up pit and waste are drained into new pit. Thereafter the latter is sealed with gravel and reuse of the old pit continues. This procedures is locally referred to as *kutapisha.* It is mainly deployed in densely built informal settlements. According to the FGDs, there are two groups each comprising three people involved in emptying pit latrines. These are normally contacted and contracted by individual households. They charge between TShs.20,000/= and TShs.30,000/= per pit latrine. In cases where the team disludge using buckets, they charge between TShs.40,000/= and TShs.60,000/= per pit. Disludging using buckets is not however, a very common procedure. Respondents who attended the FGD noted that apart from inability to pay for emptier services, empting filled-up pit latrines using cess pit emptiers was not viable in Tungi because waste is stiff, as normally very little or no water is used at all in most pit latrines.

There are no wastewater treatment plants in Kigamboni Ward. Pit latrine sludge collected by cesspit emptiers from other Subward areas such as Mji Mwema and Ferry is dumped at Vingunguti or other dumping sites in the city. Initiatives to introduce ecological toilets have not been implemented, primarily because individuals wishing to adopt this system are required to pay in advance, 60% of the total costs, i.e. equivalent to TShs. 200,000/=, as a condition for the WaterAid to pay the rest (40%). So far 16 households have indicated interest and registered but have paid nothing. Most households interviewed complained that the costs for ecological toilets were too high and unaffordable.

Even though the majority of the residents use traditional pit latrines, half of them said they do not experience serious operational problems. A quarter said collapsing and overflowing during the rainy season were common problems, the rest said frequent replacement of floors and foul-smell were the main problems.

During FGDs, Subward leaders observed that despite repeated appeals by Subward Health Committee requiring house owners of filled-up latrines to dig new latrines, several households have defied the call and continued using filled-up pits. Narrating problems arising from poor co-

[21] This refers to a pit latrine which measures between six and eight feet deep, which is serving about five persons.

operation from households, the community health worker who is also the chairperson of the Subward health committee said:

" *Some residents are not co-operative. They prevent us from entering their compounds during regular inspection of toilets. Tenants and even neighbours of one landlord have continually complained of his actions on a filled up pit latrine to no avail and the matter has been referred to the Subward leaders and the landlord is yet to take action".*[22]

Upon being asked about further steps they intend to take on the matter, the Subward leaders noted: "The landlord is well educated and rich. He surely is not doing this out of ignorance. We will summon and serve him with an ultimatum to take action. If he does not comply, we will refer the matter to the Ward Executive Officer"[23].

Concerning those who do not own pit latrine, the Subward leaders sounded optimistic saying that as long as (leaders) continue campaigning and educating community members, those with no sanitation facility will gradually heed to their call.

From the discussions with the Subward leaders and other stakeholders in Tungi, it was clear that at present there is no regulatory framework on the basis of which organs at the grassroots can intervene in situations where common welfare is at stake. Neither are there regulations or by-laws, which actors involved in WSS have to observe or adhere to.

The negative experiences and institutional deficits reported here, particularly tendencies among settlers to ignore concerns and appeals from Subward leaders and health committee also underscore institutional weaknesses at the Municipal level in relation to the regulation of the WSS services in low income informal settlements.

2.2.2 Economic and financial aspects

- **Financial mechanisms**

There has never been any project on WSS which was funded by the local or central government in Tungi. The recently completed water improvement project, financed by WaterAid, involved officials from Temeke Municipal Council, mainly as animators and trainers of the water committee members on project management and matters relating to operation and maintenance of water projects. They sensitised community members to participate in the project, and develop a common vision about the water project as well as a sense of ownership. Overall, WSS improvements in the study area are largely a result of private initiatives using own savings, occasionally with little support from friends and relatives.

[22] Discussion with Mr. Simon Chitanda on 5th February 2004 at Tungi.
[23] Discussion with Subward Health Secretary on 6th February 2004 at Tungi.

Table 12: Water prices per bucket in Tanzania

Source	1980s	1990s	2004	Remarks
-Traditional shallows wells - Deep wells -Boreholes with manual pumps	Free “	Free TShs.10/=	Free TShs5/= to 10/=	No cost-recovery. Before the 1980s four traditional wells were providing the water
Boreholes and deep wells fitted with electric motor pumps.	N/A	N/A	TShs.10-20/=	Cost-recovery based individual households.
Vendors (bicycles/ pushcarts)	N/A	TShs.100/=	TShs.100/=-150/=	Cost-recovery based.
Networked (community managed) system	N/A	N/A	TShs.10/=	-No cost recovery --Cost for operation and maintenance only.

Source: Fieldwork studies 2003/2004

Asked about the actual amounts they borrowed from the friends or relatives to accomplish the projects, most respondents were reluctant to disclose the sum. The few who were ready to reveal said they borrowed between TShs.100, 000/= and TShs.400,000/= (i.e. US$100 – 400). None of them had an access to formal credit institutions although most of them would wish to take a credit if banking institutions were ready to grant them.

Table 13: Socio-economic status of the proprietors of wells and boreholes

Main Engagement	No of wells or boreholes	Remarks
Ex-civil (retired) servants	25	- Retired soldiers from Kigamboni Navy Camp and retrenched-TIPPER refinery employees
Business people	15	- This comprises retailers wholesalers of hardware and other consumer goods.
Civil servants and private sector (salaried)	37	- Mainly soldiers employed by the Navy and civil servants.
Artisans	10	- This includes masons, carpenters and brick makers
Others	8	- This refer to boreholes under Subward administration wells owned by mosques schools and UMAWA.
Total	95*	N/A

*Source: Fieldwork studies 2003/2004: *The rest of the boreholes and well owners did not respond to the question*.

It is interesting to note that most of the residents who have invested in deep wells are poor. Majority are former civil servants, salaried people, wholesale and retail traders or fishermen. Earning fairly good income, no wonder they are reluctant to lower the water tariffs.

Sources of funding for the WaterAid project are grants from WaterAid UK. According to the Resident WaterAid Manager, her organisation receives most of the funds from UK, and a small fraction is mobilised locally from projects subcontracted to it by donors and municipal authorities. As conditionality for financial support, WaterAid requires the benefiting community to participate fully in the project, from the inception to implementation as well as in operation, maintenance and monitoring. Funding granted by WaterAid is normally given in form of donation and include a training component. The latter is geared at building the capacity of the community to take over, operate and sustainably manage the project upon completion.

Community members at Tungi water project participated fully and did contribute both in cash and in kind. Trenches were dug by the residents using own labour and tools. They also made cash contribution amounting to TShs.800, 000/=, and these funds were used to pay the artisan from the community who worked with WaterAid technicians. They also participated in community assembly meetings, where key decisions on water project were made.

- **Water pricing system**

There have been no price negotiations between water buyers and sellers or among sellers themselves. Subsequently, the price for water varies significantly from one source or supplier to another. Most private vendors who own deep wells with manual pumps charge TShs.10/= per bucket. While supply from boreholes managed by the Subward Committee is sold at TShs.5 per bucket. On the other hand, majority of those owning electricity powered pump charge TShs.20/= per bucket, a few charge TShs. 10/= per bucket. The price for supply from the networked (community managed) system is TShs.10/= per bucket. Vendors who use bicycles and pushcarts charge between TShs.100/= and TShs.150/= per bucket (Table 6) depending on the season and negotiation between customers and vendors.

The Subward leaders and water committee chairperson said that people who cannot afford water tariffs observed were few. They estimate the number to be ten to fifteen. Most of the respondents observed that at present the poor are being taken care of by their neighbours who own deep wells or boreholes.

It is worthy acknowledging here that a component specifically aimed at to the urban poor low income communities has been proposed under the Community Water Supply and Sanitation Programme (CWSSP). This programme will be undertaken by DAWASA to cover areas which will not benefit from the major water improvements to be undertaken on conventional city water supply system by CWS. Low income communities will be provided with an alternative water supply system, which will be based on an independent distribution network supplied from point sources such as boreholes or wells or from a bulk supply from the main distribution system. They will also be supported to improve on-site sanitation facilities.

The CWSSP was commissioned in July 2003, and WaterAid is among the six NGOs selected to undertake water improvement in low income communities under the CWSSP. It will mainly work in Temeke Municipality.

The networked water supply (WaterAid supported project) in Tungi was not designed or implemented under CWSSP concept, but it seems to fit and fairly well exhibits the CWSSP approach. Unfortunately in the case of Tungi project, a sanitation component is not included.

The WaterAid officials said that the TShs. 50.0mill (U$50,000/=) proposed under CWSSP to cover water supply improvement and sanitation per low-income community (approx 17,000 persons) is unlikely to be sufficient. Confirming this they observed that the TShs.40.0mill

(40,000US$) spent in Tungi project was sufficient to cover water supply for only a half of Tungi, a community of about 20,000 people.

Table 14:The number of boreholes and deep wells 1985-2003

Source	1985 – 1990	1991 – 1995	1996 –2000	2001 - 2003
Hand dug deep wells	-	4	18	39
Machine drilled	4	2	8	7
Traditional wells	-	-	1	5
Networked (WaterAid) system	-	-	-	13
Total	4	6	27	64

Source: Fieldwork studies 2003/2004

- **Socio-economic impacts**

In Tungi water constitutes a vital resource not only for domestic uses or for livestock watering, it is also the main source of employment and income generation opportunities. Due to scarcity of farmland, water use for agricultural activities is not significant; it is limited to small gardening activities within residential plots. But there are several economic and income generation activities which are directly dependent on or use water. These include brewing local beer, house construction, concrete blocks making, batik making and food vending, each of these activities employ at least 2 persons (Table 15).

Table 15: Activities, their distribution and employment generation

Activity	No. Units	No. of employment generated	Remarks (est. water requirement/unit /day
Local beer brewing	30-50	2 persons/unit	8-10 buckets
Batik making	>100	2 persons/unit	8-10 buckets
Food vending	35-50	1 person/unit	5-10 buckets
Bar operators	10	3-5 persons per unit	10-15 buckets
Livestock keeper	6-10	1-2 person	6-10 buckets
Water vendors	>50	1 person	N/A

Source: Fieldwork studies 2003/2004

Local brewing and batik making are activities that use most water. Informants engaged in batik making reported that they use between eight and ten buckets (160-200 litres) of water per 30 metres roll of linen. Each local brewer use between 10 and 15 buckets of water. A third of the water used by local brewers is used for washing and cleaning. On average a food vendor buys around five buckets each day for cooking and washing from deep well proprietors, and at least a bucket for drinking from vendors who distribute water using bicycles or pushcarts. Normally drinking water is cooled using ice blocks bought from retail shopkeepers in Tungi. Cold water is sold at TShs.10/= per 30mls glass.

Shortage of water has adversely affected employment generation and subsistence production of food crops, especially cultivation of vegetables. Many informants met during the focused group discussions asserted that in the past they used to engage in small-scale vegetable gardening but due to persistent shortage of water, they have abandoned the activity.

"If water was available without much cost, each one of us would engage in gardening. At present we only cultivate vegetables during rainy season. During dry season life becomes very difficult, there is hardly any place where one can grow or pick green vegetables"[24].

There are no households, which buy water for gardening purpose. However, among households owning deep wells, some engage in cultivation of amaranth, okra and salads on small parts of unbuilt land within their plots.

84% of the settlers buy water for drinking, primarily because the present supply of water from deep wells and boreholes is salty. Given the prevailing water prices in Tungi, if low income households earning around TShs.1000, i.e. 1U$ per day, were to buy a bucket of drinking water (from bicycle or push carts vendors) and 5 buckets for domestic use (from deep wells or boreholes), they would spend about 10% of this income on drinking water needs alone and between 5% and 10% for water for other domestic needs. In this regard, *a poor household may have to spend up to a quarter of its daily expenditure on water needs.* This is no doubt a significant proportion, which low-income households cannot afford because of other equally necessary basic needs. In this regard, the observation made earlier that 84% of the residents said they can pay at least TShs.10/=, it would appear have included water that will be bought from vendors for drinking. In which case an average household will spend only TShs.80/= for eight bucket plus additional TShs.10/= for drinking water, a total of TShs.90/= i.e. about 9% of its daily income. It is, however, unlikely that price for drinking water sold by vendors will decline dramatically because of the costs involved at source and high demand. In this regard, it is realistic to assume that the minimum expenditure on water per household per day is TShs.180/= or TShs.230/= per day i.e. at least eight buckets at TShs.80/= from wells or boreholes and TShs.100/= or TShs.150/= from vendors. This is equivalent to between 18% and 6% of the daily household income[25]

Water price for domestic and non-domestic users is the same. Large-scale users such as concrete block makers own deep wells. High water prices is one of the factors, which led to slow construction and completion of the Tungi Primary School buildings, which are being built with financial support from Tanzania Social Fund (TASAF). According to the chairperson of the school construction committee, the construction work has been frequently suspended because of lack of money for buying water. Assenting the foregoing he noted:

"Right now the construction work has been suspended because we owe our water supplier (a deep well owner) TShs.8, 500/=".

Asked about why they prefer to buy water for school construction activities instead of digging a well or drilling a borehole which can also provide water to school. The chairperson said: "A well which existed before the construction started was destroyed by some people who used it as a dumping place. It is not any longer possible to revive it."[26]

Water shortage and changes of land use plans are closely related to the waning of farming related activities and waxing of petty trading activities which are however insufficient to meet basic household needs. Land use changes have, for instance, accentuated vulnerability of poor households, which occasionally use water from shallow well because most shallow wells have dried up. Most important, the processes of social and economic changes appear to have made

[24] Discussions with Ms Salome Mkoma on 9th February 2004 at Tungi.
[25] Household income in Tungi ranges between TShs.30, 000/= and TShs.90,000/= per month.
[26] Interview with the school project Chairperson on 19th January 2004 at Tungi.

living conditions among many households more difficult because land and water scarcity have reduced livelihood options for the poor. For instance intensification of house construction activities have made it difficult for households to engage in subsistence farming activities especially vegetable gardening most of which was being done on the plot.

2.2.3 Policy-institutional environment

- **Legal environment**

Control over water in the country is the role of the Ministry responsible for water, presently the Ministry of Water and Livestock Development. The principal legislation and regulatory framework for utilization, protection and conservation of water in the country is the Water Utilization (Control and Regulation) Act No.42 of 1974, and its Amendment Act No. 10 1981, Amendment No. 8 of 1997. Section No. 8 of the Act declares that all water (flowing over the surface of the ground or contained or flowing in or from a spring or stream or natural lake, swamp or beneath a water course) in the country is vested in the United Republic of Tanzania. The Act sets conditions for use of water and empowers the Principal Water Officer to set policy and allocate water rights (section 10 and 15). Section 11 (1) sets allowable levels for abstraction of groundwater. The Act sets 22,700 litres per day as the maximum amount of water that can be abstracted from a well or borehole per day. It also stipulates that sinking of any well within 230m of any borehole or well, within 90m of any body of water surface or enlargement of any well or borehole, which is within those, distances from a well or borehole is not allowed.

Regarding waste water disposal and pollution, the Act does not stipulate specific provisions to cover pit latrines, however Section 15 A(1), prohibits discharge of waste water at a distance of 230m or less from well or other water sources.

In the absence of a regulatory framework, most of these provisions are hardly observed in Tungi. In fact none of the persons abstracting water from ground sources were aware of the Water Utilisation Act or its provisions.

Subsequently, there were several cases where distances between toilets and water wells were far much less that those prescribed in the Act. For instance, in some cases toilets were only three metres away from a well (Table 6). Elaborating on the outcomes of lack of WSS regulatory framework, a member of the Subward committee says:

"One of my neighbours who occupies a plot on an elevated land has erected a shed for goats, cattle, pigs, chicken and ducks, and liquid waste from the open 'makeshift' shed flows towards the well belonging to his neighbour thus creating filth around the well. This has provoked conflicts between the two neighbours. The aggrieved came out to report the matter to the Subward office. We inspected the site and agreed that, water users' health were at stake. We directed the accused to construct a block wall on the side bordering the well, nothing has been done so far"[27].

Asked whether they were aware of the public health risks, the neighbouring households responded affirmatively. The Subward leaders noted: that although settlers living near the two places are suffering they cannot take any legal action on grounds of avoiding conflicts among themselves or being associated with the economic downfall of the accused.

[27] Discussions with Tungi Subward Committee Members on 5th February 2004, at Tungi Subward office.

This contention by Subward leaders does not really represent popular reactions or responses, as there are often options or rooms for negotiation with respondents with a view to resolve the problem amicably. In case they fail the matter will be referred to the respective Subward, Ward and even to Municipal council. In some cases, aggrieved persons or residents may also take the matter to the court of law.

In this regard it would be fair to observe that there are problems associated with the lack of awareness and knowledge among most settlers about rights and obligations of individuals. To some extent reluctance by the accused persons to take action shows weakness on part of the local leadership.

On the other hand, because there is a vacuum caused by the lack of regulations and laws to guide individuals and Subward leaders, the latter seem to engage in a trial and error approach, without solid base to enforce orders intended to protect common values or welfare.

- Organisational environment
- The networked system

Only WaterAid supported water supply system is presently networked. Day to day management of the system is by the Water Committee, which is an elected team comprising five women and three men. According to the Chairperson of the committee there are more women than men in the team because it gives women a higher representation in water issues, primarily because water needs and supply to households are largely considered the concerns and roles of women.

The main role of the committee, which was formed as one of the conditions for WaterAid financial support, was to represent the community in decision-making matters of the WaterAid supported water improvement project. It was also envisaged that at the end of the construction of the project, the committee will be charged with the responsibility of operating and maintaining it. The other responsibilities of the committee are:

(a) Analysis of the nature of the water problems in Tungi
(b) Sensitise residents to appreciate the need for clean water and substantively participate by contributing in cash or in kind toward improvement of potable water supply.
(c) Evolve strategies for ensuring availability of fresh water
(d) Oversee operations and maintenance of water system.

Well proprietors are responsible for the organisation of the un-networked system, who decide among other things, opening and closing times, water tariffs as well as issues pertaining to maintenance and cleaning. According to the interviews with vendors, there are no associations for water vendors because some of the vendors are employed; they do not own the business, and subsequently they cannot take any decision. Others said that the pressure for vendors' associations was non-existent because overall vendors were comfortable with the current situation.

Lack of an organ which can bring water users and suppliers together in a situation where service delivery is fragmented among several actors, seems to be a source of some of the complaints raised by users who observed that they were not involved in decisions made by water service suppliers. This also accounts for the lack of understanding about the roles and obligations of each other-e.g. the private, the Subward leaders, and the local authority. Needless to add is that the community water managed supply and the private water-providers seem to compete over customers. Private suppliers feel threatened by the community water suppliers. From a policy perspective it is important to harmonise the two systems, so as to

among other things, ensure they complement one another. Such a step would benefit users as it may also provide a basis for an equitable price structure commensurate with quality of service. This could also be a strategy to institute quality control and accountability among the private suppliers towards the community they are serving. Even though the subward leaders and the Water Committee members were convinced that there is a need for harmonising and instituting quality control particularly among private water suppliers or vendors they felt helpless and unable to improve the situation without strong municipal support.

2.2.4 Social-political aspects

- **Water and environmental governance**

There are three public organs or institutions, which play an active role in water governance in Tungi. These are:

- ***Temeke Municipal Council***

The role of Municipal Councils is to promote the social welfare and economic well-being of persons within its area of jurisdiction (S.54(b)) and promote effective democracy in local governance and control of decision making by people concerned (S.54 (f) Local Government (Urban Authorities) Act, 1982, No.8, Sections 53 – 54,). However, Temeke Municipal Council, has played an insignificant role in WSS governance in Tungi. Private individuals have taken a lead in initiatives to promoting WSS services. In most cases, apart from sporadic supply of water treatment chemicals when there is a threat of out breaks of epidemics and designation of extension officers such as the community health worker at the Ward level, the Municipality is not directly involved in improving WSS services.

As for the WaterAid project, the Municipality provided animation staff (through PEVODE and WAHECO) who carried out sensitisation of the residents. In the case of Tungi it is fair to conclude that Temeke Municipal Council has played rather limited functions among its traditional roles of providing basic services to its inhabitants large because most of meagre resources available are directed into the planned areas.

- ***The Kigamboni Ward Authority***

This comprises the Ward Executive Officer (WEO), including extension officers stationed at the Ward, the Ward Tribunal and the Ward Development Committee. The composition of the latter includes the Councillor who represents the Ward in the Municipal Council as well as all four Subward chairpersons. Among the functions and responsibilities of the ward (Sections 15 and 16 of the Local Government (Urban Authorities Act 1982) which are relevant to this study include:

- Promotion of economic and social development of the ward
- Initiating and undertaking any task, venture, or enterprise designed to ensure the welfare and well-being of the residents of the ward.
- Planning and coordinating activities of and rendering assistance and advise to the residents of the Ward engaged in any activity or industry
- Formulating and submitting to the urban authority, proposals for the making of by-laws in relation to the affairs of the ward and
- Monitoring and coordinating the activities of the Subwards (Mitaa), within the ward.

As regards resolution of disputes it is not, however, known why the Subward leaders did not refer the cases which have not been resolved to the Tribunal or whether there are other cases or disputes related to WSS, which have been resolved by the Tribunal. Evidence from the

discussions with the Subward leaders and Water Committee members gives an impression that there is a weak institutional link between the Ward level structures and Subward (Mtaa) level authorities. As a result, the contribution of the Ward level institutions in the WSS activities in Tungi has been little, and at most advisory. The latter refers to, for instance, few cases where the Subward leaders contacted the Ward in order to get advise of the community health worker stationed at the Ward on matters related to public health threats arising from poor location of wells or upkeep of water supply sources.

- ***The Tungi Subward Executive Committee***

Subward Executive Committee is elected by residents and comprises six persons including the Subward leader as the chairperson. The functions of the Committee are, however, largely advisory. Among functions which may have a bearing on this the focus of study include:

- Implementing policies of the Municipal council,
- Advising the Ward Development Committee (WDC) on matters related to peace and security in the Subward,
- Advising the Municipal Council on matters relating to development plans and activities of the Mtaa and to do any other things as may be conferred upon it by the WDC.

According to Subward leaders, Tungi Subward like most other Subwards in the city is ill equipped to undertake own development initiatives, or even implement policies of the Council. Subward leaders noted that they do not have manpower resources to enforce by laws. They even lack stationery for routine functions in their office. In this case, it can hardly function as an advisory organ of the council, let alone improve WSS services. Upon being asked how much of the revenues collected last year from Tungi were remitted to the area, the Subward leaders said they did not receive any cash from the Municipality and expressed reservations that they were not even aware of how much the Municipality had collected from property taxes and licences.

At present Subward leaders are not playing any significant role in regulating decisions, which are made by private individuals on WSS. Subsequently, in so far as privately promoted WSS services are concerned, there has not been significant influence. But in the case of the recently completed WaterAid project residents played an active role in many decision-making processes made before and during implementation. In other WSS improvement initiatives, individual households have largely made decisions. As a result, decisions and actions in WSS have been disjointed, individualistic and without public surveillance.

This has translated into spontaneity tendencies in WSS improvement, operation and maintenance and overall low quality of WSS services provided by particularly individuals. This is primarily because most private actors who are keen to optimise personal gains or profits, are meeting little or no control or resistance from the community even though the ensuing environmental is detrimental to the welfare and socio-economic development of almost all settlers. In view of the evidence adduced, the costs that emerge from unregulated or ungoverned WSS provision cannot be over-emphasized. It would be a serious mistake to consider a private sector contribution in WSS a solution to the severe WSS deficits arising from public capacity deficits unless there are mechanisms to regulate it. There is no doubt that private individuals have played a commendable role in improving water supply. But disregard of, for instance water quality tests or considerations for siting of wells with regard to the location of existing pit latrines and other land uses, may generate public health problems thus defeating the prospects of improving water supply through individual household based initiatives. To this, one may add the weak position and role civil society is occupying and playing in the WSS development initiatives. If the positioning and role of residents would be changed from that of users to that of partners, they will be in a position to influence and regulate WSS decisions and

actions. Subward leaders roles are equally diluted, this is evidenced by the attitudes displayed by them vis-à-vis apathy. Even in situations where repeated appeals and orders have been issued, at the same time public health is being threatened.

- **Socio-economic and cultural values attached to water**
- ***Concept and traditions that water as a public good***

The Water Utilization (Control and Regulation) Act No.42, of 1974 vests in the United Republic of Tanzania (URT), that all water-flowing over the surface of the ground or contained or flowing in or from spring or stream or natural lake, swamp or beneath a water course is public. The main objective of vesting water in the URT is to ensure that it remains a public good to which everybody should have a right of access. The Act is therefore in tune with the United Nations Committee on Economic and Cultural and Social Rights declaration (2002) that recognises water not merely as an economic good but also a human right to which everyone is entitled-sufficient affordable, physically accessible, safe and acceptable for personal and domestic use. However, because of the costs involved in abstraction, it has an economic value, which has to be paid for. In this regard there is an increasing relationship between accessibility and ability or willingness to pay water services. In Tungi, it is a common knowledge that all water consumed except from shallow wells is or has to be paid for. The least a consumer ought to pay should be able to cover operational and maintenance costs.

- **Gender-related perceptions and values of water**

In Tungi like in other peri-urban communities, searching for and fetching water are some of the prime responsibilities of women. In fact even amongst children, it is largely understood and expected that girls and not boys have the responsibility to assist their mothers to fetch water. This is the situation even in cases where one has to pay for water. In such situations, women face a double challenge not only of assigning themselves time for fetching water, but also of meeting the costs from the little income available for households' needs. Narrating some of the incidences, a woman interviewed during the focus group discussions noted that in the past some women have been forced to place their clothes (khanga) in pawn because they could not pay for their water needs. As regards women's role in fetching water, an elderly lady asserted that fetching water is considered a feminine work. She noted that in most tribes when a man is seen fetching water it is not only embarrassing to himself but a shame to his wife and family.

One of the main visible features of WSS in Tungi is that, most of the entrepreneurial activities, which depend on water, are significantly undertaken by women. Subsequently, water shortages, unaffordable prices, or unsafe supplies hit women most. Lack of public regulatory frameworks which would check quality and improve access to water not only exacerbate hardships to which women are culturally bound but undermines socio-economic development of households as a whole.

- **Economic values attached to water**

Although water is largely considered a social asset that has to be more or less freely accessible to everybody, persistent shortage, and long history of water vending in Tungi, buying and selling of water has become a common practice that hardly catches any resident's attention. Over the last two decades the number of borehole and deep well owners and vendors increased continuously (Table11). In discussions with water committee members and Subward leaders it was observed that, every body is aware of and used to buying water. Free access to water is unexpected. Paying for water is therefore a matter of fact to everyday life in Tungi.

The Subward leaders say that the community managed water supply project is not managed on a profit. The charges levied were only intended to cover operational and maintenance costs.

They added that the community was educated on this fact and did agree to bear the responsibility for the day-to-day operation of the water supply system. They therefore noted that overall there are no complaints about the TShs.10/= charged per bucket.

Water is one of the sources of income for many in Tungi. There are some households, which are making good business, some own two wells, at the same time, and some vendors own two or more pushcarts or bicycles. Water is playing and having a direct socio-economic significance to households in Tungi as it is directly influencing production and overall well-being. Of the 50 households interviewed 39 (78%) reported that they depend on water for their livelihoods. The following excerpt support the foregoing:

" I came here because my farther got sick. I had no job; I decided to engage in water vending. I am getting enough to take care of the family including my farther, step mother and my two brothers and sisters"[28]

- **Cultural (or religious) values attached to water**

Availability of water was said to be one of the main causes for the settlement growth. Elderly settlers reported that before water was made available, very few people moved or even had interest in settling in Tungi. Water has had cultural significance also. Some of the important cultural and religious values held about water are vividly captured in the following quote:

"I am now over fifty; when I was a boy I saw women fetching water from these wells. The owners of the wells did not charge anything, because the cultural norms in the society had it that if one offers free water to other people, he will be spiritually rewarded: This is what the elders believed in[29]*"*

Water is also seen as a source of life and a symbol of friendliness and cordiality. This is depicted in the remarks made by an elderly respondent:

"You cannot afford to miss water in a house where people live. This is something you cannot deny one because it is a symbol of life. If you cannot offer a guest anything, water is the last thing one should not fail to offer. When a guest want to show his or her host's lack of hospitality he will say he/she did not give me even a glass of water[30]*"*.

These views find position in most communities in Tanzania, both in rural and urban areas.

Social and political conflicts around WSS

- **Ongoing or potential conflicts**

- Access to the services

The type and level of WSS services accessed by Tungi residents over the last decades have mainly reflected on individual ability to pay. In the case of water, those who are better off have accessed water from boreholes and deep wells for general domestic purposes and from vendors for drinking; few have afforded to buy water from vendors for cooking also. Few inhabitants, who are too poor and cannot afford to pay for water at all, are currently getting water free of charge. That access to and quality of water services depict ones ability to pay does not seem to present a problem. However, this cannot be ruled-out in the future if the number of

[28] Discussions with Mr. Marwa on 6th February 2004 at Tungi.
[29] Discussions with Mzee Athmani Hassan Makupula, a member of Subward and Executive committee in Tungi on 5th February 2004.
[30] Discussions with Mama Mitambo on 7th February 2004 at Tungi.

those who cannot afford to pay at least TShs 10/= rises. On the other hand, if the quality of the water from the boreholes or wells, especially salinity, particularly from the networked system increases, this will precipitate discontents because the number of those who cannot afford other option but have to continue using poor quality water services will increase.

- Weak or lack of regulatory framework

Residents repeatedly complained that they do not have a say on the management of the water services provided by private individuals, even on pertinent matters such as opening and closing hours or water pricing. There were also complaints that because during dry season, water levels in the wells and boreholes fall, some borehole proprietors close their business without consulting or informing their customers, ostensibly because they do not make a good profit. Besides, some of them expressed their dissatisfactions that most boreholes and well owners do not assist women to pump water from manual boreholes or wells. In addition, they complained that equal prices are charged for water from manual pumps and electric motor wells, which was seen as unfair. Two potential conflicts are worthy noting here, one relation to who is responsible for regulating the private actors in WSS and who gets the best out of the present WSS system. Water services are key factors which shape the social and economic development of urban areas, especially among the poor. It is therefore crucial that the roles and activities of private actors in WSS are regulated by the public sector and, this is particularly necessary in cases or settlements predominantly occupied by the poor such as Tungi.

The question of lack of or very poor user protection repeatedly surfaced during the fieldwork studies. Many inhabitants complained that there were no mechanisms or regulations, which compel well or borehole proprietors to test the quality of water before they sell to customers or carry out routine cleaning. Respondents also complained about public health problems which arise from 'unregulated' locating of wells vis-à-vis other land use or activities on-going on the plots. At present, the problems could be tolerated, but as housing densities are growing fast the situation will soon become more fluid and thus more difficult to manage. From the foregoing, it is clear that the realities revealed in Tungi underlines the gap in policy including lack of regulatory framework that exists in WSS provision in peri-urban informal settlements

- **Community and civil-society forms in WSS**

Except for the WaterAid supported project the role of the community and civil society in the WSS governance in Tungi has been overall weak. The WaterAid supported water improvement project was initiated by the community through their Subward committee or leaders. The community elected water committee members represent them in the project. These worked closely with the WaterAid personnel, and participated in key decision making stages and processes including mobilisation of residents and identification of sites for water kiosks. They also conducted negotiations with landowners to donate land where the 13 kiosks were erected. Emphasising the role played by the community in the organisation and implementation of the water improvement project, water committee members observed during the FGD that because of the severe water problems Tungi residents have been experiencing, many come forward to support the project and willingly contributed cash, whilst others volunteered their labour. The decision to charge users a nominal fee was also deliberated and agreed upon by the Tungi Assembly.

The Subward leaders and water committee chairperson dismissed the allegations made by some respondents that water kiosks are erected close to houses occupied by the Subward or Water Committee members, noting that all matters concerning locating water points were settled during the Subward Assembly. During the meetings, sites which had been identified,

were made public for the members to give their views. In order to avoid complaints, location of the water points was based on the catchment's population. Municipal and WaterAid officials were also involved in all the decision-making processes. It was not therefore the water or ward committee decision alone[31]". By and large the WaterAid funded project seems to have been executed in a transparent and participatory manner. These seem to be the factors, which continue to sustain smooth operation and maintenance of the networked system by the community water committee.

Quality of the services

The quality of WSS services provided was considered satisfactory by most informants. Whilst most residents have struggled to meet their needs for WSS services, the local government and ward authorities have done little to provide for a mechanism to institute public surveillance system. This is necessary in order to check imminent threat to safety and public health arising from contamination or pollution of (particularly) water supply sources. Such deficits on the part of the government adversely affect the quality of service.

So far, the Subward leaders seem to be unable to resolve disputes particularly those associated with the contamination of water wells. Conclusion from FGD and reflection on the data collected lead one to believe that the Municipal Council and grass-root institutions at Subward level are presently ill-quipped and have no capacity to regulate or influence individual households decisions on WSS and associated problems. This is a major challenge, which will have to be addressed in the future.

Management of services

There are positive and negative experiences, which are associated with the private actor domination in the WSS services. In Tungi, private actors have played a leading role in improving access to potable water supply and sanitation. Privately funded deep (manual) wells and boreholes increased from about 10 (excluding traditional) in the early 1990s to about 123 in 2003, remarkably increasing access to water. One of the issues, which constantly struck us, is a glaring lack of participatory organs, which can bring together the private, and community service suppliers so as to enhance the quality of WSS provided.

One more important issue to observe in relation to the management of WSS in Tungi, concerns the privatisation of the management. When the idea to privatise operations and maintenance of the three boreholes which were built by the City Council but with financial resources donated by the Lions Club, was mooted in the mid 1980s following poor performance, there was resistance, because many residents felt it was improper to privatise and require people to pay for water services while costs for boreholes and equipment were fully paid for by a donor. However, after extensive deliberations, a decision to engage a private individual to operate and maintain the borehole was adopted. This served the three boreholes from collapse. Asked whether there are plans to privatise the management of the 13 public kiosks erected under the WaterAid supported project, the Subward leader noted with disapproval: "It is too early to talk about privatising operation and maintenance of the WaterAid supported project. The performance by the water committee so far is excellent[32]"

It is necessary to point out that one of the advantages of putting the management services such as water under community committee management and control is that the actual users of the service participate in decision-making and develop a sense of ownership. But, unless there are

[31] Subward Assembly comprise all adult residents of Tungi
[32] Discussion with Subward leaders on 9th February 2004

effective institutions to closely monitor and ensure accountability among the community members who are entrusted by the community to manage the service on its behalf, it will be difficult to guarantee sustainability. This is an issue the Subward committee has to reflect upon.

- **Conflict forms (actions)**

The major conflicts in WSS in Tungi are listed below:

- Public (community) nuisance

In Tungi, undesirable decisions and actions on WSS by some households are already putting stress on the wider community because of the ensuing health threats. In the absence of strong government intervention or framework to regulate decisions by and actions of private individuals, conflicts which are associated with WSS, especially water supply have taken the form of squabbles between neighbours because of locating wells or borewells too close to pit latrines or conflicting land uses which may lead to the contamination of water. Even though these squabbles have not given rise to open conflicts, as housing densities increase conflicts are likely to emerge.

- ***Customers defection***

The introduction of electric motor operated pumps has by and large eliminated the hard work or drill to which women who came to fetch water were subjected, and many have shifted to the boreholes or wells with electric pumps. As a result, private suppliers who are still operating with manual pumps are aggrieved because they have lost customers. This has in turn created uneasy relationship particularly between them and those using electric motor pumps.

- ***Quality of WSS services vs. institutionalisation and housing densification***

Although most respondents consider the quality of service provided satisfactory, there are neither water quality control standards that are enforced nor an institution monitoring or observing the service delivery include setting of abstraction conditions. Attempts by Subward leaders to intervene seem to have no effect. The water market in Tungi is free and unregulated. Free in the sense that one can get in and out without restrictions, and at the same time, activities of private suppliers are not institutionalised. Non-institutionalisation of private actors is one of the factors which undermine the quality of service delivered by WSS.

Owing to changes of land use from farming uses to residential and increasing housing densities, the present WSS systems will not be able to cope with the population demand or guarantee public health. Some of the potential public health problems could be overcome if there are pro-active strategies to regulate individual decisions and actions on WSS as house construction activities in Tungi.

- Water prices, the poor and affordability

At present WSS service agents are free to determine prices and business environments. There are however, many households, which cannot afford the current prices charged under the community managed water supply system or by private water sellers. Unaffordable prices may be deterrent to the poor to achieve desirable levels of health and hygiene. This may particularly be the situation if costs for water services have to be paid up front.

It would be wrong to assume that access to WSS, in particular safe water, can be achieved without cost. The demand to cover at least operational and maintenance costs arises from the desire to ensure sustained service delivery, and this makes payment for water services obvious or else the service delivery will cease to operate. Many households interviewed and observations made by community leaders lead to the conclusion that most residents are willing

to pay for improved water services. But some reported that the present charges were too high and unaffordable. As noted earlier, women are affected most by unaffordable prices. To what extent the prices charged by the private suppliers or community-managed system can be lowered is debatable. From the discussions with the Subward leaders and water committee, however, it was clear that the TShs.10/= currently charged by the community was arbitrarily set. Indeed the key consideration was to charge a price below what the private water supplier were charging. As noted earlier review of the prices is an issue, which *inter alia* requires a policy intervention, regulatory framework, and collaboration between the private and community water services suppliers.

2.3 Key emerging issues in Tungi

2.3.1 Introduction

The discussions presented in the case study profile including issues raised by the various stakeholders involved in WSS in Tungi provide useful references towards identification of the potentials and constraints of the current WSS systems. Most importantly, they offer inferences about critical areas and requirements for a regulatory framework.

As noted, water supply in Tungi like many other peri-urban low-income settlements constitutes a critical link in the livelihoods of the poor. Social and economic well being of most settlers hinges on the availability and access to potable water. An affordable and safe water supply source facilitates income and employment generation and provides important inputs into poverty alleviation in peri-urban low poor communities. The vulnerability to and viscous circle of poverty to which many peri-urban poor households are subjected can be broken or reversed if the quality of the WSS services provided are improved significantly.

Privately managed WSS services comprise a variety of systems, including shallow wells, deep wells and boreholes Vendors who supply water using bicycles and pushcarts are also playing active role in water supply. As regards sanitation, area predominantly served by traditional pit latrines, very few all households most are do not have own latrines.

Except for the recently inaugurated WaterAid supported supply there is no public sector involvement or control in the privately managed WSS modes. Attempts by the local government institutions namely the Subward to intervene have largely been futile. In the following sections key challenges and opportunities in WSS sector in Tungi are outlined.

2.3.2 Challenges

Analysis of the challenges surrounding the WSS services revealed five main issues of concern, that is problems emanating from location and depth of the wells, contamination, volume of water extracted, quality of water supplied, and land use conflicts including activities ongoing around water sources.

- **Location aspects**

Most households have located their wells on the front part of the house so as to make them (easily) accessible to customers. In this regard, households do not seem to have given much regard to other factors such as distance to the house, at latrines or public access system. Many wells and boreholes were less than two metres from the house or roads. Some of the wells were hardly a foot from the house giving rise to possible contamination. Problems arising from

unregulated or haphazard siting of wells and boreholes are worsened as a result of increasing housing densification.

- **Depth of wells**

Generally soils in Tungi have high composition of clay, making them fairly impermeable (Table 1). However, as housing densities increase and owing to the predominance of pit latrines, contamination of ground water sources is likely to occur, particularly in areas where clay contents in the soil is low. On the other hand, because some shallow wells were hardly two metres deep and unlined, chances of contamination from traditional pit latrines are high. This is particularly a problem in Bondeni area, an area where water table was reported to be high.

- **Contamination of during transportation**

Water vendors are responsible for maintaining water facilities including plastic buckets, which are used to transport and distribute water to customers. There are no restrictions or monitoring system to ensure routine cleaning and proper upkeep of the buckets. Types and condition of buckets, which can be used for supplying drinking water, are also not monitored. Some vendors store water in their houses if they are unable to sell it. This could give rise to the contamination of water, particularly in crowded households. This could be a serious problem because most residents do not boil the water before drinking.

- **Activities close to or around the source**

Like in other unplanned settlements, land use development activities in Tungi are unregulated or uncontrolled. There is a general lack of concern or insensitivity among most municipal authorities on land use development in informal settlements. This manifests itself in the widespread land use conflicts and blatant existence of incompatible land uses, such as animal sheds or pit latrines close to wells.

There were also several incidences where washing and cleaning activities were taking place around water sources – including open water wells. Yet because some wells were either not covered, or very loosely covered using light materials such as Corrugated Iron Sheets (CIS), there was no guarantee that such sources are adequately protected.

- **Quality of water supplied**

Apart from the water supplied by vendors who use pushcarts and bicycles, supplies from all other sources were said to be somewhat saline. However, most respondents said that water from boreholes and wells is satisfactory for most domestic needs.

As regards upkeep of wells and boreholes, respondents said that such matters were solely the responsibility of the proprietors not the water buyers. On the other hand, because groundwater yields from wells declines during dry season, some wells and boreholes proprietors discontinue water-vending business claiming that it is unprofitable to continue operating. Decision about this is made again without involving the users who as a result suffer due to inconvenient water services.

- **Volume of water extracted**

The Water Utilisation (Control and Regulation) Act. No.42 of 1974, amended in 1997 among other things, sets a limit of 22,700 litres as the amount of water that can be extracted from a well or a borehole per day. However, according the Subward leaders, the 20,000 litre tank built by WaterAid has to be filled twice a day litres tank to ensure adequate supply,. This implies that around 40,000 litres of water are extracted per day. This is far beyond the limits set by the

Water Utilisation Act. The amount of water extracted from the boreholes at *Kwa Msomali,* the main source of freshwater, is unknown. But considering the fact that this source is also used for industrial purpose it would not be a surprise if the extraction exceeds 40,000 litres per day. None of the respondents interviewed in Tungi were aware of the provisions and restrictions stipulated in the Water Policy (2002) or the Water Utilisation Act of 1974. Unawareness among users and water vendors alike about the contents of the Policy and the Act makes the two dormant and ineffective regulatory instruments.

2.3.3 The Opportunities or potentials of regulatory framework

- **National level**

The Water Utilisation (Control and Regulation) Act is the main instrument for regulating the utilisation, protection and conservation of water in the country. However, because it is ineffective, the privately provided WSS services in Tungi like in most other low income peri-urban areas are to date unregulated and disorganised. The Act has not been operationalised at the lower levels where problems and impacts of lack of regulatory tools are most felt. Some of the implications of lack of or poor enforcement of the Policy and the Act is the proliferation of wells and boreholes without regard to critical issues such as possible contamination and land use conflicts.

On the other hand, prices for water supplied by some vendors are inflated because of lack of a regulatory framework. For instance, private boreholes and deep wells proprietors are selling water at TShs.20/= per bucket whereas others, including the networked community managed system are selling at TShs.10/= per 20 litre bucket. Wide price variations, without significant quality differences, at best depict the general state of lawlessness in the WSS services provision.

- **Municipal level**

Lack of a regulatory strategy on WSS services to guide private actors in informal settlements is a gap emanating from failure to translate and operationalise the Water Utilisation Act at municipal level. The focus of most municipal authorities seems to be on the promotion and monitoring of conventional WSS systems in the formal or planned areas. There is hardly any systematic monitoring of the water abstracted from ground sources by private individuals. Overall policies and laws in WSS are not enforced. It would appear that policy and legislation on WSS at national level are detached from implementation mechanisms at municipal level and local community level.

- **Community level**

As a response to the lack of governance and regulatory framework, grassroots actors viz. Subward leaders are trying to fill the gap through ad hoc interventions in situations where public health is at stake threatened or where land development conflicts have emerged. These initiatives however, have had little or no impact at all, largely because many a time wrongdoers ignore appeals and orders from Subward leaders or community health committees. For instance, efforts by the community health committee or workers to promote public health through regular inspection of sanitation facilities and issuance of orders requiring landlords to empty filled-up toilets or dig new ones have overall received little or no attention. In some incidences health committee members have been denied access to private plots making inspection difficult. Subward leaders are weak and unable to take action or impose fines on wrongdoers because there are no By-laws for WSS services at community level.

That there are administrative structures, which are ready and attempting to check undesirable actions of private actors even without a formally sanctioned regulatory framework or By laws,

represent an opportunity that can to be consolidated. The Water Utilisation Act (1974 amended in 1997) and the Water Policy (2002) also present other opportunities, which can constitute a base for formulating a regulatory instrument.

In view of the actors and processes involved in WSS observed in Tungi, effective deployment of these instruments will depend on a collective approach and participation of the numerous actors involved in the WSS services provision. Among the key actors are the residents, associations at municipal level, the local leaders and their committees. Lack of or weak collaboration between formal actors (WaterAid networked system) and informal actors (privately developed WSS systems) was repeatedly observed in the study area. This is also an issue which require attention.

2.4 Conclusion

Tungi is one of the rapidly growing PUI informal (unplanned) settlements in the metropolitan Dar es Salaam, this is manifested in its housing densification in the built-up areas and many new houses being built in the outlying flood prone areas in the South and East.

In general, WSS in Tungi has four main characteristics. Firstly, apart from the recently completed networked water supply funded and constructed by the Water Aid, the rest of the WSS services are provided and funded by private individuals. In total they are 135 boreholes and wells. Of this, 12 are traditional shallow wells used for washing, cleaning, animal feed, gardening, and rarely for domestic use by very few poor households. Secondly all the water consumed in Tungi is from ground sources. With exception of few very poor households (hardly 15), most of them pay for the water they consume. Prices for water vary between Tshs.5 and Tshs.20/= per bucket depending on the source and suppliers. Drinking water which is supplied by water vendors who use bicycles and push carts is sold at between Tshs.100/= and Tshs.150/= per bucket. Apart from commercialisation, another important feature of water in Tungi is that it is one of the main sources of livelihoods. It supports income and employment generation pursuits such as local brewing, batik making, food vending, gardening and construction activities. Fourthly, traditional pit latrines are the most common sanitation facility. Whilst private individuals have played and will continue to play an indispensable role in the WSS services provision in Tungi and other PUI areas, the present system does not guarantee responsible use of natural resources or promote equality in terms of access to WSS services. Besides, it does not enhance service efficiency. As a result, overall WSS services provided in Tungi are poor giving rise numerous public health concerns, environmental problems not to mention adverse effects on the livelihoods particularly among the poor. Lack of mechanism to regulate private WSS providers coupled with lack of or weak enforcement of the existing policies and legislation are some of the contributing factors. Due to the increasing competition on land for housing and escalating urban poverty, the quality of WSS services provided by particularly private individuals is likely to deteriorate further. This is mainly because increased demand for land is giving rise to excessive housing densification, land use conflicts including inappropriate locating of wells, pit latrines and houses on residential plots. Apathy or delays on the part of the Municipal Council to put in place mechanisms to check informal land subdivision, and housing construction is accentuating the problems. In view of the vital role WSS plays in socio-economic development of a society and country in general and the increasing pressure on WSS services in Tungi like many other the PUI of metropolitan Dar es Salaam one need not over emphasize how important it is to taken concerted efforts to mitigate imminent crisis.

In the following section, WSS services in the second case study areas, namely Sitakishari are examined using a similar presentation format.

3. THE CASE OF SITAKISHARI

3.1 Profile of the Peri-urban Locality

3.1.1 Introduction and justification of the peri-urban case study

- **Hierarchy, location and role of the peri-urban area**

The metropolitan region of Dar es Salaam is constituted by the three municipalities of Ilala, Kinondoni and Temeke. There are a total of 72 wards in the metropolitan region. Sitakishari is located in Kipawa ward. Kipawa ward comprises four subwards (Mitaa) of Kipunguni, Kipawa, Mogo and Karakata. Sitakishari settlement is part of Mogo subward. The settlement is located along Pugu road about 10 kilometres from the city centre of Dar es Salaam (Map 3.1). Sitakishari is bordered by Karakata to the east, Majumba Sita to the south, Ukonga to the west and Msimbazi valley to the northern part (Map 3.2). The settlement is characterised by rapid changes in terms of housing densification and changing patterns of livelihoods. A part of Sitakishari comprises the Msimbazi Valley. According to information available in the sub-ward office, the population of Mogo is 23,000. Out of this, 11,000 people (48%) live in Stakishari. In terms of geographical coverage, Sitakishari covers 100 hectares, which is almost half of the Mogo sub ward area. This gives a gross population density of 110 persons per hectare. Houses count from 2002 aerial photographs registered a total of 742 houses. This gives an average housing density of approximately one house per hectare.

Despite being a part of the peri-urban area of Dar es Salaam, the majority (75%) of the settlement is occupied by housing, located on fairly large plots, i.e. most of them being more than 1500 square metres. The current spatial growth of Sitakishari settlement proceeds in two directions. First is the expansion southward towards Kitunda and westwards towards Kinyerezi. Second is growth towards North along Msimbazi valley. The growth towards Msimbazi Valley is undesirable because housing construction is taking place in the low-lying areas of the valley, which floods during rainy seasons. The highest concentration of houses is found along the Pugu road, housing density decreases southwards.

The main access to Sitakishari settlement is the Pugu road. Inner clusters are accessable by minor roads that terminate at Ukonga Majumba Sita. Two minor roads cross the settlement one leads to Segerea and the other to Kinyerezi. A number of buses ply between Ukonga and Kinyerezi road via Sitakishari. The settlement is closer to a number of key development areas such as the Dar es Salaam International Airport, Ukonga Prison, Segerea Mission, the privatised National Milling Kiln along Pugu road and the metrological station. A number of former employees of these institutions have settled in Sitakishari. The settlement is also closer to the commercial centre at Ukonga Majumba Sita where shopping facilities including, restaurants, filling station, bus station and a dispensary are located.

There are many houses that are under construction, and these are being constructed by both high and low income people. The settlement is largely characterised by low-density housing with densely built housing along the railway and Pugu road. Sitakishari is therefore an area, which still depicts several qualities of a peri-urban settlement.

3.1.2 Demo – geographic, socio-economic, and physical characteristics

According to the national population census of 2002, Kipawa ward had a total population of 49,456 people and Mogo subward had a total of 30,000 people. Like most other areas of the city the indigenous people of Sitakishari are believed to be the Wazaramo. However, with the advent of informal land markets, coupled with increased demands for residential land, most of them subdivided and sold their land to immigrants and migrated further to the peri-urban areas. Most of the displacees from Stakishari were reported to have moved to settle on the outlying village such as Chanika, others moved to Kisarawe. The population growth trend by gender composition in Kipawa Ward is summarised in Table16.

Table 16: Population growth trends in Kipawa Ward (1978-2002)

Year	*Population*			*Number of Households*	*Average size*	*Growth Rate*	
	Male	*Female*	*Total*			*1978/88*	*1988/2002*
1978	8,368	7,909	16,277	-			
1988	19,637	17,355	36,992	9,282	3.9	6.9%	2.1%
2002	24,851	24,605	49,456	11,233	4.4		

Source: Dar es Salaam Statistical Abstract (1993), Census Report (2002).

It is apparent from Table 16 that there was a remarkable increase in population within Kipawa ward between the two inter-censal periods 1978-1988 and 1988 and 2002. Between 1978 and 1988 the growth was fairly high i.e. 6.9% per annum, but this slowed down to 2.1% per annum between 1988 and 2002. The slow growth rate could be linked to a decreased availability of land for selling. Large tracks of land especially in the northern part of Sitakishari is owned by the first generation of land buyers and settlers. These include retired civil servants and army officials.

- **Development patterns**

The Sitakishari settlement started in early 1960s as a farmland for paddy cultivation. Intensification of the land market and the displacement of the Wazaramo became more apparent starting in the 1970s. It was during this period that most indigenous people sold their farms. As a result of increased densification and informal land subdivision and market transactions, land prices increased from TShs 5,000 to TShs 1,000,000 for plot sizes ranging between 300-400m^2 in the 1980s and 2003, respectively. Although housing consolidating started in 1980s, there are still many large plots, which are under farming activities such as vegetable cultivation, and use for outdoor activities. According to the physical surveys carried in the settlement in February 2004, out of 50 plots inspected, there were 6 high density plots measuring between 100 to 400 square metres and many measuring more than 1500 square metres (Table 17). Therefore, overall, the spatial and demographic character of Sitakishari depicts a settlement, which is in transition from infancy to consolidation[33].

[33] The growth characteristics of informal settlements goes through three main steps, infancy, consolidation and saturation.

Table 17: Distribution of plot sizes in Sitakishari settlement

Plot size (M^2)	Number of Plots	% of Total Plots	Remarks
100-400	6	12	Equivalent to high density plots
401-800	17	34	Equivalent to medium density plots
801-1200	6	12	Equivalent to low density plots
1200-1500	-	-	
Above 1500	21	42	
Total	50	100	

Source: Field studies in Sitakishari settlement, September 2003

It is notable from Table 17 that even though Sitakishari is rapidly consolidating land use, the plot sizes are still big. This phenomenon that characterises many of the settlements in the peri-urban interface of Dar es Salaam. An examination of the housing consolidation trend, through a count of houses from a series of aerial photographs, revealed that by 1975, there were about 96 houses. This number increased to 186 houses in 1982, and 292 houses in 1992. A house count based on the 2002 aerial photographs registered a total of 742 houses, i.e. more than double the 1992 figure. Gross housing densities increased from 2 houses per hectare in 1982 to 7 houses per hectare in 2002.

Table 18: Housing densification in Sitakishari (1975-2003)

SN	Year	Number of houses[34]	Number of houses per hectare
1.	1975	96	1
2.	1982	186	2
3.	1992	292	3
4.	2002	742	7

Source: House count Aerial Photographs 1975, 1982, 1992 and 2002.

The spatial growth of Sitakishari settlement towards the north in the late 1970s seems to have been restrained by the Msimbazi valley, but in the recent years the the valley has been increasingly encroached.

Several property owners have taken initiatives to survey their plots. Out of 50 respondent, 24 said they had surveyed their plots, 21 had not, and 5 respondents could not reveal the status of their plots. Most people surveyed their plots in order to acquire titles and improve the security of tenure.

- **Socio-economic trends**

Household economy, livelihood, income and commodity

Household livelihood activities include petty trading, urban farming, poultry and livestock keeping. There are also residents who are employed in the private and public offices in the city. Within individual plots, dominant activities include poultry keeping and piggery, vegetable gardening and dairy farming. Trends in livelihood activities also reveal changes over time from typical agricultural to small scale gardening, livestock keeping, small businesses such as shops, kiosks, restaurants and other petty business undertakings. The distribution of economic activities is as summarised in Table 19.

[34] Approximate number of houses counted from aerial photographs of 1975, 1982, 1992 and 2002.

Table 19: Household economic and livelihood activities

Category of economic activity	*Number of Household*	*% Age of Total*	Remarks
Petty trading	3	7	This includes kiosks, charcoal selling, food vending, selling of used clothes, selling of water
Self employed	16	38	Carpentry, tailoring, salon, brick layers, garaging, gardeners, masons, dying of clothes
Civil servants	11	26	Nurses, teachers, policeman, prison officers and soldiers
Employed in private sector	6	14	Drivers, Bar maids, housemaids, employed by NGOs
Unemployed	4	5	Housewives, primary and secondary school children
Others	2	5	
TOTAL	42	100	

Source: Household interviews, September 2003

Like in Tungi, majority of the residents are self-employed. There are also many artisans who are engaged as masons, carpenters, tailors, bricklayers and fitter mechanics. Because of the low income earned from these activities, most of them are operated by low-income households. Daily expenditure patterns in Stakishari area are as outlined in Table 20.

Table 20: Daily expenditure pattern of households in Sitakishari

Expenditure per day in TShs.	Number of Households	% of Total Households	Remarks
100-1000	-		Below US$ 1
1001-2000	2	4	
2001-3000	5	10	
3001-4000	6	12	
4001-5000	6	12	
5001-6000	10	20	
6001-7000	5	10	
7001-8000	1	2	
8001-9000	4	8	
9001-10,000	1	2	
Above 10,000	10	20	
Total	50	100	

Source: Household interviews in Sitakishari, September 2003

Ten households out of 50 said they spend between TShs 5000 to TShs 6000 (US$5 to 6) per day. Given the average household size of 4.4 people, the expenditure per capita per day is about TShs 1136 or approximately 1 US$. As indicated in Table 20, more than half of all households have per capita expenditure of just about one US$ per day.

Some house owners rent rooms so as to increase household income. Out of the 50 interviewed households, 36 (72%) were occupied by house owners and tenants. Although house owners-tenant ratio in this settlement is low when compared to inner city informal settlements in Dar es

Salaam, it is noteworthy that some owners use houses as an important source of household income. Notably, this has an implication on the density and demand for water and sanitation services.

According to the household interviews, out of the 50 households, 20 had formal employment, 25 were engaged in informal livelihood activities, and 3 were involved in both formal and informal activities. Categorisation of the employment sector into formal and informal categories may give an indication of poor households, assuming that informal livelihood activities indicate poverty. However, it is wholly justifiable to conclude that all households engaged in informal sector activities are poor. In fact, many households engaged in informal sector activities are in some instances better off than those earning the minimum wage in the formal employment sector. The advantage of the formal activities is the guaranteed nature of the secured income and the possibility of mixing both formal and informal sources of income. Despite the fact that many households in Sitakishari carry out at least one livelihood activity such as livestock keeping and gardening, sale of water, and food and vegetable vending, many households cannot meet a number of the basic necessities of life.

Figure 3: Gardening is one of the main livelihood activities in Sitakishari.
Above is a lot of amaranth

Two types of gardening take place in Sitakishari. Small subsistence gardening takes place within individual plots, and this is the case among households with relatively larger plots. People of all income levels (the rich and poor) are involved in the subsistence gardening. The second type of subsistent gardening is the medium scale gardening that takes place along Msimbazi valley. According to the interviews and discussions with households living close to the valley, most of the people involved in medium scale gardening are low-income earners. A retired officer living closer to Msimbazi valley said:

"hakuna mtu hata mmoja mwenye uwezo analima kule bondeni; wote ni watu ambao tunaweza kusema ni wa kipato cha chini." meaning: "*there is no high income people who cultivates in the valle; all are low income earners".*

Another resident revealed that cultivation of '*mchicha*' is mostly done by women. Mr. Twijo Mwasandende who also grows *'mchicha'* near the valley revealed that most of the gardeners are Wazaramo, most of whom are poor.

Even though there was no formal order to protect the Msimbazi valley until the early 1990's, the Msimbazi stream were protected communally by people living near and along the valley. Residents were forbidden to use the area for activities such as house construction, but in the recent years the pressure for residential development prevailed over these restrictions. Today there are many buildings built in the valley. The sub-ward leader observed that continued building development in Msimbazi valley is due to lack of a mandate among local community leaders to check or control land development.

- **Livelihood patterns, changes and their implication to poverty**

There is a notable change in livelihood pattern in Sitakishari settlement, characterised by a shift from rural farming practices that were practised by the indigenous Wazaramo to mixed rural and urban livelihood activities. This is evidenced by the presence of activities ranging from businesses such as shops, restaurants and petty trading activities, to salaried employment as well as rural oriented livelihood activities that include livestock keeping (i.e. poultry keeping, dairy cattle keeping, piggery) and urban farming, especially vegetable cultivation in the housing areas and along Msimbazi valley.

The displacement of the indigenous Wazaramo most of whom have opened new homesteads outside the city in the peri-urban areas, could have adverse impacts on their welfare. Data on the extent of potential loss in terms of livelihood activities among the Zaramo was not available in this study. It is nonetheless imperative to note that the further a household is dislocated from the influences of the city economy, the less are the potentials for economic gains in terms of access to employment and income accrued from both the formal and informal activities. Most rural households have low propensity to income generation activities due to limited market opportunities for the goods produced, poor infrastructure and limited marginal profits one can make from agricultural oriented produce.

On the other hand, households which bought off the indigenous Zaramo have gained in terms of acquisition of land for building and undertaking livelihood activities close to the city centre. For example, because of locational advantages a litre of milk in Sitakishari sells at Tshs.500/= (approximately US$ 0.5) while in the other areas the same sells at TShs 300-400 (approximately US$ 0.3-0.4). This trade-off in terms of who loses and who gains, however, needs to be taken cautiously if the economic advantages of livelihood opportunities in the rural setting versus those in the urban setting are to be understood. In one of the focused group discussions, one of the group members observed the following:

"Indigenous people are very much affected by land use changes as prices for vegetables and other rural related commodities are becoming very high much as larger parts of the land are being occupied by houses. As a result, the indigenous people are shifting to Kinyerezi and Chanika where such changes are yet to take place".[35]

This indicates that for indigenous households who are still living in Stakishari, living conditions are getting more difficult. Discussing the changing livelihood patterns and how people cope with such changes a member in a focussed group discussion observed:

"Changing of land uses from agriculture to residential has influenced livelihood opportunities. Opportunities have decreased apparently due to the diminishing agricultural land as a result of housing construction. In order to survive, people have been changing their livelihood activities

[35] Focused group discussion with Sylvester Lihonga, Emily Alfred, Cecilia Mwakabana, Anjelina Mathias, Agatha Likonga and Lucia Mathias of Sitakishari in September 2003

and most of them are getting engaging in activities such as carpentry, tailoring, petty trading, food selling, shoes shining, local brew selling and selling of cement blocks".

In view of the changed livelihood activities, some of the households have benefited because they have opted for better and more stable income generating activities. However, the majority of settlers are still engaged in activities that do not guarantee sustained incomes.

Another livelihood activity which a number of youths have been engaged in was water vending. This has particularly been the case from the 1990s up to the late 2003 when most settlers experienced severe shortages of water from DAWASA system. Construction of boreholes in 2003 has kept many of the water vendors out of the business. One water vendor was quoted saying:

"Before 2003, I used to sell up to 2000 litres and earning up to TShs.20,000/= per day. Nowadays I hardly sell 200 litres".
This implies that construction of boreholes has lead to loss of both jobs and incomes among water vendors. However, on the other hand this has increased supply of water and boosted establishment of water related income-generating activities such as livestock keeping and gardening. Water is also still being sold although by largely middle income settlers.

Livelihood versus environmental characteristics
As a result of increased human and livelihood activities there are notable changes in environmental setting in Sitakishari. One of the livelihood activities in the area is gardening in Msimbazi valley. Because of increased cultivation and use of water for irrigation, springs in Msimbazi valley are drying up. Tree felling around the spring sources and housing development in the valley accentuates drying up of the water sources. During focused group discussions the following observation was made:

"The large number of Sitakishari residents depend on urban agriculture, particularly gardening and livestock keeping that are mainly carried out in Msimbazi valley. Because of the competition in the utilisation of land as well as water, the springs in this valley have been affected. Unlike in the past when water was available all the year round, Water is now only available seasonally; hence people are forced to dig shallow wells in order to get water for irrigation. Besides, the springs that used to be public have been appropriated by one of the land owners"[36].

Animal keeping is another livelihood activity carried out by many residents in Sitakishari. However, wastes from cows and pigs are disposed of haphazardly, causing environmental pollution. During the rainy season, the wastes are washed away into Msimbazi valley polluting water sources, especially shallow wells. Figures from a three-month report from the Dispensary within Sitakishari area revealed that out of 271 patients, who were treated at the dispensary 180, were suffering from malaria while 16 were typhoid cases.

Physical observation and focused group discussions further indicate that construction of houses along the main drain leading into Msimbazi valley has led to blockage of the drain, leading to pools of water which are breading grounds for mosquitoes. Livestock keepers also direct waste from cattle sheds into this low-lying and flooding area. This leads to environmental pollution and

[36] Focused group discussion involving Suleiman Lolila, Rajabu Shemweta, Julieth Kianesh, Petronilla Milanzi, Fatuma Chande, Hatibu Mavura, Hamis Chande and Glorious Luoga, all residents of Sitakishari settlements, in September 2003.

public health threat to residents. In a focused group discussion, members of the group observed:

"Changing land uses and livelihood activities from agricultural to residential has affected most residents in the area. Livelihood opportunities have changed and at the same time spatial changes have led to environmental problems whereby natural water drains have been blocked and natural water sources disturbed. For example, while the Msimbazi river valley has always been the major source of water, in the past two years it has dried up due to increased construction activities and clearance of vegetation within the valley"[37].

- **Water related health problems**

An interview with the doctor of Prime Care Dispensary located in Sitakishari area also suggested that water from boreholes is not quite safe for drinking. Records from the dispensary on reported cases of various diseases show that Malaria is the most prevalent disease accounting for over one third of the cases. Water related diseases which include intestinal worm infection, diarrhoea, typhoid and dysentery account for about 35% of all reported cases as shown in Table 21. This raises a concern about the quality of domestic water that is used by residents. Although there were reports that water from DAWASA boreholes was tested before use, it could not be confirmed whether or not water from privately owned boreholes was also tested.

One of the concerns during interviews with residents and in focussed group discussions relate to the quality of water from private boreholes. Like in Tungi, many settlers consider water from the boreholes unsafe for drinking without treatment or boiling. The other problem concern to the closeness of the boreholes to the toilets in some cases they were very close, typically less than 5metres from boreholes. Because most households use traditional pit latrines, there are possibilities of borehole water being contaminated by wastes from the pit latrines. One resident noted during the interviews:

"Most people who use water from shallow wells suffer from stomach diseases. In order to reduce problems related to water people have started to boil water. Others use chemicals in water reserve in tanks".[38]

Table 21: Reported and recorded cases of diseases at Prime Care Dispensary (2003)

Disease	Number of patients	Percentage (%)
Malaria	8226	38.3
Dysentery	4616	21.5
Pneumonia	3113	14.5
Worm infection	2182	10.2
Trauma	1063	5.0
Bronchial	869	4.0
Diarrhoea	613	2.9
Burn	388	1.8
Typhoid	283	1.3
Malnutrition	107	0.5
TOTAL	21460	100

Source: Official interview with the Medical Doctor Sitakishari, March 2004.

[37] Focused group discussion with Athanas Mbogela, Mbepo Ntundu, Grace Msaki, Zainab Rajab, Zainab Idd and Mary Mbogela all residents of Sitakishari in September 2003.

[38] Interviews with residents and leader of Mogo Development Committee (MODECO) in Sitakishari settlement, September 2003.

The overall urban population with access to improved drinking water sources stood at 76% in 1996, but by the year 2000, this figure had risen to 90%. Similarly, access to improved sanitation increased from 84% to 99% during the same period (Habitat 203:258). Although these statistics show an encouraging situation, the problem that impinges upon these services is much more on the quality aspect rather than quantity. This is particularly the case in density informal settlements where pit latrines are the dominant sanitation system. Fieldwork studies in Sitakishari showed that out of the 50 houses visited, 25 (50%) used traditional pit latrines, 11 houses (22%) had WC toilets , 10 houses (20%) had ventilated improved pit latrines (VIPs) and the remaining used a combination of VIP and WCs or both pit latrines and WC. Due to high water table, most of the pit latrines fill up rapidly, necessitating frequent emptying part from increasing possibilities for contamination. One pays between TShs 10,000 – 30,000 (US$10-30) for pit emptying service once a pit latrine is full. A third of the residents (30%) considered this charge to be too expensive and unaffordable. The structural conditions of some toilets is poor, which increases the chances of spread of diseases due to flies. Inadequate water supply is one of the factors which limit use of water based sanitation system.

3.1.3 Environmental characteristics and processes of change

In the past, Sitakishari area was primarily an agricultural land with large parcels of green areas with many trees, especially along the Msimbazi Valley. Increased housing development has resulted into tree felling, affecting the natural ecosystem that supports and protects ground water sources, especially springs and shallow wells.

Existing land use, land use conversion and ownership
Like in Tungi, the prime land use in Sitakishari area is residential. Some areas are used for community facilities such as a church and a primary school. There is also a pond whose water supports making of sand/ cement/blocks. The pattern and characteristic features of land use changes in Sitakishari, like in Tungi, is similar to most other peri-urban settlements of Dar es Salaam city. The conversion of land use, from agricultural to residential, is largely a socio-economic process characterised by rapid population growth and changing livelihood. Lupala makes an important observation note that:

"In order to put into context the driving force changing the land use development in the peri-urban zone of Dar es Salaam, three main issues that characterise peri-urban development are population growth, peri-urban economy and peri-urban spatial patterns" (Lupala, 2002:27).

He further argues that as a result of rapid population growth, peri-urban zones of Dar es Salaam are experiencing an explosion of immigrants from both the urbanised part and up-country regions. In the late 1990s some of these zones, especially those along the major roads, experienced population growth rates of over 200 per cent per annum. The designation of land uses in these areas has been sporadic largely influenced by private individuals. The Strategic Urban Development Plan (SUDP) 1998 estimated that the city has been expanding into the peri-urban areas at an average rate of about 7 per cent of the built up areas per annum. In other words, this is the rate at which agricultural land is being replaced by urban-related land uses, particularly housing. Trends in land use conversion are as summarised in Table 22.

Table 22: Changing patterns of land use in Sitakishari (1975-2002)

S/No.	Land Use	Area in Hectares			
		1975	1982	1992	2002
1.	Agricultural	70.3	52.5	28.6	8.1
2.	Residential	21.2	39.0	64.3	86.3
3.	Swampy (valley)	8.5	8.5	7.1	5.6
	TOTAL	100.0	100.0	100.0	100.0

Source: Analysis of land use changes from series aerial photographs of 1975, 1982, 1992 and 2002.

It is notable from Table 22 that, while the total land for agricultural in the year 1975 was estimated at about 70 hectares, this decreased to approximately 53, 29 and 8 hectares in 1982, 1992 and 2002 respectively. Similar trends can be observed with respect to the swampy (Msimbazi valley) where housing encroachment has over-spilled into the valley reducing the land use from 8.5 hectares in1975 to approximately 6 hectares in 2004.

Although land ownership under the Wazaramo tribe was held under customary regulatory arrangements, on-going land subdivision, and selling and buying created new landowners and tenure arrangements, which are primarily managed by the grassroots actors – i.e. landowners and community leaders.

Main water sources and supply systems
Presently the main water sources for Sitakishari community are boreholes and shallow wells. Piped water supply that was laid down by NUWA in the 1980s has been more or less abandoned because of persistent water shortage. As a result, boreholes and shallow wells have increasingly become the major sources of water. It is likely that these developments will have ecological impacts. For instance, excessive abstraction of ground water sources may affect the ground water table by lowering the level and hence disturbing the flora and fauna dependent on it.

Land subdivision, access (sale, inheritance) trends, change in land use versus environmental problems
The process of land use subdivision, selling, access and change was elaborated by Mzee Sungura, one of the few indigenous Zaramo resident in Sitakishari. Mzee Sungura narrates:

"Kabla ya Uhuru, eneo hili lilikuwa msitu na wakazi walikuwa wachache sana. Nakumbuka nilikuwa na Mjomba wangu, Mzee Hiari pamoja na Mhindi aliyekuwa akiishi hapo eneo la Polisi akifuga. Kwa shamba langu nilianza kuwauzia Kimicho, Mwankusi na Mwasendende wakati huo ndio Karume alikuwa ameuawa. Miaka kama saba baadaye niliuza kwa watu wengine, akina Ngura, Ngozoma, Kafanabo, Kiza na Haule; wakati huo ardhi iliuzwa elfu tatu tu."

Meaning:
"Before independence (in 1961) this area was a forest area with very few inhabitants. At that time, my Uncle and one person of Indian origin who stayed at the present Police Station site and used to keep animals (cattle). With regard to the sale of my farmland, I started by selling farm lots to Kimicho, Mwankusi and Mwasendende. At the time when Karume was assassinated (that is in 1972). Seven years later, I sold parcels of land to Ngura, Ngozoma, Kafanabo, Kiza and Haule. During that time, each lot of land was being sold at TShs 3000 only[39]".

[39] Interview with Mzee Sungura, one of the few Zaramo people still residing in Sitakishari area in March 2004.

Mzee Sungura, sold his land to the people who migrated into the area during the construction of the new airport terminal, that is in the early 1970s. Later in the 1990's he sold land near Msimbazi Valley to Kimicho. Some of those who bought land in the past have in turn subdivided and sold it . For instance, Mr Mwankusi who possessed a large parcel of land subdivided and sold it to three new comers. The subdivision, selling and building are all informally managed, and as a result housing densities vary. In some cases land has been subdivided several times giving rise to small plots, while in other cases plots are fairly large.

Although land parcelling is done informally without adhering to official procedures, neighbours and local leaders are often involved as witnesses. Land parcelling and transactions trends of Mr. Sungura's farm are illustrated in Figures 8 - 12.

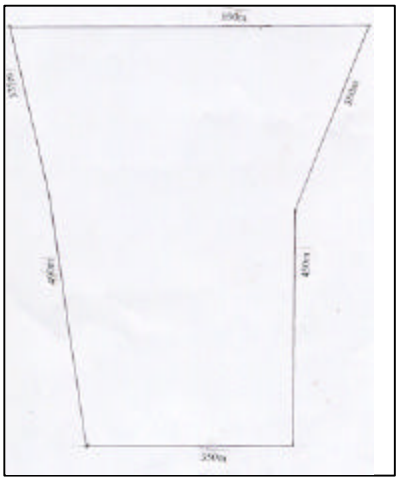


Figure 4: Mzee Subgura's farm before subdivision and selling in the 1960s

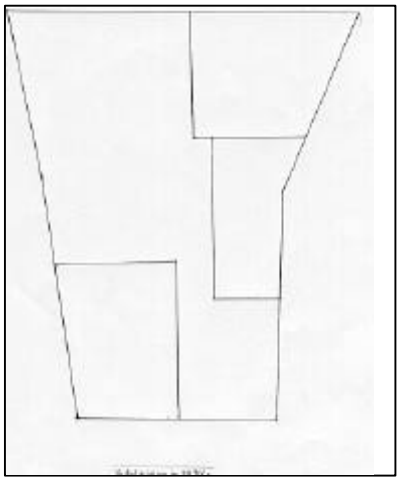


Figure 5: Mzee Subgura's farm in the initial stages of subdivision in the 1970s

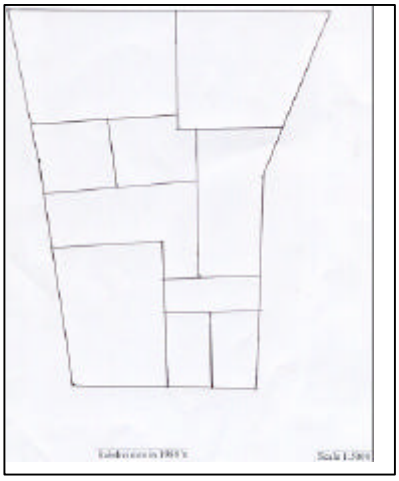


Figure 6: Further subdivision of Mzee Sungura's farm in the 1980s.

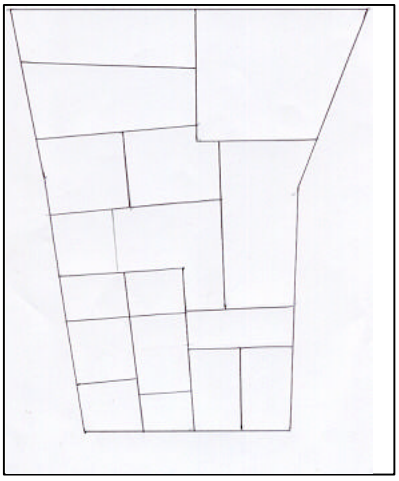


Figure 7: Further subdivision in the 1990s.

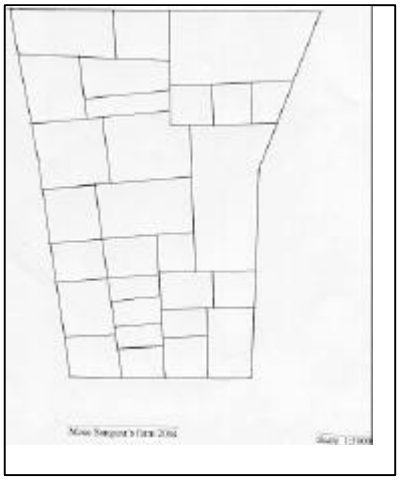


Figure 8: Mzee Sungura's farm and other constituent plots as mapped in March 2004

Environmental consequences resulting from unguided land subdivision processes include densification and congestion of houses especially those built close to the water sources. As noted earlier, in some cases individuals have appropriated areas that used to constitute sources of water for shallow wells. Land use subdivisions and house construction activities have also led to poor sanitation systems such as underground water sources as pit latrines, which pose a communicable diseases threat.

3.2 Characterisation and trends of water and sanitation service systems (WSS)

3.2.1 Environmental conditions and water resources

The situation regarding environmental conditions and water resources in Stakishari is as discussed in the metropolitan profile.

3.2.2 Water supply

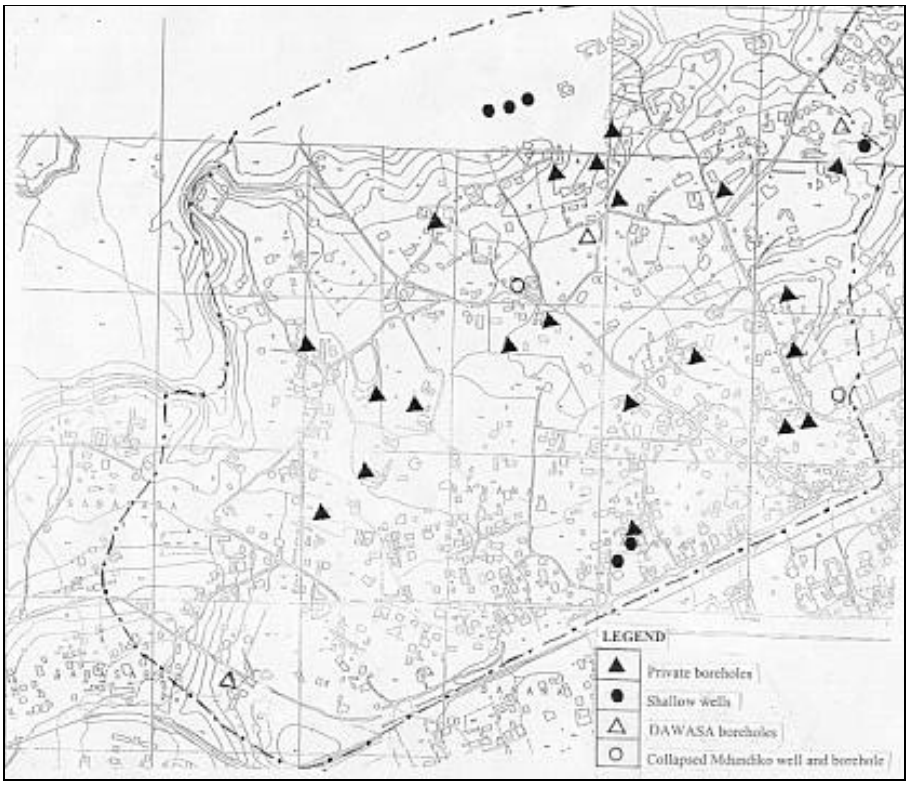
From the 1960s to 1980s, residents relied on traditional shallow wells as the main sources of water supply. During that period, shallow wells in Msimbazi valley constituted the main source of water. As a result of housing development and pressure from residents, between 1980 and 1986 NUWA (now DAWASA) provided piped water supply, and during this period this source became the major water source. Due to increased population and livelihood activities towards mid 1980s, residents of Sitakishari started experiencing severe shortages. Water rationing was introduced and the settlement got water twice a week. In the early 1990s, water shortage had become chronic forcing women and children to travel as far as Kinyerezi area (some 5 kilometres away) to search for water. Presently, piped water flows only once or twice a month. This has forced residents to search for alternative water sources such as digging shallow wells, some of them are along the railway reserve. Starting from 1990 residents started constructing boreholes.

In view of the persistent water problems, in the late 1990s the Ward approached the city authorities in a bid to address the persistence of water shortage. It was during the same time also that the government was trying to provide alternative water sources due to drought that had

adversely affected many areas of Tanzania after the *el nino* rains of 1998. Narrating how borehores came about, the Chairman of the Water Committee noted:

"The three DAWASA boreholes were a result of government response to severe shortage of water which was experienced after the El – nino rains. During this period many parts of the country suffered serious water shortages. As such, the government through DAWASA drilled the wells in Stakishari to alleviate severe problems of water supply during that time"[40].

By the end of 2003, there were four (4) 'public' boreholes[41] in Mogo Sub-ward out of which 3 are located in Sitakishari. Another borehole is owned by the Moravian Church, and this is connected to four points (taps). Besides the Moravian and DAWASA boreholes, there are 26 privately owned boreholes in the settlement (Map 4).



Map 4: Distribution and location of sources of water in Sitakishari settlement

Residents who fetch water from the boreholes pay monthly bills or up front at a rate of TShs 20/= per bucket of 20 litres. Overall, many households said that the construction of the three boreholes by DAWASA and the private ones has substantially boosted the availability of water. Water sources available in Stakishari at present comprise traditional wells, deep wells and boreholes, and piped (DAWASA) system.

[40] Interview with Mr. Ali Uvuruge who is the Chairman of Water Committee in Mogo Sub Ward.
[41] Boreholes are deep wells which are drilled to the depth of 60 metres or more and fixed with a hand or electricity pump to scoop water from underground.

- **Traditional shallow wells**

Like in Tungi, traditional shallow wells are dug manually and have a depth of between two and three metres. They are usually open and mainly located on low-lying areas with high water table. There are 6 traditional shallow wells in Sitakishari, 4 being located in the Msimbazi valley and 2 along the railway line in the southern part of the settlement. Because these are open, water from shallow wells is not safe for domestic consumption. Water from shallow wells is mainly used for irrigation along the Msimbazi valley or for watering animals and washing purposes. None of the 50 households that were interviewed in Sitakishari of them was using water from shallow wells for domestic purposes. Physical observations of some of the shallow wells also revealed that the water from this source was dirty with lots of mud, and the surrounding environments were not well kept.

Figure 9: One of the shallow wells located in Msimbazi valley.
The immediate environment is not well protected and water from this source is unsafe for domestic use

- **Deep wells and boreholes**

Deep wells are drilled by machines and operated with an electric motor or hand pumps. Those operated with hand pump are popularly known as 'Mdundiko'. Unlike shallow wells, deep wells are normally well protected from surface water pollution and other wastes from surroundings. In Sitakishari settlement, there are only two (2) deep wells that are operated with hand pumps, however, both were not operational because the hand pumps were broken. There are 21 privately owned boreholes and 3 boreholes owned by DAWASA but managed by the Mogo Sub-ward office (Table 23). Boreholes constructed by DAWASA are fitted with electric pumps that pump water to 10,000 litre tanks mounted on concrete structures. Some proprietors of boreholes draw water directly from the boreholes, and fill up bowsers or cans, which they use to sell the water to customers. A few borehole owners have water tanks in which water is stored before it is sold or used.

Table 23: Number of connections per service provider

Water provider	Number of connections	Remarks
DAWASA	12	MODECO is hesitating to have many connections due to uncertainty on the capacity of the boreholes.
Private	50	
Total	62	

Source: Field studies and interviews wit residents of Sitakishari, March 2004

Figure 10: A privately owned deep well fitted with a hand pump (mdundiko)

Figure 11: A privately owned borehole.
Note that while the water tank lies on the ground, the supply pipes have been set high to provide trucks collecting water a direct access to the supply

Figure 12: One of the three boreholes built by DAWASA

- **Piped water supply**

In early 1980s, piped water supply was the main source for the settlement. The rapid population growth associated with increased human and livelihood activities rendered piped source of water inadequate. At present, almost all residents (80%) in Sitakishari depend on water from boreholes. At most piped water flows only once a month. Since pipes are dry most of the time, when water flows it often dirty. Besides, most pipes have worn out, and as a result there are rampant leakages.

Results from household interviews indicate that out of 50 interviewed households, 41 households (98%) used water from boreholes, and out of this, 8 households (16%) also use water from shallow wells for non-domestic needs and only one household (2%) use both borehole and tap water. The distribution in household water use and average daily consumption are shown in Table 24.

Table 24: Household water consumption per source per day

Water source	*Household water Consumption per day (l)*							*Total*
	20-100	101-200	201-300	301-400	401-500	501-600	Above 600	
Boreholes	4	15	8	9	3	2	-	41
Shallow wells	-	-	-	-	-	-	-	-
Tap/shallow well and Boreholes		1	2			3	2	8
Boreholes/Tap					1			1
Total	**4**	**16**	**10**	**9**	**4**	**5**	**2**	**50**

Source: Household interviews in Sitakishari settlement, September 2003

Many households (15) use between 100 and 200 litres per day. The per capita consumption of water supply in many low-income settlements in Tanzania has been set at 25 litres per capita per day. Based on an average of 4.4 household size, the average consumption per capita in

Stakishari will be about 40litres/day. It can then be argued that the consumption of water in this settlement is slightly above the average national consumption.

Apart from domestic use, water is also used for other activities such as livestock, irrigation and business activities such as cement block making. Results from household interviews revealed that 20% of the residents use water for gardening purpose. This refers to settlers who carry out gardening in the Msimbazi valley, of whom 10% use it for livestock while another 10% use it for both gardening and livestock. The amount of water for non-domestic consumption varies. Out of 50 households interviewed 20% use less than 300litres per day while the rest use more than 300litres (Table 25). There are also local brewers, few 'mama lishe' and small restaurants in Sitakishari which use water from the boreholes. The amount of water used in these activities ranges from 4 -7 buckets of 20 litres per day. According to a local brewer who prepares 'Komoni' (local brew from maize) the amount of water required per day is 6 buckets (120 litres).

Table 25: Water consumption for non-domestic activities

Activity	*Water consumption in litres per day*							
	20-100	*101-200*	*201-300*	*301-400*	*401-500*	*501-600*	Above 606	TOTAL
Livestock keeping		1	3	1				5
Irrigation	1	2	2	2	2	1		10
Irrigation and Livestock	-	-	1	1	1	1	1	5
TOTAL	1	3	6	4	3	2	1	20

Source: Household interviews, September 2003, the rest of the respondents do not use water for non-domestic activities.

Even though there are several privately owned boreholes the costs involved in constructing boreholes are still far above the reach of many Sitakishari residents. Majority of the households (60%) was get water from the DAWASA and privately owned boreholes. The few privately owned boreholes are a reflection of high costs associated with drilling and installation of pumps and electricity. Interviews with a private boreholes proprietors revealed that the average depth for a borehole that is in the area close to the Msimbazi valley is 25 metre deep. Confirming the high costs for drilling a borehole, one of the residents owning boreholes said that:

" In this part of the settlement, underground water is quite deep. In some occasions, the drilling vehicle had to stay here for three days. Therefore the drillers charge a lot of money. It is unaffordable by most residents of Sitakishari"[42]

In some areas one has to drill up to the depth of 36 metres whereas in other areas of the city drilling a borehole can go as deep as 100 or even 140 metres. The cost of drilling a borehole ranges from TShs 1,000,000 to 1,800,000 (US$ 1000 –1800). Drilling costs may be higher up to TShs 4,000,000/= depending on the depth and location. The average cost of surveying an appropriate area for siting a borehole or deep well is TShs 200,000 (US$ 200), procurement of water a pump costs TShs 300,000 –1,200,000 (US$ 300-1200) depending on the size, (horse power). The deeper the borehole, the more powerful the pump is needed.

[42] Interview with the son of Mr. Kazimoto, one of the owners of boreholes in Sitakishari in March 2004.

3.2.2 Techno-infrastructural development

- **Water supply networks**

Results from household interviews showed that out of 50 houses, one had a private piped water supply linked to DAWASA boreholes, seven had connections linked to private boreholes, 30 bought water from DAWASA kiosks, 6 were dependent on boreholes and shallow wells belonging to their neighbours and six had on-plot supply from their own boreholes (Table 26).

Table 26: Distribution of water connection by source

Water source	*Number of lines connected*	*% Age of Total*
Connection from DAWASA and Private boreholes	1	2
Private connection from private boreholes	7	14
Public Kiosk (boreholes)	30	60
Boreholes and shallow wells	6	12
On plot supply e.g. boreholes	6	12
TOTAL	50	100%

Source: Households interviews, September 2003

There are a total of 62 houses with private water connections. Out of this 12 houses get water from DAWASA boreholes and the remaining get from privately owned boreholes.

Information on the capacity of the boreholes in Sitakishari area could not be established, but it was reported by the Ward Water Committees that the capacity of the DAWASA boreholes was 300litres per minute. Water production rates of most of the privately owned boreholes ranges between 60 and 80litres per minute.

An artisan who has been drilling boreholes in Sitakishari owns a manual driller for boreholes. There are also plumbers who provide maintenance services to private and DAWASA boreholes. These operate from their houses and therefore have to be contacted when there is a breakdown.

Due to reliability of the borehole water supply in Sitakishari, people from outside the settlement, including large scale operators of trucks fitted with tanks, fetch water in Sitakishari. During the dry season water shortage is experienced because the yield from the boreholes declines. Water shortage is also experienced when there is power cut or rationing as most boreholes are run by electrical pumps. According to a response from water attendants, the water sold by some boreholes proprietors ranges from 20,000-35,000 litres per day. One of the borehole proprietor is also operates two trucks each with a 5,000 liter tank. He therefore supplies water to customers on request.

Figure 13: Terminal point for private water connections at Bakanja.
Each pipe leads to a single user. Because there are no metres, corks are used to control the flow of water to private users

As regards private piped water connection to private or DAWASA boreholes, it was reported that water is connected only when an applicant has installed a tank and paid for the fittings and pumping cost. Installation of the tank is a precondition for getting piped water supply from boreholes, because in the absence of a meter charges for water depend on the size of the reserve tank a household has installed. When water is depleted in one's tank the owner informs the water seller who will in turn open the cork and pump to fill the tank. Most households who have private connections and tanks pay for water up front just like other water users. The price is TShs 1/= per litre.

Results from household interviews gives a fairly balanced picture between those who said that water from boreholes was safe and those who decried safety of that water source. 22 households said the borehole source was unsafe water while 24 households refer it as safe. Results from people's response on safety of water by source are as summarised in Table 27.

Table 27: Safety of water by source in Sitakishari

S/No.	*Water Source*	*Quality Assessment by Households*	
		Safe	*Not safe*
1.	Boreholes	24	22
2.	Shallow wells	-	6
3.	Tap water	1	
4.	Msimbazi river		1
TOTAL		25	29

Source: Household interviews in Sitakishari Settlement, September 2003

One of the main reasons given by those who said water was not safe for domestic use is that it is salty and that it is contaminated. There were contradictory observations on water quality. In one of the focused group meetings, residents pointed out that the quality of water is so poor that

they are compelled to use chemicals in the reservoir tanks to treat the water. But Chairman of the Water Committee (MODECO) said that the chemical for treating water was provided only once when the boreholes were inaugurated. Presently neither the DAWASA nor the private boreholes proprietors use chemicals to treat water. When asked about the quality of water and the need for treatment, the chairman said:

" The present water quality is not that much poor to necessitate treatment by chemicals. Water is generally of good quality even DAWASA has not advised to use chemicals to treat water from boreholes".

The Health Committee occasionally campaigns to sensitise residents to boil water before drinking it or using for domestic uses. Suggesting that the quality of water from boreholes requires laboratory testing, the Medical Doctor of Primary Care Dispensary said that the water for the dispensary activities is fetched from piped (DAWASA) sources from the city centre because water from boreholes is corrosive to hospital equipment. It also causes rusting.

- **Wastewater networks and storm water drainage**

Wastewater sources in Sitakishari include flows from pit latrines and toilets, cattle and pig sheds. It was difficult to estimate the amount of waste water per activity as there are no records. According to Mato (2002), estimates for underground water from septic tank effluents in Dar es Salaam revealed a range of 40-70% in concentration of pollutants. Quoting Haskoning report (1989), Mato further notes that the amount crossing the water table line was estimated at about 47,000m^3/day (or 1.7 x $10^7 m^3$/year) for the year 1988. Extrapolation of these figures with population data show that more than 60 and 20 tonnes/day of BOD_5 and total nitrogen pollutants will be reaching the unconfined ground water sources by the year 2015. Mato cautions that such loading rates can have devastating effects on ground water quality should remedial actions not be put in place. On the basis of these observations and the fact that almost 80% of Sitakishari residents depends on the borehole source and that 52% and 24% of the households use traditional pit latrines and VIPs, respectively, contamination of ground water sources can not be ruled out.

Some residents hire cess-pit emptiers whereas others dig new pit latrines when the old ones fill up. There are no waste treatment systems in the area. As a result wastewater from bathrooms and cattle sheds is left to freely flow into the open area surrounding the built-up areas.

- **Sanitation**

According to the household interviews in Sitakishari, 50% of the households use traditional pit latrines and 22% use WCs with on plot septic tanks. About 20% use the ventilated Improved pit Latrines (VIPs) and the remaining proportion use a combination of VIP and WCs. The distribution of number of households per type of sanitation is as shown in Table 28.

Table 28: Types of sanitation facilities

S/No.	Type of Sanitation	Number of Households	% Age of Total
1.	Traditional Pit latrines	25	50
2.	Water closet (WC)	11	22
3.	Ventilated Improved Latrines (VIP)	10	20
4.	VIP & WC	2	4
5.	Pit latrine & WC	2	4
TOTAL		50	100

Source: Household interviews, September 2003.

As regards the location of the pit latrines, because most of plots were large majority were far away. However, there were cases where boreholes were closer to toilets. For example, the hand dug 'mdundiko' at kwa Likonga is located within 8 metres of a toilet, and to make matters worse the area is water logged. Another borehole owned by a local artisan is six metres from the toilet, another borehole is only 15 metres from the toilet[43]. The fact that pit latrines remain the dominant sanitation system the possibility of underground water sources being polluted remains to be high.

Table 29: Distance of pit latrines from water sources

Water Source	Distance in Metres									
	0-100	101-200	201-300	300-400	401-500	501-600	601-700	701-800	801-900	901-1000
Shallow well	4	2								
Borehole	25	8	11	1	2					
Water tap										1
Msimbazi river									1	
TOTAL	30	10	11	1	2	-	-	-	1	1

Source: Household interview in Sitakishari, September 2003

Owing to the low-lying topography of Sitakishari and given the fact that majority of the households use pit latrines, the problem of filling up and flooding of pit latrines is also frequently experienced. In 2001 the Health Committee of Mogo with support from UNICEF initiated a pilot project involving new types of toilets called 'Compost Toilets' locally known "Vyoo Mbolea". The system involves sealing filled up toilets and allowing the waste to decompose thereafter they are collected and used as manure. Compost pit latrine operates with two chambers because solids have to be separated from liquids. The urine is also collected and used as manure as well.

The "Vyoo Mbolea project was preceded by sensitisation of people to adapt this new technology, this was done by the Health Committee. UNICEF provided financial support for piloting the project. A total of 45 toilets were constructed in Mogo settlement and Sitakishari area. However, due to non-adherence to the principles such as maintaining separate chambers for urine and excreta, they have abandoned the project.

2.2.3 Economic and financial aspects

- **Financing mechanisms**

As observed earlier, the boreholes which were constructed by DAWASA were financed by the World Bank. The privately owned boreholes were financed by individuals largely through own savings while the Moravian church financed the borehole it manages. Of the three boreholes provided by DAWASA, only two were effectively being used. The one which is located near Msimbazi valley is too far from the densely built up residential area, and as a result it is not much used. According to the focus group discussions, the boreholes owned by Mr. Rwehumbiza and Mama Kiango were the most reliable because they yield plenty of water throughout the day.

[43] Measurements taken at Kwa Likonga, Mr. Maulid and at Ms. Kiango's premises.

Boreholes proprietors said that boreholes ought to be at least 60 metres deep if one has to get a continuous flow and reliable supply of water. Most also reported that the funds used to construct boreholes were from various sources including pensions, savings and money from small business engagements. Drilling of the boreholes was motivated by the severe shortage of water that confronted Sitakishari residents, especially in the 1990s. Response from Mr. Gaspar who owns a borehole confirms this:

"Piped water supply from DAWASA water supply system became so unreliable in the 1990s. Many of Sitakishari residents were fetching water from Chemchem (the springs). When I was about to move into my house I decided to drill this borehole so as to minimise inconveniences of searching for water".

Notably, the he respondent is also selling water to his neighbours.

- **Pricing system**

Like in many other settlements in the city, residents of Sitakishari buy water from boreholes at TShs.20/= per 20 litre bucket. Those with piped in-house connection (from the boreholes) also pay TShs.20/= per 20 litres. There has been a gradual increase in water prices over time, that is, from TShs 5 in the 1980s to between TShs 10 and TShs 15 in the 1990s. In the year 2000, water price went up to TShs 20 per 20 litre bucket.

Table 30: Changing water prices in TShs (1980s- 2003)

Year / Source	1980s	1990s	2000	2003
DAWAS piped water	5	10-15	-	-
DAWAS boreholes	-	20	20	20
Private boreholes	-	20	20	20
Shallow wells	Free	Free	Free	Free

The water charges are usually set by the borehole owners. For example, Mr. Kimwaga's borehole is connected to ten customers. He charges his customers on the basis of the amount of water pumped into their respective tanks, rates varying between TShs 10,000/= and TShs 30,000/= (US$ 15 to 30) per month.

Similarly, water from DAWASA boreholes is sold at TShs.20/= per 20 litres. With regard to the connecting and billing of households connected to boreholes, water is connected only when the applicant has installed tanks, while bills depend on the volume of water consumed. When water is depleted in the tank the attendant who operates the pump is informed to refill the tank. Most buyers pay for water upfront. Arrangements were being made by some boreholes proprietors to charge customers on monthly basis. There were few borehole owners who had fixed meters for their customers. In this regard, consumption is charged on monthly basis.

For most boreholes which are owned by private individuals an attendant or seller is employed to operate the pump. Interviews with one of the borehole owners revealed that in the period 1999-2000, he earned between TShs.10,000/= and 11,000/= per day from selling water. This gives an estimated monthly income of between TShs.300,000/= and TShs.333,000/= i.e. US$ 300 to 330). The monthly salary paid to the water attendant or seller ranged between TShs.20, 000/= and TShs.30,000/=. Presently, the daily revenue realised from water sales stands between TShs.3,000/= to TShs 4,000/=, which is less than 50% of previous earnings. Proprietors of

boreholes that are frequently used, earn between TShs.6,000/= and 8,000/= .Those with only few customers earn around TShs.1000/= per day.

Customer preference between DAWASA and privately owned boreholes is still divided. For example water from the DAWASA borehole located at Chemshem was disliked by many households because it was somewhat black in colour. For the rest of the boreholes there was no preferences because the prices and quality were equivalent. What influences most people to get water from a particular borehole was therefore mainly the distance of the borehole to their houses.

It was further reported during the focus group discussion that, although water supply situation in Sitakishari is overall satisfactory, during electricity power rationing, most of the boreholes do not function. This causes problems because people are forced to buy water from the water vendors. During such periods water price go up to TShs 100/= per 20 litres, making it unaffordable by many people, especially the poor. There are no mechanisms to provide water to the poor, although a few borehole owners provide water to old poor people. Mr. Sungura, one of the elderly indigenous residents said that sometimes he gets free water from the borehole owners. But this is not guaranteed.

3.2.4 Policy-institutional environment

The policy and institutional environment in Stakishari, especially the legal aspects, is essentially similar to the case of Tungi (refer Section 1). However, there are some issues and aspects that are contextually specific to Stakishari, and these are discussed in this section.

Although in Sitakishari area, DAWASA advised the sub-ward authorities to establish MODECO to supervise the day to day operations of the three boreholes, based on the household interviews and focus group discussions many residents seemed unaware of the existence of MODECO. During focused group discussions, most residents could not ascertain the existence and the role played by MODECO. One cause of the unawareness of many people about MODECO could be the way this unit was formed, i.e. by the Mogo sub-ward leaders without wider participation of residents. In this case the decision to establish MODECO came from the top (DAWASA) and implemented without the residents' participation. This could be a source of discontent in the community and could undermine the good intentions to put in place an effective unit to manage the boreholes.

Despite the fact that privately owned boreholes were reported to be the most reliable sources of water there were complaints over the management of those boreholes. It was, for example, reported that some of the boreholes were not deep enough as they were manually drilled. As a result, the quality of water from such boreholes was poor with unpleasant smell and salty taste.

It was further reported that many people have applied for private water connections from the DAWASA built boreholes. However, MODECO declined to supply them with water allegedly because it did not know the capacity of its boreholes. MODECO argues that extending or granting private connections to the boreholes may lead to the drying up of sources which apparently serve many people.

Table 31: Ownership role and problems of various water sources in Sitakishari

Source and number	Owner	Role	Problems and complaints
Shallow wells	Private	Managing water, restricting tree felling around the wells, water pollution.	Restricted access to other people
Boreholes (DAWASA)	Sub-ward	Operation and maintenance (selling water)	MODECO not known by most residents, and there were reports that some water sellers were not trustful.
Boreholes (private &church owned)	Private individuals Moravian Church	Operation, maintenance, Treatment Selling and collection of water charges	• Inconvenient, operation starts late - some customers would wish to get water early in the morning • Water price is high • Water quality is not good
Piped Water (DAWASA)	City Water	Operation, Maintenance Preparation of water bills	• Often dry water taps – supply comes only once a month • People get bills even though water flows only once a month.

Source: Household interviews and focused group discussions, September 2003/ February 2004

Although there were several proprietors of wells there was no association to spearhead and co-ordinate their activities. Also, at present most of water vendors who enjoyed monopoly in the late 1990s when water was a scarce commodity in Sitakishari are more or less out of business. Nonetheless, private investments in water (boreholes) has relieved people from the severe water shortages of the 1980s and 1990s and improved living conditions of most people.

3.2.5 Socio-political aspects

- **Socio-economic aspects**

There are two or more dimensions of water supply service in relation to employment creation. First, before boreholes became the main sources of water, water was scarce as a result water vendors earned a good income from water sales, with some earning between Tshs.10, 000/= and 11,000/= per day. However, as a result of establishment of boreholes, the water scarcity problem resolved and prices went down to TShs 20/= instead of the TShs 100/= per bucket charged by the vendors.

The boreholes managed by the Sub-ward leaders under MODECO employ 32 people as water sellers while the Moravian boreholes employ 8 people. On the other hand, most of the private boreholes proprietors employ at least one water attendant per borehole to sell water. Beside employment creation, there are other water using economic ventures that have emerged in Sitakishari including the concrete and sand/cement blocks making, gardening, food vending ,e.t.c. The concrete block making venture employ four people who are paid on daily basis. As discussed earlier, animal keeping and vegetable gardening are widely carried out in Sitakishari because of reliable water supply from the boreholes.

- **Water and environmental governance**

It is evident from the preceding discussion that private individuals, and to a lesser extent, local government (DAWASA) have contributed towards improved water supply in Sitakishari area. However, their efforts are not co-ordinated or guided to ensure good water service delivery. The Sub-ward leaders only manage the DAWASA built boreholes but there are no checks and balances as to what is happening with regard to privately owned boreholes and the one

operated by the Moravian Church. Neither is there a control on the water quality. Many residents accuse the Sub-ward Health Committee because of laxity with regard to norms or regulations for protecting public health. The committee does not seem to be sensitive or concerned about water quality, especially regarding cleanliness of the areas around water kiosks, and treatment and distribution of water. Besides, the Sub-ward leaders do not have in place mechanisms to help the poor particularly elderly persons who cannot afford the TShs 20/= per bucket. Water governance in Stakishri is done on ad-hoc basis each individual actor abstracting and selling water without regard to Water Act provisions or regulations.

- **Socio-economic and cultural values attached to water**

Traditionally, many Tanzanian societies regard the search for water and its administration at the household level as the responsibility of women and children. This is so in both rural and urban areas. However, in recent years, as a result of water scarcity in many urban centres, men have come up either to provide a supporting hand to overburdened women or make business out of the commercialised water source provision. It is not uncommon to see several medium sized pick-up vehicles and lorries, which have been converted into water bowsers primarily to ferry water to the areas where the supply is scarce. Water has become a real business venture especially during the dry season. Bicycles and pushcarts are increasingly being used by water vendors in most cases mainly because water sources are too far from users.

Water remains a basic necessity of life, which everybody should get access to. In the 1960s and 1970s the government under the socialist policies persued a policy of free water supply to all Tanzanians. As time went on, and as the government capacity to provide free water diminished, private water providers emerged in the 1980s and more prominently in the 1990s. Water sales became a common practice and nowadays bottled water is sold in all supermarkets and even by street vendors. Large lorries nowadays ferry water that is paid for by the customers from one settlement to another. The changing attitude from water being supplied free to a commodity that has to be paid for is also reflected in the Water Policy (2000) which requires water users to pay for the cost of supply.

- **Social and political conflicts around WSS**

Conflicts/problems related to accessibility
Although residents complained about the increasing price of water from TShs 10/ to TShs 20/= per 20 litre bucket, the general impression is that they are paying this charge. Conflicts were reported, however, with regard to other uses of water, for example, water needed for watering vegetable gardens along Msimbazi valley. It was reported that during the dry season, people compete for water accessibility for irrigation purposes. At times this water caused conflicts among vegetable cultivators.

Two additional problems are notable with respect to water supply in the study area. First, because some borehole owners give priority to large scale water buyers who operate water bowsers, residents have to queue for a long time waiting for water. Second, even though DAWASA water taps are almost dry through out the month the authority continue to issue water bills.

Management conflicts
As observed earlier one of the complaints raised in many of the focused group discussions was the non-recognition of the MODECO. Many residents seemed to be unaware of MODECO. One reason for the unawareness, as pointed out earlier, that the unit was established without

stakeholders involvement. Essentially, MODECO is more or less of an extension of the sub-ward government whose members seem to have been hand picked from among sub-ward committees members. Already there were complaints from a number of residents on how revenue collected by MODECO was utilised. This is a potential conflict, and area if it is not addressed it could adversely affect water service provision.

Another problems that was reported by both the private borehole owners and MODECO chairman was the theft of water pumps. This is a serious problem because water pumps cost between TShs 300,000 and 1,200,000 depending on the size - (horsepowers). MODECO is been obliged to employ two people for each borehole one responsible for guarding the pumps and the other for selling water. This increases running cost, making it difficult to reduce water prices. One borehole owner, complained bitterly because two pumps were stolen from his premises in two different occasions. This undermines private initiatives to invest in and improve water supply in Stakishari.

3.3 Key emerging issues in Sitakishari

3.3.1 Introduction

Like in Tungi, in Sitakishari there is a direct link between existing livelihoods and water supply services. This is particularly true when one compares the situation with 1980s and early 1990s when Sitakishari residents faced acute shortages of water, and many activities including gardening and animal husbandry could not flourish. The construction of boreholes by DAWASA and private individuals has opened up new economic avenues in which many people are engaged in. Borehole owners have been generating income through water sales apart from meeting their household demands for water. The establishment of boreholes has provided employment to a number of young people either as water sellers, guards to the water points, and workers at brick making sites. There are also many other employment opportunities including food vending kiosks (Mama Ntilie), bars and restaurants. There are, however, a number of key challenges that face water supply and sanitation systems in Sitakishari. These are discussed in the following sections

3.3.2 Challenges

- *Capacity of the underground sources*

Even though there were no figures on the quantity of water abstracted through the boreholes, estimates based on data on the bowser trips and customers fetching water from some of the boreholes far exceeds the 22,000 litres per day limit set by the Water Utilisation Act (1974). The capacity of the aquifers that supply most of the boreholes is unknown. Obviously, neither the sub-ward/ward leaders nor municipal officials were following up the provisions stipulated in the Water Utilisation Act. Extensive extraction of groundwater resources may lead to depletion of aquifer water resources with undesirable environmental consequences.

- *Water quality and treatment*

Although the quality of water from many boreholes was reported to be good, several respondents noted that water from some of the boreholes was saline. Even though there were reports that water from the DAWASA boreholes was tested to ascertain its safety for domestic needs, like in Tungi, most private boreholes proprietors do not test the water for its safety although they argue that their supplies were satisfactory for domestic needs. For example,

water from the borehole closer to Msimbazi valley was reported to have dark colour. Water from some of the boreholes and wells is likely to be contaminated because some of them are too close to pit latrines. Again like in Tungi, the Sub- ward, ward and municipal authorities were not regulating/checking siting of boreholes with respect to other land uses. Problems associated with poor siting of boreholes are likely to increase concurrent with the increase in housing densities.

- *Rates charged for water supply*

Although current rates charged for water consumed seem to be affordable by many residents, there seem to be no mechanisms for taking into consideration those who cannot pay or afford the current charges. The cases of water borne diseases reported by the dispensary indicate that some households might be using contaminated water from sources and as such as shallow wells, probably because they cannot afford to pay the safer water from the boreholes.

- *Uneconomic private connections from the boreholes*

The fact that individuals connect water from any source, and that borehole owners connect water to people without any co-ordinated pattern (reticulation system) lead to a situation where there are several pipe sizes leading to the same direction each serving only one customer. This is an uneconomical use of resources given the fact that public spaces (such as roads and streets) are restrained in Sitakishari area. Uncoordinated provision of water pipes can lead to leakages and potential contamination. Private connections ought to be co-ordinated with a view to facilitating economy in use of resources as well as enhancement of water supply.

- *Environmental up-keep of sites surrounding boreholes in relation to sanitation systems and types*

The location of pit latrines relative to the water sources does not take into consideration provisions necessary to ensure public health. The fact that Sitakishari settlement is low-lying and many residents use pit latrines, increases possibilities of contaminating ground water sources. Some of the boreholes were either not covered or loosely covered using light materials such as Corrugated Iron Sheets (CIS). As a result, such sources were not adequately protected from contacts with disease vectors such as flies. Poor drainage systems around some borehole and well sites increase the possibility of surface run-off contributing to groundwater pollution. There were also incidences where washing and cleaning activities were taking place around or in the vicinity of the boreholes. This is another issue, which calls for an effective regulatory framework.

- *Role of residents in the overall management and operation of boreholes/water sources.*

Although there is a good intention by MODECO to manage and run boreholes, many residents were unaware of this institution primarily because it was a creation from top to serve those at the bottom. Projects like community water projects ought to be built on participation from the wider community if sustainability of such projects is to be assured. This is also an issue, which concerns institutional setting for water management.

- *Unawareness about the legislation*

It seems that neither the health committee members nor the Ward and Sub-ward leaders are aware of the Water Utilisatiion Act provisions. While the focus has been correctly on finding solutions to the acute problem of water shortage, which Sitakishari was facing for decades, non-adherence to the basic public health requirements could be too expensive especially in the long run. Unawareness on the legislation implies non-enforcement of the same provision.

3.3.3 Opportunities/potentials

- *Legislative premises*

The Water Utilisation (Control and Regulation) Act. No.42 of 1974, amended in 1997 among other things, sets a limit of 22,700 litres as the maximum amount of water that can be extracted form a well or boreholes per day. The presence of this legislation is an opportunity that ought to be seized. Residents and other stakeholders ought to be educated on its provisions and rationale. Sensitisation and awareness creation about the Water Utilisation (Control and Regulation) Act may facilitate resolution of the identified challenges and weaknesses in the provision of water supply in Sitakishari.

- *Availability of substantial underground reserve*

There are many signs that the underground reserve for Sitakishari settlement has substantial amount of water that can be tapped to offset water requirements within the area. Residents indicated this when they said that many vehicles pick water from Sitakishari when there is water scarcity at city level. However, this reserve needs to be quantified so as to make its extractability sustainable and optimal for the daily uses.

It is noteworthy that, at local level there is a proliferation of wells and boreholes without regard to critical issues including size of plot, location and conflicting land uses in the immediate surrounding.

On the other hand, prices of water supplied by some suppliers are inflated because there is no regulatory framework. For instance private borehole and deep wells proprietors are selling water at TShs.20/= per bucket whereas others including the networked community managed system is selling at TShs.10/= per 20 litre bucket. The reason for price variation could not be established, suffice to note that price variations, without quality differences, at best depict a state of lawlessness in the WSS services. This like in Tungi, undermines efforts to ensure adequate safe water supply among social groups.

3.4 Conclusion

Sitakishari is one of the peri-urban interface settlements in the metropolitan Dar es Salaam. The settlement is characterised by rapid informal land subdivision and housing development. As a result of intensified informal land transactions and building construction, a several houses have been built in the flood prone Msimbazi Valley to the north of the settlement.

The WSS systems in Sitakishari comprise the traditional shallow wells which are dominant in the Msimbazi valley. Water from shallow wells is mainly used for irrigation purposes. There are also deep wells and boreholes, together these serve 80% of all households. In total there are 26 privately and 4 DAWASA owned boreholes from which residents fetch water for domestic use. Also there are several private boreholes who owners have extended pipes to other residents but on demand. Privately connected individuals pay the water charges on monthly or on the basis of quantity of water consumed. In total there are 62 private connections in Sitakishari including those with on-site boreholes. The third water supply system is piped water supply by DAWASA. This system is however, unreliable due to low pressure and intermittent flow, especially during the dry season.

The construction of boreholes and deep wells in Sitakishari not only relieved residents from the severe problems of water shortage experienced in the 1990s but has also stimulated livelihood activities such as animal keeping, gardening, making and sale of bricks and above all, sale of

water as a commodity. Water sales from one of the 4 boreholes constructed by DAWASA and managed by the Mogo Development Committee (MODECO) was reported to be generating revenues amounting to between Tshs.300,000 to 330,000 per month. This excludes revenue accrued from private vendors. The 4 boreholes also provide employment to 32 community members working as water sellers and guards. Water selling is therefore an important livelihood activity especially to private individuals who own boreholes or deep wells.

Although the ground water is the major source of water supply in Sitakishari, its quality for domestic use has remained poor. Portability of the water is poor as mechanisms for purification and testing are yet to be put in place. The fact that 50% of all households in Sitakishari use pit latrines some of which are located as close as 5 m from water sources, suggest that some of the underground water sources may be contaminated. Records from Sitakishari dispensary indicate high incidences of water-borne diseases confirming that the quality of WSS in Sitakishari is not good and could be one of the sources of health problems.

Traditional shallow wells continue to support gardening activities along Msimbazi Valley. However increasing housing densities and encroachment on Msimbazi valley has led to the drying of some of the water sources. Competition over water for irrigation has intensified following the increase in local population, which is engaged in gardening activities.

Despite the significant improvement by the DAWASA and private individuals who have constructed boreholes and deep wells in Sitakishari, there are a number of challenges that impinge on sustainable utilisation of water resources and efficient WSS delivery. These include: the lack of information on the capacity of the underground recharge of water from which both DAWASA and private operators abstract water and poor quality of water. Other challenges are related to over extraction of underground water sources with little regard to the Water Utilisation Act (1974), unregulated private connections, increasing prices that are increasingly becoming unaffordable especially by the poor and un-regulated housing development and densification. The latter has given rise to encroachment upon the water resource.

Even though private investments in WSS in Sitakishari have contributed substantially to improved, unregulated and poorly coordinated WSS service provision raise a number of questions with regard to the sustainability of the ground source. As long as housing densification continues unabated and underground water extraction remains unregulated, the sustainability of WSS services remains bleak unless coordinated efforts among by actors at various level are initiated and implemented.

In report III, a discussion on potentials, constraints and room for improvement of the current WSS in the metropolitan region of Dar es Salaam is presented.

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